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#### ABOUT THE SOCIETY

**MOBILIZATION Society** was established in 2003 as a non-profit professional society aimed at sensitizing and mobilizing development partners and community for sustainable development. The Society, during these ensuing years has successfully mobilized researchers, academicians, planners, grass root mobilizers and student and created conducive intellectual atmosphere for introspective deliberations and conducted National seminars/ workshop to address the emerging problems experienced by the agrarian mass. Presently the Society has more than 1200 Life Members. The recognition of the Society in the efforts for strengthening the forum for scientific communication is growing among the related professionals and concerned agricultural stakeholders rapidly. The Society works on following objectives-

- 1. To document the on-farm and adaptive research experiences in multi- disciplinary agri-bio sciences and extension education.
- 2. To offer a platform for sharing the empirical experiences of development professionals, community mobilizers, academicians, multi-sectoral researchers, students etc. for the benefit of ultimate users.
- 3. To facilitate close and reciprocal linkage among the institutions for sustainable rural development.
- 4. Promoting potential and practicing entrepreneurs.
- 5. To disseminate the documented knowledge to the global partners through approach abstracting and indexing.

### ABOUT THE JOURNAL

Journal of Community Mobilization and Sustainable Development (print ISSN 2230 – 9047; online ISSN 2231 – 6736) is published by Society for Community Mobilization for Sustainable Development twice a year. The Journal of Community Mobilization and Sustainable Development has NAAS rating 5.30. The Journal of Community Mobilization and Sustainable Development, is also available on our website www.mobilization.co.in and it has been registered with www.indianjournal.com for national and global abstracting and indexing. MOBILIZATION envisages reorienting the young professionals and researches for imbibing the values of community participation in research, training and extension efforts.

#### The aim and scope of the journal are:

- 1. Sharing the relevant experiences and issues related to agriculture and allied fields at the grass root level and global forum to create the necessary academic and development climate.
- 2. Sensitizing the different stakeholders about the knowledge and innovation management system in pluralistic agri-rural environment.
- 3. Developing network among the related partners for convergence of their efforts for sustainable academic development of extension education discipline.

### Editorial

India is in a fight against the COVID 19 pandemic along with the whole world, even though the country has made many strides to excel during this hysterical period. Atmanirbhar Bharat or the Self-reliant India, through the competitive and comparative advantages in the entire sector of the economy in complement with Make in India Initiative, is the core concept which now deepens our secularity and unity. Despite the COVID 19 induced GDP contraction, agriculture sector (the single sector with a positive growth rate) reported with a growth rate of 3.4% and offering 41.49% of the total employment in the nation. Thus, the Agriculture has again inveterate it's supreme position to give a promising vocation for the ever-increasing population. To make the nation with ignited minds of future-ready and future-fit status, creation and development of knowledge destinations with enhanced employability is a must. Owing to the vast opportunities that agriculture sector can offer, the new National Education Policy (NEP) also identified, agriculture as a major player to contribute in Atmanirbhar Bharat Abhiyan by enhancing the capabilities of farmers producer as well as developing them as agri-entrepreneurs through its educational interventions from school level onwards. This points to a paradigm shift in the current agricultural education system by incorporating more participant learning or experiential learning elements in it, promoting start up attitude among the students through the initiatives like AGRI-UDAAN, ARISE etc., cultivating the business mind-set in the students through 'earn while you learn programmes', detailing the situational specific and locational specific employable opportunities and the content to capture the same etc. along with the conventional pedagogic and epistemological approaches.

I feel happy and privileged to share that our current issues of the MOBILIZATION journal (May-August 2020), will give the scenic view to the beloved readers about various contribution of agriculture sector through field research and educational activities in the development of sustainable and self-reliant India. The range of topics included are Entrepreneurship development and correlates of the same in Dairy, Integrated Fish Farming System, Shrimp Farming, Chicken Raising Systems, Diversified Farming Systems etc., Knowledge and educational aspects related to Post Graduate Students, knowledge about Package of Practices among Paddy Growers, Behavioural analysis of consumer and fast-food street vendors, Theory development in the area of measurement of job Satisfaction of extension personnel, Gender and its impact on small ruminant disease control, Price analysis, forecasting and yield gap analysis, Effectiveness of entrepreneurial training programme and many more.

The commitment showed and the contribution made by the editorial team members Drs. Souvik Ghosh, S.K. Dubey, R. Roy Burman, Nishi Sharma, S.R.K. Singh, Reshma Gills, Sudipta Paul and Sujit Sarkar are worth mentioning. I am indebted to them, the devotion they showed at each and every point of drafting and the timely publication of the journal. I express my sincere thanks to Ms. Subhashree Sahu and Dr. Hema Baliwada for their efficient management and timely support in shaping this issue of the journal as on-line editors. Finally, I would like to thank, the contributors and readers of Mobilization Journal for the interest in the journal. I seek your continued support by contribution of your precious research findings, ideas and feedbacks for further improvement of our journal.

J.P. Sharma Chief Editor

# Factors Which Encourage Farmers to use Pesticides for Vegetable Agriculture in Thailand

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#### ABSTRACT

The aims of this study are: 1) To study factors which inform farmers' decision-making for the use of pesticides, and 2) The opportunities for farmers to stop using pesticides in vegetable production. Methodology is qualitative with indepth interviews as the primary techniques, and a semi-structured interview as the tool for collecting data, with content analysis and triangulation technique for data analysis. The results showed that the main factors which induce a farmer to use a pesticide in vegetable production was the pesticide's value in responding to the needs of the farmer to produce vegetable in a way which is "easy, but good price". The farmer's expectation for high-yield vegetable production is to get more money from vegetable product ( $\bar{x} = 5$ , SD.=0), and the expectation associated with the use of pesticides from the viewpoint of easy to treat product management is very important ( $\bar{x} = 4.47$ , SD.=0.552). Possibilities for farmers to stop using pesticides exist, but these must exhibit benefits similar to the use pesticides. The alternative products for weed control, insect and plant disease control, however, remain a big challenge for the further development of chemical pesticide-free vegetable production.

Keywords: Expectation, Pesticides, Vegetable production, Push factors, Pull factors

#### **INTRODUCTION**

Pesticides are a productive technology (Rambo, 2017) for agriculture. Farmers undertaking agriculture on high land started to use pesticide during the 1960s, and at that time agriculture went through rapid development to adopt modern agricultural techniques, or, as it became known, the "Green Revolution" (Jantaraworrachat et al., 2015; Hayao and Eiichi, 1971). Statistics show that, at present, pesticides are important for the agricultural production of farmers. In 2010, total pesticide imports in Thailand were 117,815 tons, and in 2016, the quantity had risen to 160,824 tons, of which 78% were herbicides (Office of Agricultural Economics, 2018). Pesticide import statistics, however, must be compared with farmer usage rate, too, and so many have incorrectly reported the impact of pesticides on the environment. Concern over pesticide use started with Carson (1962) writing the book titled "Silent Spring", which reported the impact of pesticide use in modern agricultural systems. In time, pesticide use has developed less impact to environment (Ngamniyom, 2014; Hoffman and Loenz (1998)) and rapid disintegration in

soil, water and sun light (Qiu et al., 2005; Eerd et al., 2003). Farmers who use pesticides in heavy agricultural systems possibly have less regard for safety and less concern over their effect on the surrounding ecological system (especially soil and water). However, if such farmers were exposed to more information about the overuse of pesticides, such as report of Poolpak et al. (2008) where river sediments in a branch of the Mae Khlong river found heptachlor epoxide, a pesticide in the organochlorine group used as an insecticide, at a contaminate rate of 11.61 microgram per kilogram (the maximum rate is 152.17 microgram per kilogram) they might be willing to change. These pesticides, which make possible the contamination of plants and animals in the surrounding ecosystem (Houbraken et al., 2016), seem likely to have been introduced into the environment because of farmers engaged in heavy and long term use of pesticides, which still continues.

At present, pesticides are major factors in vegetable production for farmers in Thailand. Data of imported chemical pesticides shows about 117,815 tons for 2010, and 160,824 tons for 2016, of which 78 per cent is

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herbicides (Office of Agricultural Economics, 2018). The impacts on human health are much-reported (Panuwet *et al.*, 2012), for example the account of a farmer who uses pesticides (Jantaraworachat, 2015) showing concern over the pesticides being accumulated in their bodies, and who as a result employs other workers for spraying pesticides in the paddy fields.

Information is, however, available to support farmers with a knowledge of the impacts on pesticides (Wilson and Tisdell, 2001; Aktar *et al.*, 2009), so in this study the research questions are: "When a farmer understands the impact of pesticides on human and ecological health, why are they still using them?" and "What factors influence farmers in using pesticides for vegetable production?". The aims of the study are: 1) Study factors which influence farmer decision-making for pesticide use, and 2) Identify opportunities for farmers to stop pesticide use in vegetable production. The results of the study can be considered as guidelines for agriculture officers for their work, or for support programs for farmers to continue to produce safe food in the future.

**Conceptual framework:** Self-preservation is a basic impulse of biological human behaviour, and an effect of this is that individuals develop self-enhancement and self-protection practices (Alicke and Sedikides, 2009). For the study of chemical pesticides various reports can be used to examine the multi-dimensional impacts, such as the detrimental effect on biodiversity in the wider environment. In the report by Jeamponk and Thipsaeng (2014) it is explained to farmer experiences to pesticides using because they have understandings with the result of pesticides impacted to the production, so the concept of learning and awareness are factors to the behavior of farmer to

use the pesticides. The farmer, however, may exhibit a more complex logic for decision-making over pesticide use on the farm, which can be broken down to 3 primary factors: 1) Push factors, related to expectation and commitment, 2) Pull factors related to the goals of production, orientation, value standards, habits and customs, and 3) Ability factors, related to opportunity and ability (Kroeksakul, 2010). Furthermore, the framework for the relation of theoretical factors influencing farmers is shown in Figure 1.

#### MATERIALS AND METHODS

This study is qualitative research, with a focus on factors which induce a farmer's decision to use pesticides in a vegetable production system, and the exploration of opportunities for farmers to stop using pesticides in such a production system.

*Study site:* The first criteria for data-collection points to use in this study are that sites of vegetable production must have been in use for more than 20 years, and the second is that they must sell products within the area known as Talad Thai (a central market region which sells agricultural products). The areas selected for study are:

- Bueng Se-nat sub-district in Nakhon Sawan province, around limit UTM. 47P 621609 m E and 1739755.58 m E.
- 2. Rom Klao district, Phetchabun province, around limit UTM. 47Q 741629.00m E and 1862640.00m E.
- 3. Phu Thap Boek high land of Phetchabun province, around limit UTM. 47Q 724466.27 m E and 1869908.34 m E.

The 3 sites for study are shown in Figure 2.





**Figure 2: Study sites** *Source:* Google Earth, 2018

*Tools and techniques for collecting data:* This study used in-depth interviews for collecting data; the tools for collecting data use semi-structured interviews or SSI (Simarak and Suphatera, 1987), and the farmer activity checklist of agriculture practices.

#### Key informant

- 1. Collected data from 13 household farmers who are engaged in vegetable production in the Nakhon Sawan province, who have done so for more than 20 years.
- 2. Collected data from 11 household farmers in the Rom Klao district of Phetchabun province, who do multiple cropping in paddy fields and, therefore, manage vegetable production after rice and tobacco harvesting, and who have been involved in agriculture for more than 20 years in this area.
- 3. Collected data from 12 household farmers in the Phu Thap Boek highland of Phetchabun province, who grow cabbage and Chinese cabbage and have been doing agriculture there for more than 20 years.

**Data analysis:** This study, related to vegetable production systems, used content analysis of farmers' practices, decision making flow, and farmer perception of pesticide use under

the pressure of product expectation, and used a Likert scale of 5 points to rank topics of farmer expectation. However, the information will be considered by the conceptual framework of push and pull factors to induce farmers to use pesticides in agricultural processing.

*Terms of comparable units:* Rai is an area unit in Thailand; 1 rai approximately 0.16 hectare. *Baht* is the primary money unit in Thailand; 33 baht approximates to 1 US dollar. (duration of November 2017 to March 2018.)

#### **RESULTS AND DISCUSSION**

Situation of farming: Bueng Se-nat sub-district in Nakhon Sawan province; the farmers in this area are separated between paddy fields and areas for vegetable production, and most of the farmers will produce vegetables in plots of about 0.02 rai, or 0.0032 hectares. However, most of the farmers producing vegetables use land not over 2 rai because a farmer can't manage more on their farm. In these areas farmers will manage household labor staff of about 2–3 persons. The temperature of the area is about 26–28°C all the year, and average rainfall is about 1149.7 mm/year (Climatological Center, 2018).

Rom Klao district in Phetchabun province; the area of study is flat land and paddy fields. The land owner of farms in Rom Klao will use fields of about 5–15 rai, of which they will use an area of about 1–3 rai for vegetable production, and the labor of household on the farm will be about 2–4 persons. After rice there is also vegetable and tobacco production. The average annual temperature is 28°C, and average rainfall about 1133.4 mm/year (Climatological Center, 2017).

Phu Thap Boek highland of Phetchabun province; the area for study is highland and with a high slope. Here the land owners have about 4–21 rai, their area usage is about 4–12 rai for vegetable production, and the labor of household on the farm is about 2–3 persons. The temperature of the area about 9–22°C all year, and the rainfall about 1133.4 mm/year (Climatological Center, 2017).

*Land cultivation patterns:* In the study, vegetable production areas have 3 patterns: 1) Low land solely for vegetable production, 2) Low land rice production with other plants after rice, and 3) High land just for vegetable production.

In low land solely used for vegetable production; farmers use herbicides sprayed for weed control, and use hand tractors and hoes for cultivation.

Low land for rice production and other crops as part of a rotation; the farmer has 2 steps for land cultivation; the first is tractor plowing for rice production, and second after the rice harvest a farmer will use a hand tractor for land preparation prior to vegetable production.

*High land solely for vegetable production;* In high land, the land is cultivated using burning and then treated using herbicide spraying. The farmer does not plow because the area is on a high slope which prevents the use of plowing machinery or tractors.

**Pattern of vegetable production:** Bueng Se-nat sub-district in Nakhon Sawan province; here the farmer will grow mainly vegetables, such as: scallions, Chinese broccoli, lettuce, coriander (cilantro), Chinese morning glory, parsley, celery, etc. Here the types of vegetables which the farmers produce will change in a rotation system, for example once the farmer has harvested Chinese morning glory they will then grow Chinese broccoli or lettuce, as shown in Figure 3.

The farmers' pesticide use can be classified in two patterns, which are: 1) for controlling weeds before planting vegetables, and 2) killing insects or for other plant disease control. As weed control, about 60% of farmers use herbicides before vegetable growth begins, 30 per cent use herbicides after planting the vegetable and for destroying weeds on the plot, and about 10 per cent don't use herbicides because they have a small plot and so perform weed control by hand. However, for killing insects, or plant disease control, all farmers use pesticides when they see insects or signs of disease in their plot or when they receive information from a neighboring farm that there is a nearby insect or disease problem.



*Rom Klao district in Phetchabun province;* in this area the study will be separated into two periods: rice plantation, and after rice plantation. In the rice production system of the area it should be noted that rain-fed areas are subject to effects which cause a farmer to produce 1 rice crop per year. After the farmer has harvested the rice, around December, the farmer will plant vegetable crops and others, often tobacco. A description of these two further crop types follows:

Tobacco plantation; farmers in the area will grow tobacco using an area of about 0.25 – 3 rai in the plantation, and use burley tobacco as the main species for growth. It takes a farmer about 4 months from planting to harvesting the tobacco product. One rai can produce about 300 kilograms of tobacco product, and the cost of production is between 80 baht/kilogram at the low end to 150 baht/ kilogram at the high end, and the average price farmers can sell at is about 100 baht/kilogram. The farmers use large amounts of herbicide for weed control, often more than 4–5 times in the early crop period (once per week in the first month of the crop), and farmer will use insecticide about 4 times per crop, with the frequency of pesticide control depending on the insect and plant disease found, and varying from farmer to farmer.

*Vegetable plantation;* here the farmer will tend to use an area of 0.25 rai (or less) up to 0.5 rai, due to farmers not using additional labor under their management. The region is famous for growing Chinese morning glory, collards, mustard greens, scallions etc. The vegetable farmer here will not use herbicide for weed control, instead they use rice straw as a covering on the field and create small holes for the growth of young vegetables. They will, however, use insecticide for plant disease control about 1–2 times per crop of vegetable production. Pesticides are used to control insect and plant disease as and when these problems are identified on the farm. *Phu Thap Boek highland;* an area of vegetable cultivation all year round, with farmers favouring crops such as cabbage, Chinese mustard, strawberry, cape gooseberry etc. Farmers take about 90–100 days per crop (average 93 days), and productive farmers can yield about 4 cropping per year. The agricultural area is rain-fed, and farmers can produce highland plants all year. The farmers only get the product to harvest, after which the middleman come to buy from his farm. In this highland region agriculture is unlikely to be rotational, so farmers generally do not make plots, instead they make a large area of about 2–5 rai per vegetable crop.

Farmer objectives for vegetable production: Study results showed that farmers' objectives can be classified into 4 main factors. The primary objective for farmers to decide on vegetable production is the aim of selling produce for making money. The secondary objectives are presented in Table 1. The results are similar to the report of Johnson (2008) who reported that the farmer values profit more than anything else, due to the desire to generate income for the household. Growing vegetables is the main occupation of such farmers. Therefore, the primary objective of the farmers is to grow plants to sell and make money for their household (Kebede and Gan, 1999; Weinberger and Genova II, 2005), but there are other areas with potential for growth, such as developing farming activities related to ecotourism, which may help provide extra income (Hüller et al., 2017; Torres and Momsen, 2004). For example a farmer in Phu Thap Boek will be developing objectives which coincide with tourism in addition to their existing vegetable production.

*Farmers' objectives for using pesticides:* The basis of farmers' decision-making when deciding to use pesticides, judging from the interviews conducted, could be classified into 6 main issues with the ranking number shown in parentheses.

Table 1: Farmers'	current obj	jectives in	vegetable	production
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-					
Bueng Se-nat	Ranking	Rom Klao	Ranking	Phu Thap	Ranking
sub-district		district		Boek	
$\checkmark$	1	$\checkmark$	1	$\checkmark$	1
$\checkmark$	2	$\checkmark$	3	$\checkmark$	2
-	-	$\checkmark$	2	-	-
-	-	-	-	$\checkmark$	3
	Bueng Se-nat sub-district √ √ -	Bueng Se-nat sub-districtRanking $$ 1 $$ 2	Bueng Se-nat sub-districtRanking districtRom Klao district√1√√2√√	Bueng Se-nat sub-districtRanking districtRom Klao districtRanking n $\sqrt{1}$ 1 $\sqrt{1}$ 1 $\sqrt{2}$ $\sqrt{3}$ 3 $ \sqrt{2}$ $\sqrt{2}$ $ \sqrt{2}$ $\sqrt{2}$	Bueng Se-nat sub-districtRanking MRom Klao districtRanking BoekPhu Thap Boek $$ 1 $$ 1 $$ $$ 2 $$ 3 $$ $ $ 2 $ $ 2 $-$

- 1. Weed, insect, and disease control (1)
- Easily increasing productivity, or getting better yields
   (5)
- 3. To ensure vegetable products are beautiful (2)
- 4. To ensure a high market value for the vegetables (4)
- 5. Ease and cheapness in management of vegetable production (3)
- Use hired labor to work less, for spraying pesticides
   (6)

**Reasons for Pesticide use by farmers:** The reasons for pesticide use by farmers can be separated 2 groups, which are:

- Weed control; farmers use herbicides to control weeds before vegetable cultivation. There are 5 issues which cause farmers to use herbicides for weed control, which are: (1) easy and rapid weed control management, (2) high efficiency weed control, (3) save money from reduced labor, (4) no labor for weed control by denuding, and (5) farmers' habituation to existing use.
- Insect and disease control; there are 5 reasons for farmers to use pesticides for insect and disease control: (1) easily and rapidly control insect and plant diseases, (2) high efficiency for eradicating insect and plant disease, (3) increased vegetable yield, (4) the vegetables are more beautiful, (5) uses less labor in control and management, (6) the ease of which they can buy a pesticide.

Value of vegetable production per area unit: The production value of vegetables will vary between species, for example coriander; when in a high price period the price reaches a high of 150 baht/kilogram (approximate 1US. = 0.027 baht) but the farmer can't continuously grow this species in the same plot, meaning they will be forced to adopt a rotation of vegetable species in the plot. The year-round farmer in Bueng Se-nat will be able to earn an income from vegetable production averaging 298,240 baht per year (calculated from area 0.12 rai over 4 crops). In Rom Klao farmers will get an income from vegetable production averaging 92,000 baht per year (calculated from area 11 rai in 1 crop). Finally, the Phu Thap Boek farmer will get an average income from vegetable production of around 222,600 baht per year (calculated from area 27 rai

over 3.5 crops). If, however, the value of production is calculated in proportion to the area of land used, it can be found that Phu Thap Boek can produce vegetables generating the highest income of 111,300 baht/rai, second is Bueng Se-nat with a production value of 49,706.67 baht/ rai, and finally Rom Klao is able to produce at 30,666.67 baht/rai. Furthermore, the value ratio of production area is shown in Figure 4.



Figure 4: Shows the value of vegetable production per area unit (baht/rai)

**Expectations in vegetable production:** The expectations of farmers in producing a vegetable harvest can be grouped into 4 topics, which are: (1) yields of vegetable production increasing, (2) high sale price for the product, (3) improved quality of life, and (4) to get more money from vegetable product. When ranking these factors it became apparent that making more money from vegetable production is of the highest importance for farmers ( $\bar{x} = 5$ , SD.=0) (shown in Table 2), so the ranking shows the relative importance of the objectives of vegetable production of farmers to products to sell.

**Expectations for using pesticides:** The expectations of farmers for using pesticides can be identified as 5 major topics: (1) efficiency of pesticides in weed and/or insect control, (2) the pesticides can decrease production loss from insect and disease, (3) the vegetables can be of high quality, attractive appearance, large size, etc., (4) ease of product management, and (5) uses less labor. When ranking these factors by importance, ease of product management is ranked highest ( $\bar{x} = 4.47$ , SD.=0.552), so the ranking demonstrates the relative perception of farmers when using pesticides in vegetable production, as presented in Table 3.

	-	_							
Items	5	4	3	2	1	Ν	X	SD.	Ranking
Yield of vegetable production increasing	9	4	18	5	0	36	3.472	1.013	4
High price of production	29	7	0	0	0	36	4.805	0.395	2
Improved quality of life	25	8	2	1	0	36	4.583	0.721	3
Get more money from vegetable products	36	0	0	0	0	36	5	0	1
Average	24.75	4.75	5	1.5	0	36	4.465	0.881	

#### Table 2: The expectation ranking of farmer to vegetable production

Remarks. Rate of score: 5 = maximum, 4= max, 3= medium, 2= min and 1= minimum

#### Table 3: The expectation ranking of farmer to use pesticides

Items	5	4	3	2	1	Ν	x	SD.	Ranking
Efficiency of pesticides in weed and/ or insect control	21	9	4	2	0	36	4.361	0.886	2
Can decrease production loss from insect and disease	15	14	4	3	0	36	4.138	0.917	3
The vegetables are high quality, meaning beautiful, large size etc.	10	18	5	3	0	36	3.972	0.865	4
Ease of product management	18	17	1	0	0	36	4.472	0.552	1
Use less labor	7	5	12	9	3	36	3.111	1.214	5
Average	14.20	12.60	5.20	3.40	0.60	36	4.011	0.888	

Remark. Rate of score: 5 = maximum, 4= max, 3= medium, 2= min and 1= minimum

#### Table 4: The ranking of causes of concern about use of pesticides for farmers

Items	5	4	3	2	1	Ν	X	SD.	Ranking
The pesticide can't control weeds and/or insects	27	4	5	0	0	36	4.611	0.717	4
The price of pesticides are high	25	10	1	0	0	36	4.666	0.527	3
The pesticides can't control insect, effecting to vegetable quality, and therefore price of product	30	6	0	0	0	36	4.833	0.372	1
The impact of pesticide to farmers' health	25	11	0	0	0	36	4.694	0.460	2
The impact of pesticide on the environment	7	21	8	0	0	36	3.972	0.644	5
Average	22.80	10.40	2.80	0.00	0.00	36	4.555	0.544	

Remark. Rate of score: 5 = maximum, 4= max, 3= medium, 2= min and 1= minimum

The farmers' concerns about pesticides use: When farmers use pesticides in a vegetable production system they have 5 topics which cause concern, these are: (1) doubts over pesticide quality, e.g. ineffective at controlling weeds and/or insects, (2) the pesticides' inability to control insects having an effect on vegetable quality, and therefore impacting the price of product, (3) the price of pesticides are high, (4) the impact of pesticides on the farmer's health, and (5) the impact of pesticides on the environment. The issue of a pesticides' inability to control insects, and the associated effect on vegetable quality and impact on the price of product, is the most important aspect of the farmer's concerns ( $\bar{x}$  =4.833, SD.=0.372), as presented in Table 4.

**Push and pull are inside factors of farmers for using** *a pesticide n vegetable production:* The inside factors of farmers can be considered a balance between push and pull factors:

 The push factors for farmers deciding to use pesticides are a combination of expectations and considerations of productivity. The farmer's expectation with pesticide use is that it makes for comfortable management, and farmers hope for a vegetable production which generates more money from the product, so all farmers accept the increased efficiency of chemical pesticides.

(2) The pull factors for farmers deciding to use a pesticide are that it is responding to the farmer's expectation of weed control, insect and plant disease control, it saves time and labour, etc., so the farmer's opinion of pesticides is a major factor responding to vegetable production systems.

The relationship between pesticide use and vegetable production is considered by farmers to help ensure "easy, but good price". In the study it was found that a cyclical system of inside factors of farmer expectations on pesticide use will respond to the production yield, and production yield will in turn respond to the price of a product, & price of a product will itself respond to household incomes of farmers. This is presented in Figure 5.



Figure 5: Cycle of inside factors of farmer expectations over pesticide use

Outside and Able factors of farmer for use a pesticide to vegetable production: The farmers do not deal with the problem of taking the produce to market, as the products are acquired from the farm by a middleman. The market destinations for the middleman are Talad Thai and Talad Sri-Mum-Meung in the central region of the country, from where the vegetable products will be distributed to local markets all over the country. and able factors of farmer are 6 issues:

- The farmer not a problem with marketing, so farmer is vegetable culture only after than will be middleman come to farm for buying.
- The market need a lot value of vegetable.
- The vegetables are good price, so farmer can sell and got more benefit.
- The vegetable have a wide market.
- A farmer is land owner to vegetable culture.
- The farmer has a skill to vegetable production.
- Able factors affect to farmer decide to culture vegetable continues.

Possibility of farmers to stop pesticide use: In this study it was found that all farmers (100%) who were interviewed wanted to stop using chemical pesticides, but only under the condition that the alternative is "not more difficult to implement, and has efficiency greater than chemical pesticides". From this we can see that the farmer has the perception that organic vegetable production is difficult to manage, uses more labour, and that selling the produce at market can be difficult, too. These issues can be classified as:

- The product must to replace the benefits of pesticides
- The product must have efficiency similar to pesticides
- The product must be cheaper
- The product must be easy to use and quick to respond in weed control, insect and disease control
- The vegetable products must to sell well
- The vegetable products should command a high price
- The government should guarantee a product to have no pesticides in its production system

It can be observed that 4 of the 8 topics is related with the farmer's need for the alternative product to be omparable with chemical pesticides.

#### CONCLUSION

The farmers are cultivating vegetables for sale as they need income for their household, so vegetable production is the farmer's occupation. A pattern of vegetable production will be separated from land use are; (1) vegetable rotation species in Bueng Se-nat sub-district, (2) vegetable culture after rice harvest in Rom Klao district, and (3) high land cultivation in Phu Thap Boek high land of Phetchabun province. The land value of vegetable production found in the Phu Thap Boek highland is higher than in Rom Klao and Bueng Se-nat areas (3.6 : 1.6 : 1). The primary objective for vegetable farmers to use pesticides is weed control, insect and plant disease control. The motivation for using pesticides is that high volume production will result in more money for the farmer. ( $\bar{x} = 5$ , SD.=0), and the expectation for pesticide use is that it will result in easier production management ( $\bar{x} = 4.47$ , SD.=0.552). However, in the study it was found that farmers tend to use pesticides as they respond to the needs of farmers to produce their crop "easy, but good price". It is possible that a farmer may stop using pesticides, but only if an alternative product can be found with similar benefits.

#### RECOMMENDATIONS

in the study it was found that factors which effect farmers' use of pesticides, such as the availability of alternative products for weed control, insect and disease control, remain a big challenge for developing vegetable production to be free from chemical pesticides. At present in Thai agriculture, the government is trying to promote organic products and supports IPM (integrated pest management) for farmers. However, identification and development of pesticide substitutes which meet the needs of most farmers will be the best solution for them to cultivate vegetables.

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# Stability of Native Chicken Raising Systems: The Case of Lawa Ethnic in Mae Hong Sorn Province, Thailand

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#### ABSTRACT

This study's purpose is to examine the stability of the native chicken raising system of the Lawa people in the Dong village, Houy Lom sub-district, Mae Lanoi district, Mae Hong Sorn province, Thailand. The methodology is a qualitative survey, using an observational checklist, and semi-structured interview of the local experts, focused on the topic of indigenous chicken stability. The Dong village has 229 households and a population of about 993 people (4-5 villagers per household). The main occupation of the villagers is to raise native chickens for offering spirit, called Phuk Kwan, and as food for household consumption. The ecology of native chicken raising in the village is tied to the feeding methods, feed quality and natural control of naive chickens. The hatch rate is about 40% of fertile eggs per period, and the living rate is between 50% and 70% of hatchlings. The reproductive rate of native chickens is very low, but the time to return to production after die-off from epidemics is short 5 to 8 months, and this is one reason the villagers do not vaccinate the native chickens. The ethnic group's productivity in raising native chickens is not different from that in the lowland region or that of the other ethnic groups in the northeast region of the country, which shows that the Lahu ethnic group maintains the stability of the native chicken production system. This is because at present, the chicken has remained in food production and useful due to the belief systems in the community, but there is a risk that the system is breaking down because the community and believers are changing with the social dynamics, and the benefits of raising native chickens have continued to trend downward. Making a valuable product is very important to the continuation of native chicken raising in the Lahu community.

Keyword: Lawa ethnic, Native chicken raising systems, Northern, Stability, Thailand

#### **INTRODUCTION**

The native chickens are mainly raised by villagers for household consumption, and others raise them as pets or for activities like cock fighting (Pharaluk *et al.*, 1985; Choprakran *et al.*, 2005). Information related to the native chicken population of the country is inconsistent, so there are many projects to support and bring technology into rural communities. The National Development Plan V (implemented between 1982 and 1986) had a project focus on poultry development in poor villages in rural areas. Under the National Development Plan VII, the Livestock Department will be undertaking academic studies, and the Agriculture Extension Department has planned 2 projects: healthy animal development and an animal raising extension service (Choprakran *et al.*, 2000). A part of the native chicken raising/breeding extension service is crossbreeding

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to 2 and 3 lines of chickens to increase production, but farmers have not responded to the government program, and in the report of Srimaraks *et al.* (2007) found that farmers in the rural northeast area of Thailand are raising their chickens in natural systems similar to previous times.

In 2004, Thailand was affected by the avian influenza, and the government took defensive measures, which decreased damage to the native chicken population. However, information from the Department of Livestock Development (2005) reported that the number of native chickens in the country after the avian influenza increased to their normal population. The rate of repopulation for native chickens shows that the sustainable concept of Convey (1980) is possible. Convey's sustainable concept explains that the sustainable systems can have productivity decrease rapidly (or the system can fail), but production can then improve to the original rate, which means that the system is sustainable.

Data from the Department of Livestock Development (2004) reported that the total poultry population of Thailand in 2002 – 2003 was about 280 million, of which native chickens amounted 22.5 per cent (63 million) of total poultry. The report "Summary of monitoring and evaluated annual 2004" by the Livestock Department of the Agriculture Ministry shows that in 2004, the Thai government destroyed about 49.932 million poultry, and possibly about 11 million native chickens. However, the native chicken raising systems and the report from Department of Livestock in 2005 show that native chickens numbered about 65 million nationwide, so the rate of repopulation is high.

However, the native chicken raising system has the possibility of changing depending on the content of the community; in the effected situation, the research question is "what is the state of the native chicken raising system in the community, and is the native chicken productivity system stable and sustainable?" The answer to this question will be guaranteed to increase knowledge of native chicken productivity and will also help create guidelines for improving native chicken raising systems so they will continue to be suitable for the village.

The rural community is changing rapidly according to the Simaraks *et al.* (2007) report on the native chicken raising system of ethnic groups in Northeast Thailand. There is an important connection between the system of livelihood in the village and the area of social beliefs, as is made evident by the ceremony in the rural community. The information given has helped us develop a working hypothesis, which is that the differences between the ethnic groups in the region include the differences in native chicken raising methods, or similarly the differences in how native chickens are used, so the logical working hypothesis focuses on an extreme purpose for the ethnic groups of the highland region of Northern Thailand.

This study is focused on the Lawa people in Northern Thailand, because the Lawa people are a group that engages in highland agriculture in northern Thailand. The study focuses specifically on the Lawa people in the Dong village, Houy Lom sub-district, Mae Lanoi district, Mae Hong Sorn province, and examines the stability of native chicken raising systems in Northeast Thailand.

In the theoretical framework of the stability concept in vision of systems approaches in agriculture, so consider in the situation of the area (Rerkasem, 1989), so Conway (1985) explains with stability is the degree of productivity survive constant in spite of normal, and possibly its small scale waver in environment variables, so in the stability can be measured by the reciprocal of the coefficient of variation in productivity. However, when considering that stability should be defined as the constancy of yields from harvest to harvest and the capacity to continue on an indefinite basis, respectively. The time series data are required to be established for these properties, and the nature of the project cannot arrive at quantitative measures of these properties (Salinas, 1988), so the properties of the systems will consist of productivity, stability, sustainability, and equitability (Simaraks, 2002; Borisutdhi, 2015).

However, the study by Chamber *et al.* (1989) shows that knowledge of how to maintain the stability of production systems is transferred by the farmer to the villagers by experience, so the scope of stability of the native raising system should be considered with environment and the uses of the native chicken in mind.

#### MATERIALS AND METHODS

This study employs a qualitative method of surveying and interview the local experts, and focuses on the topic of villagers' methods of native chicken raising, the benefits of raising the indigenous chicken, and how the ecological system in the village relates to the native raising system.

*Study site:* The criteria of study site are focused in 1) the Lahu village, 2) the village settled in the highlands of northern Thailand, 3) the village that has villagers raising native chickens and 4) in the area of study in the Dong village, settled in the Houyhom sub-district, Maelanoi district, Mae Hong Sorn province of Thailand.

#### The personnel for data collection

- 1. The village leadership is two persons, one is the village leader, and one is the old village leader.
- 2. The senior villagers have six persons for interviews.
- 3. The villagers in the community have 12 persons raising the ingenious chicken in the community.

*The tools and data collection:* This study was conducted in the village and interviewed the leader of the village and

villagers who live in the community. The semi-interview (Simaraks and Suphatera, 1987) is mainly a tool to interview the key informants (KI) and villagers in the community and was combined with the checklist from observation in the community.

**Data analysis:** This data is used for content analysis mainly to analyze the framework of stability for the productivity and sustainability from environmental, economic, and social perspectives in the villagers' native chicken raising systems of the community.

#### **RESULTS AND DISCUSSION**

**Context of the study site:** Most of the Lahu people live in the hill tribes community in the northern region of Thailand. The Lahu have a population between 85,845 – 127,200 peoples. Diamond (2011) and Young (1962) have a report of original believed by Lahu people live in the hill tribes of Northern Thailand are theistic animists. Almost every village consists of farmers who grow rice and corn as their main crops, and the main animals raised are swine and chickens for household consumption.

The Dong village is settled in the Houyhom sub-district, Maelanoi district, Mae Hong Sorn province. The village, settled on a hill, is about 1150 meters above sea level, and in the Universal Transverse Mercator projection zone 47 with the coordinates 406734.79 East and 2028534.78 North. The village has 229 households and has a population of about 993 people, so most people live with about 4-5 villagers per household. Almost villagers are aged below 16 or over 45. The house of a villager is close and does not have walls, which is an effect of the village's high density (about 6 houses per Rai or 37.5 houses per hectare).

Most of the villagers' food will come from the local market (about 2 kilometers from the village), so they have many products imported from the urban market, including pork, poultry, meatball, fish sauce, among other things. Some produce, such as vegetables, natural food products (e.g. mushrooms, insects) are collected in the forest around the community and bought in the local market.

*The economy of villagers in the community:* In the community, there are three main sources of income for villagers are:

1. Agriculture production is the main occupation of villagers in the community.

- 2. The villagers participate in labor exchange between farms in the community and the Royal Highland Project.
- 3. The grandparents of a household work out in the community and send money back to the family.

However, the livelihoods of villagers have adapted to mirror those of people in an urban area; in light of this, household expenditures are:

- Education of a child; in the village, household expenditures are used to support a child's study in high school and in an undergraduate [diploma] university in the urban area. Village expenditures are 3000 – 12000 baht (approximately 36 Bath = 1 USD) per month (36,000 – 144,000 bath per year) or about 20% – 30% of the total income of the household.
- 2. Food consumption; the average cost of food for villagers is 170 250 bath per day or 62,050 91,250 bath per year. Most of the food consumed is protein, such as pork, beef, chicken (including eggs), etc., and less of the food consumed includes carbohydrates, vitamins and minerals. However, food expenditure today is different from that of the past because previously, villagers searched for food in the forest near the village and engaged in agriculture to support their families. If they experience agricultural overproduction, they can sell their products to the local market or pick up to sell an urban market.
- 3. Agricultural investment; agriculture is a major household occupation in the community. Villagers are highly active in land agriculture, and many villagers are members of the royal highland project. The cost of agriculture investment per household is about 1,450 bath per rai (1 rai = 0.16 hectare). This cost can be classified as relating to seeding, herbicide control, pesticide control, water supply management, labor support and harvesting. There is about 15 20 rai per household for agriculture, and the villagers' average agriculture investment per crop is about 21,750 29,000 bath per crop.

**Objective of animal raising in the community:** The Dong village has four species of animals that are being raised. They are: 1) The native chicken is the main type of animal raised in the village, with about 80% of households in the village raising chickens; 2) swine is a minor animal

raised in the village, with about 25% of households raising it; 3) about less than 10% of households raise cows; and 4) about 2 - 3% of households raise buffalos. Previously, villagers who raised cattle rounded them up and took them to the mountain for grazing. There are currently stables on farmland outside of villages. At the present time, villagers continue to use the previously used cattle raising system part of the time, but the grazing land for the cattle has area smaller variance the fields of villagers have increased.

Objective of villager in native chicken raising: The main objective of the villager is to raise native chickens for food consumption in the household. When the villagers in the Dong village were interviewed, they were asked about the purpose of raising native chickens in community comparing between the present and previous time for considering in benefit of native chicken of villager. In the past, the first objective was protein consumption in the household, and the second goal was the use of chickens in worship and as gifts, but at present, the purpose of raising native chickens has mainly changed to using them as gifts for neighbors when they have household members sick. In addition, kinship can give an offering to the spirits, or what they call Phuk Kwan; using a native chicken boil is necessary for making an offering to the spirits. Furthermore, spiritual worship, or Intakeen, is similar to pee phu ta in Northeast Thailand; the community will offer a buffalo, but at the household level, a native chicken boil will be offered; thus, the survey results were found to be similar to the report of Kayo et al. (2009) regarding the purposes of raising native chickens in the village in the highlands of Northern Thailand. In total, the seven purposes classified are: [1] consumption, [2] sale, [3] spiritual purpose, [4] cock fighting, [5] fortune telling, [6] medicinal use, and [7] pleasure. Report data of Takashi and Kazunobu (2009) studies at the Mien hillside village about the purpose of raising native chickens indicated that three purposes are: ritual (89% in the village), household consumption (7% in the village) and gift (4% in the village).

The three main reasons for raising chickens are: 1) The villager can purchase this protein relatively cheaply and easily; 2) the villager knows about karma and is scared to slaughter other animals—almost no villagers under 45 years old have even slaughtered chickens; and 3) the native chicken has been raised for a long time and is cooked every day, but a change in production is not enough to affect household consumption.

The ecology of native chicken raising in the village: Regarding the ecology of the native chicken raising system, one may call the system the "backyard raising system." Villagers do not build houses especially for chickens; rather, the chickens live in the same houses as the native swine and the cattle.

Feeding and feed quality: The main feed of the native chicken may be called the *as best one could system* because the villager will use waste from cooking or food scraps as feed for native chickens, and sometimes they will use rice grain as a supplement for the chicken. The report of Saiprajong and Pinitglang (2012) presented that the rice protein of Thailand has about 6-8 per cent crude protein, and the normal native chicken needs 15-21 per cent of crude protein (Hongladdaporn, *et al.*, 2014). In open systems for raising native chickens, chickens can go hunting for natural food, such as worms in swine or cattle excrement, bugs, etc., around the village to get the nutrient balance they need.

Natural control of native chicken: The natural control of native chicken raising systems has caused the native chicken population in the village to increase to 20 - 30chickens per household annually. In about 3-4 years, there will be an epidemic, such as newcastle disease, fowl cholera, pullorum disease, etc., which affects the native population in the village, causing it to decrease too quickly. This phenomenon is similar to the result of a report by Simaraks et al. (2007) explaining the biological control of native chickens: In the village, there will be a poultry epidemic [this does not have academic data support] in 3 – 5 years. The poultry epidemic affects more native chickens in communities, but an antibody may be available by breeders. Solomon (1949) and Scott (1988) explained that when an animal population increases to over its optimum point in relation to the density of the population, there could be problems such as genetic defects from inbreeding, a decrease in the volume of feed in nature, problems related to ecology, etc. A suitable rate of native chicken raising in natural systems in the future should be sought.

**Productivity of native chicken in the village:** From the perspective of villagers, about 40% of fertile eggs can be produced per period, and in the natural chicken raising systems in the village, the chicken living rate is 50 - 70 per cent. Thus, the productivity of native chickens is low, including the productivity in the Dong village. The results

are similar to those reported by Simaraks *et al.* (2007), who explained that the productivity of the native chicken is low; the productivity of native chicken raising in the natural systems of farmers in Northeast Thailand is similar among all ethnic groups.

**Productive performance:** The productive performance of native chickens is very low because four months is spent raising them for eating or for use in a ceremony. According to the report of Jatursitha *et al.* (2002), the average daily grain (ADG) of native chickens is about 4.24 grams per day (ages 0 - 4 weeks) and about 7.32 grams per day (ages 0 - 4 weeks). Efforts are being made to develop the raising system to improve the productivity, but the growth rate has not improved much (Wantasen *et al.*, 2014), for development of the performances of native chicken.

**Productive return:** The productive return is related to the situation of the volume of native chickens in the community after there has been an epidemic in the community (this phenomenon will appear epidemic annually around every 3 - 4 years per time). The epidemic causes a loss of native chickens, but villagers in the community use the following methods for breeding:

- Keep the breeding stock after the epidemic. There will be some native chickens remaining, and the villager can use them to continue breeding. This is the situation facing about 60% of villagers raising native chickens in the community.
- 2) The villager will buy native chickens from a neighboring village to use for continual breeding. This is the situation facing about 40% of villagers raising native chickens in the community.

However, regarding the concept of a sustainable system, Conway (1985) explained the relation of productivity breakdown and the return of productivity to the production system. The native chicken raising system in the community will take about 5 - 8 months to return after an epidemic situation, so the native chicken in the community has stability in production systems.

**Vaccination of native chicken in community:** The villager has knowledge about poultry vaccines because the government provides information and suggestions about vaccination. However, the villager does not use vaccines for epidemic control because they have these ideas: 1) It is difficult to use and procure vaccines, 2) vaccination cannot

stop an epidemic because there are many epidemics in native chickens, and 3) when native chickens die, villagers can easily find reserves for breeding.

**Pattern of native chicken raising in community:** The native chicken raising in the village occurs in an open system that has a natural raising pattern and that uses natural feed supplemented by rice grain. Thus, the pattern is similar to the native raising pattern of the lowlands and other ethnic groups in the northeastern region of Thailand:

- 1. Feeding using natural feed is major and supplemented by rice grain. The villager feeds the chickens about one time per day or two days. The villager will broadcast rice grain on the ground, and the chicken will drink from wastewater and water in the cattle corral under the house of the villager.
- 2. The breeding of native chickens in the community involves the concept of having a breeder/ replacement stock because the villager will allow the chicken to move around the village and breed naturally; this is good for protection against animal inbreeding. However, the pattern of the villager's raising a chicken was not significant in previous times, so the report of Lopez *et al.* (2014) explained that the pattern of native chicken raising is related to the sociodemographic profile of community.

# Reason for the native chicken's low productivity in the community

- 1. Native chicken raising is not the main activity of the household, so villagers may not be interested in it.
- 2. Native chicken raising takes a long time.
- 3. There is no market to support natural chicken raising locally (actually, chickens can be sold in the local market, but villagers have the idea that buying native chickens is easier than raising them).
- More villagers like boilers more than native chickens (we found that villagers under 35 years old prefer boilers because they are more tender than native chickens).
- 5. The native chicken's low productive performance affects villagers, who must spend too much time raising these chickens.

*Relation of ethnic group and native raising productivity:* The relation of the ethnic group and native

raising productivity is not different between the lowland region or other tribes in the northeastern region of the country. The relationship of the villager and the native chicken is impacted by the food production system as well as the community belief system. This study shows a decreasing trend for raising native chickens because the village can buy chickens more easily than it can raise them, so there is a risk of a low volume of native chickens in the future.

Value and economic sides: Regarding the demand side of native chickens in the community, the main purpose of native chicken raising in the village today is different from how it was in the past. In the present, the knowledge of the villager has increased. In the past, when a household member became sick, the family used the native chicken for propitiating the spirits, but in the present time, when a household member is sick, he or she will simply go to the hospital. The propitiating of four spirits still occurs in the community today, but the emphasis that has been placed on such ceremonies is decreasing. Based on this study, there is a trend of the regression of the value of native chickens in the community due to urbanization. With the price of native chicken slaughtering being about 120-150 bath per chicken, in the community, only about 20 per cent of households have been selling chickens in the past few years.

However, when the researcher focused on the question of "If the native chicken is not important, why are we still raising it?" the villagers answered that, in the village, the native chicken does not appear to be important in the food production system compared to in the past, but if it is a guaranteed food source, it is impossible to lack protein in the household. The villagers' answer shows that the native chicken still has importance in the food system in the community (similar to the food security concept).

#### CONCLUSION AND RECOMMENDATION

In the study, it was found that the Lahu ethnic group in the highlands of the northern region of Thailand maintain the native chicken production system because the chicken has remained an important part of food production and belief systems in the community. Also, the native chicken raising system is low cost and has a fast productive return, so it is a sustainable system concept altogether. The situation of the native chicken raising system of the Lahu ethnic group is not significant when compared with other ethnic groups in the northeastern region of Thailand. At present, the native chicken is stable and sustainable in the raising system of a community, but the result of the study found that there is anxiety surrounding the native chicken raising system in the community because the perception of the benefit of the native chicken in the community has changed. Also, the native chicken's importance in food production and on the economic side is decreasing. In addition, the urban concept is becoming increasingly popular. All of these pose a risk to the native chicken raising system in the community. However, in the present situation of native raising systems, we are finding a new opportunity for the systems of native chicken raising because the production of native chickens is required from urban people (ages 35 years and older), and chickens are clean and healthy food products, so this is a market trend in the present and future. This is particularly true if the villager has a market in which to sell the chickens, or some organization, such as an agriculture extension department or a ministry of commerce, that can help the villager with marketing. In addition, the native chicken raising system in the community is low costanother reason the chicken raising system in the community remains promising in the coming years.

#### LIMITATION OF THE RESEARCH

The limitation of research is timing of villager, almost villager goes to field early morning and go back to home about 5 - 6 pm. effect too difficult for interviews the key informant in the evening day.

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## Relevance of Good Agricultural Practices in Organic Production Systems

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#### ABSTRACT

Demand for organic food is higher than ever but the sustainability and the health benefits of organic food has always been a issue of discussion as the food produced using agricultural means is not produced in harmony with nature, whether it is grown by organic or conventional methods. Clinical and field trials conducted in various settings established that nutrition wise also there is no or non-significant difference between organic and conventional food. In such scenario Good Agricultural Practices (GAPs) offers immense scope for Agricultural economies like India to take advantage of the new trade opportunities that sustain the export of premium farm produce and processed farm products. This can be achieved only if production is made as per the consumer demands and requirements of international markets. GLOBAL GAP (earlier known as EUREPGAP) has established itself as a key reference for Good Agricultural Practices (GAPs) in the global market place, by translating consumer requirements into agricultural production and the concerns and commitments of a wide range of stakeholders about food production and security, food safety, quality and the environmental sustainability of agriculture. Besides these it has social impacts as it takes care about workers health, safety and welfare. The paper elaborates the scope of GAPs in context of organic food production system and the relevant protocols available to take advantage at stakeholder level.

Keywords: Good Agricultural Practices (GAPs), Organic production system, Preparedness

#### INTRODUCTION

Over the years, the world agricultural scenario has undergone sea change altering significantly its global picture and the transformation of some of the countries, from mere subsistence farming to commercially-oriented scientific crop cultivation like India in a short span has very few parallels in the world. Few agriculturally backward countries now grows food and non-food crops in adequate quantity to meet the growing needs of burgeoning population and have emerged as a strong agricultural force which once were viewed as a market for food and other agricultural products by the agriculturally developed western world. This self-reliance of such countries in the field of agriculture and their place in global agriculture had been the result of application of science in agriculture supported by conscious, sustained and meticulous planning and research efforts by the scientists along with untiring efforts of the extension workers in transferring of relevant farm technologies. But now a day the global emphasis on safe and secure food has increased in milieu of food scams

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and health hazards in developed world. The global emphasis on safe and secure food supplies must be seen against a backdrop of an increasing number of immunocompromises people (i.e. HIV/AIDS) as well as increased outbreaks of diseases such as cholera and typhoid, particularly in developing countries, which are result of inadequate sanitary measures and contaminated drinking water. With respect to developed countries such as the European Union, the importance of food safety was emphasized by the recent outbreaks of Mad Cow disease (BSE) and Food and Mouth disease as well as traditional concerns with environmental pollution, particularly pesticides and the issues surrounding Genetically Modified Organisms (GMO).

Pesticides consumption in some of the major countries, like USA (7.0 kg/ha), Europe (2.5 kg/ha) Taiwan (17 kg/ ha), Japan (12 kg/ha), Korea (6.6 kg/ha), India (0.5 kg/ ha) is much higher than permissible limits. Much bigger is the problem of pesticide residue in food products, which mainly percolate from fruit and agriculture crops wherein pesticides are used to kill pests. Giving reasons for more pesticide residue in food products in India *vis-a-vis* other countries, representative of CSE during her evidence before the Committee stated that other countries were using degradable pesticides. Pesticides used by them are not persistent. However, in India due to more use of persistent pesticide, their residues remain in food products. The problem of persistence of pesticide residues in food and agricultural products is due to lack of awareness on the part of farmers with regard to judicious use of pesticides, the other reasons are:

- Indiscriminate use of chemical pesticides
- Non-observance of prescribed waiting periods
- Use of sub-standard pesticides
- Wrong advice and supply of pesticides to the farmers by pesticide dealers
- Continuance of DDT and other uses of pesticides in Public Health Programmes
- Effluents from pesticides manufacturing units
- Wrong disposal of left over pesticides and cleaning of plant protection equipment
- Pre-marketing pesticides
- Treatment of fruits and vegetables

Microbial Food Safety Concern and Changing Food Safety Standards has resulted in increased public awareness due to outbreaks, activism and availability of information, advances in scientific knowledge, increased and improved surveillance, value-added opportunities, rapid domestic and import trade and land use and waste management conflicts. Changes in consumption patterns towards increased consumption of "riskier" foods like uncooked produce, salad bars, minimally processed/pre-prepared, imported foods (year round availability) and also the increased popularity of "riskier" produce in the form of green onions, Cilantro (16% positive Salmonella and Shigella) mesculun / spring mix, seed sprouts, unpasteurized juices and melons has been the driving force regarding the food safety and its quality. Potential contamination sources considered include- irrigation water, manure (intentional and incidental), inadequate field sanitation during production and harvest process, wash water, handling, cross contamination during processing and ice, inadequate sanitation during distribution of the food products.

## Organic production vis-a-vis sustainable food production

The organic food industry is booming. Demand for organic food is higher than ever, according to the Organic Trade Association's recent report, Americans spent a whopping \$43.3 billion on organic food in 2015, an 11 per cent increase over last year's record. And yet 5.6 billion pounds of pesticides are used around the world each year. Global organic food market is projected to register a CAGR of over 16 per cent during 2015-2020. The increasing wakefulness about the chemical free and safe food for a better living, the willingness of consumers to pay out more on organic and high demand for organic produce in international market have raised the demand of organic food even in the domestic markets and lured farmers to adopt organic production through group efforts of farming, marketing and exporting (Gills et al., 2013). The share of land under organic farming is abysmally low (1.1% of total agricultural land). Out of this, 45% of the worlds' organic agricultural land is in Australia (Oceania) and 99 per cent of it is under grazing land. Organic food is made without; synthetic fertilizers and pesticides, genetic engineering, sewage sludge, radiation and preservatives. Organic agriculture is often described as an "alternative" agriculture; an alternative to- conventional or industrial agriculture which has emerged over the past 100 years as the dominant agricultural system in most places across the world. Thus, the two methods are often contrasted with one another with organic agricultural operations portrayed as small-scale, mixed crop production and - conventional agriculture portrayed as large-scale mono-cropping. In relation to environment, organic agriculture refers to a farming system that enhance soil fertility through maximizing the efficient use of local resources, while foregoing the use of agrochemicals, the use of Genetic Modified Organisms (GMO), as well as that of many synthetic compounds used as food additives. Organic agriculture relies on a number of farming practices based on ecological cycles, and aims at minimizing the environmental impact of the food industry, preserving the long term sustainability of soiland reducing to a minimum the use of non-renewable resources (Gomiero et al., 2011)). Organic agriculture comprises a set of management practices aimed at environment-friendly production by avoiding the use of synthetic fertilizers and pesticides and by strong reliance on closed on-farm nutrient cycling,

including biological nitrogen fixation and crop rotations, to support soil fertility by enhancing soil organic matter content. Organic agriculture often strives to protect soil fertility which includes crop rotation, intercropping, polyculture, cover crops, and mulching (Gomiero et al., 2011). Further soil can be understood as an ecosystem or food web which is a series of conversions of energy and nutrients that occur as one organism eats another (Ingham, 2000). Another consideration is soil organic matter, which according to Pimentel et al. (1995) facilitates the formation of soil aggregates, increases soil porosity, and thereby improves soil structure, water infiltration, and ultimately overall productivity. In addition, organic matter increases water infiltration, facilitates cation exchange, enhances root growth, and stimulates the proliferation of important soil biota. About 95% of the nitrogen and 25 to 50% of the phosphorus is contained in organic matter. Thirdly, the relationship between soil, food and human health can't be ignored. According to Quayson et al. (1997) what people and animals eat determines to a large extent their health status. What the soil lacks in nutrients, the crops will also lack, as will, ultimately, human beings and animals. Mayer (1997) suggested that the cumulative effects of ongoing synthetic fertilizer applications to the soil might affect the food grown in it. Some of the studies have demonstrated that the content of certain vitamins, minerals and secondary nutrients (e.g., antioxidants) are higher in certain organically grown produce. There is also evidence that some nutrients are more persistent; that is, some organically grown vegetables retained more of particular nutrients after a period of storage than conventionally grown produce. Evidence suggests that these higher levels of vitamins, minerals and secondary nutrients may be a result of organic soil management through practices such as the application of organic (as opposed to synthetic) fertilizer (Nowatschin, 2013).

After the fascinating discussion on organic agriculture let us try to understand other side of the coin focusing organic agriculture's link with sustainability. What does "sustainable" really mean, and how does it relate to organic methods of food production. An extension professor defines that a sustainable agriculture must be economically viable, socially responsible and ecologically sound. The economic, social and ecological are interrelated, and all are essential to sustainability and the three must be in harmony (Ikerd, 2001). Organic food production appears to be natural, but agriculture is in no way natural. Food produced using agricultural means is not produced in harmony with nature, whether it is grown by organic or conventional methods. According to the Worldwatch Institute, "Organic farming has the potential to contribute to sustainable food security by improving nutrition intake and sustaining livelihoods in rural areas, while simultaneously reducing vulnerability to climate change and enhancing biodiversity." On the other hand Dahan et al. (2014) concluded that commercial farms that rely on compost as the main fertilizer source, as commonly practiced in organic agriculture, result in substantial down-leaching of nitrate compared with farms that rely on fertigation methods, as commonly practiced in conventional agriculture hence increased groundwater pollution potential in organic agriculture and composting generated significant amount of greenhouse gases.

Organic food can only be produced using manure and other organic fertilizers, among other requirements. Mineral fertilizers, also called chemical fertilizers, are not allowed, nor are chemical pesticides. Grønlund says that most agree that sustainable food consumption means that people eat more vegetables, less meat, and waste less food. "If we do this, there will be fewer animals and (consequently) less organic fertilizer. Can a production system be sustainable if it relies on a consumption pattern that is not sustainable?" Organic food is not inherently safer and has the same risk as non-organic foods for foodborne bacteria contamination. Fresh produce of all varieties are prone to listeria, E. coli, salmonella, and other bacteria. A British meta-analysis published in the Journal of Environmental Management (2012) addressed the question whether organic farming reduces environmental impacts. It identified some of the stresses that were higher in organic, as opposed to conventional, agriculture: "ammonia emissions, nitrogen leaching and nitrous oxide emissions per product unit were higher from organic systems," as were "land use, eutrophication potential and acidification potential per product unit." The low yields of organic agriculture-impose various stresses on farmland and especially on water consumption. In a meta-analysis study of 316 studies comprising 34 different crops, it has been observed that the yield reduction may range from 4 to 34 per cent with an average of 25 per cent in organic farming (Seufert et al., 2012). Lower organic crop yields typically 20 to 50 per cent than conventional agriculture are largely

inevitable in organic agriculture, which have the implication for the conversion of more land to farming and on water supplies, both of which are serious environmental issues. Another issue challenging sustainability of organic agriculture pertains to absolute exclusion of "genetically engineered" plants whereas the resistance to some disease/ insect pest, higher yield and other desired characteristics are results of one or another technique of genetic engineering.

Regarding health benefits of organic foods, the results of one of the largest study conducted by Dangour et al. (2010) suggested an association of reported consumption of strictly organic dairy products with a reduced risk of eczema in infants, but the majority of the remaining studies (8 reports of human studies, including 6 clinical trials, 1 cohort study, and 1 cross-sectional study, and 4 reports (of studies in animals or human cell lines or serum) showed no evidence of differences in nutrition-related health outcomes that result from exposure to organic or conventionally produced foodstuffs. Bradberry et al. (2014) studied the impact of organic versus non-organic food on incidence of cancer and concluded that there was little or no decrease in the incidence of cancer associated with consumption of organic food except possibly for non-Hodgkin lymphoma, on the basis of 0.6 million women. In a meta-analysis, examining the safety and quality of organic vis- a-vis traditional farm produce, it was observed that there is no proof to support such a claim that organic food is tastier, safe and qualitatively better compared to traditional food (Spangler et al., 2012). The study conducted by All India Network Project for Pesticide Residues with 26 centers in the country shows the concentration of pesticides above MRL (Maximum Residue Limit) has been detected only in 2-3 per cent of samples tested in the last five years. Sreekumar (2017) advocates ensuring food security, safe food and nutritional security and farm income without deteriorating the natural resources like soil, water and biological resources. Scientifically fine-tuned agriculture has long term applications for agricultural sustainability as the basic premise of modern scientific agriculture is to address shortcomings through science and there is scope for continuous improvement.

For the farmers who make a living out of agriculture and see it as an enterprise, GAP (Good Agricultural Practices) based farming, Integrated Nutrient Management and Integrated Pest Management (IPM) with more emphasis on biological methods of control, soil test based nutrient application, increasing nutrient use efficiency, adoption of precision farming technologies and use of pest and disease resistant varieties, etc. seems to be a viable solution. It has the potential to address the concerns of different stakeholders (governments, food retailing industries, farmers and consumers) about food production and security, food safety and quality, and the environmental sustainability of agriculture. GAP offers means to help reach those objectives. It leaves scope for the farmers to understand the nature of different chemicals (pesticides, fertilizers) used in farming and also on the safe use and disposal of pesticides.

The pesticides sustain food production and control vector borne diseases, hence, regarded as social need. Thus, the option of safe use of pesticides by recommending good agricultural practices based on supervised field trials; to recommend waiting period/pre-harvest interval so that the residues in the food commodities remain well within the prescribed safe limits; and monitoring of pesticide residues in agricultural produce has to be adopted. Some steps have already been taken to minimize pesticides residues and enforced the provisions of Insecticides Act, 1968. India has already initiated educating farmers about ill effects of pesticides, need-based use of chemical pesticides, use of recommended dosage, correct application techniques, observance of prescribed waiting period, and practices of Integrated Pest Management (IPM) and benefits of organic farming. As a result, pesticides consumption has been substantially reduced in rice and cotton which are main pesticide-consuming crops. The consumption of chemical pesticides reduced from 65,462 MT during 1994-95 to 47, 020 MT during 2001-02 and an increase in use of bio-pesticides from 219 MT during 1996-97 to 902 MT during 2001-02.

Microbial Food Safety Concern and Changing Food Safety Standards has resulted in increased public awareness due to outbreaks, activism and availability of information, advances in scientific knowledge, increased and improved surveillance, value-added opportunities, rapid domestic and import trade and land use and waste management conflicts. Changes in Consumption Patterns towards increased consumption of "riskier" foods like uncooked produce, salad bars, minimally processed/pre-prepared, imported foods (year round availability) and also the increased popularity of "riskier" produce in the form of green onions, Cilantro (16% positive Salmonella and Shigella) mesculun / spring mix, seed sprouts, unpasteurized juices and melons has been the driving force regarding the food safety and its quality. Potential contamination sources considered include; Irrigation water, manure (intentional and incidental), inadequate field sanitation during production and harvest process, Wash water, handling, cross contamination during processing and ice, inadequate sanitation during distribution of the food products.

# Globalization of marketing Vs Good agricultural Practices

The challenge of globalizing markets is nowhere greater than in the primary food sector. GLOBAL GAP (earlier known as EUREPGAP) has established itself as a key reference for Good Agricultural Practices (GAP) in the global market place, by translating consumer requirements into agricultural production in the context of a rapidly changing and globalizing food economy and the concerns and commitments of a wide range of stakeholders about food production and security, food safety and quality, the environmental sustainability of agriculture. Besides these it has social impacts as it takes cares about workers health, safety and welfare. GLOBALGAP is a private sector body that sets voluntary standards for the certification of agricultural products around the globe. It is a pre-farmgate standard, which means that the certificate covers the process of the certified product from farm inputs like feed or seedlings and all the farming activities until the product leaves the farm. It is a business-to business label and is therefore not directly visible to consumers. GLOBALGAP includes annual inspections of the producers and additional unannounced inspections and consists of a set of normative documents. These documents cover the GLOBALGAP General Regulations, the GLOBALGAP Control Points and Compliance Criteria and the GLOBALGAP Checklist. The list of countries adopting GLOBALGAP, in exchange of food products is rapidly growing- currently more than 100 on every continent. The EUREPGAP Protocol describes essential elements and develops best practice for global production of fresh agricultural produce which includes horticultural products and all crop bases. It demonstrates to customers a commitment and ability to produce safe and quality food, under an exhaustive system verified by an internationally recognized independent third party. It mainly focuses

reducing risks associated with the use of pesticides, taking into account public and occupational health, environmental and safety considerations. EUREPGAP started in 1997 as an initiative by retailers belonging to the Euro-Retailer Produce Working Group (EUREP). British retailers were the driving forces. They reacted to growing concerns of the consumers regarding product safety, environmental and labor standards and decided to harmonize their own often very different standards. The development of common certification standards was also in the interest of producers. EUREP started working on harmonized standards and procedures for the development of Good Agricultural Practices (GAP) in conventional agriculture including highlighting the importance of Integrated Crop Management and a responsible approach to worker welfare. Over the next ten years a growing number of producers and retailers around the globe joined in with the idea as this matched the emerging pattern of globalize trading EUREPGAP began to gain in global significance. The decision was announced in on 7th September 2007 at the 8th global conference in Bangkok. EUREP (Euro Retailer Produce Working Group), represents leading European food retailers and use GAP (Good Agricultural Practice) as a framework for verification. It is designed specifically for businesses in the fresh produce supply chain. It offers a means of incorporating Integrated Crop Management (ICM) and Integrated Pest Management (IPM) practices within the framework of commercial agricultural production. It demonstrates a commitment and ability to produce safe and clean food, under an exhaustive system (HACCP) verified by an internationally recognized independent third party.

#### **Evolution of GAP**

The concept of GAP has evolved in recent years in the context of a rapidly changing and globalizing food economy and as a result of the concerns and commitments of a wide range of stakeholders about food production and security, food safety and quality, and the environmental sustainability of agriculture. The GAP came into existence to improve the quality of the agricultural products, monitoring of cultivation, harvesting and processing of the plant material. The main aim of GAP is to ensure that the plant material meets the demand of the consumers and the standards of high quality. It describes general principals and provides technical details for cultivation along with quality control measures. The participants of the

production process from primary producer to the traders are required to comply with the guidelines voluntarily and to elaborate practical measures in order to realize them. The stakeholders include governments, food processing and retailing industries, farmers, agricultural workers, and consumers, who seek to meet specific objectives of food security, food quality, production efficiency, livelihoods and environmental benefits in both the medium and long term. The term GAP connotes different meanings and implications. For example, GAP is formally recognised terminology used in the international regulatory framework and associated codes of practice to minimize or prevent the contamination of food. Good Agriculture Practices (GAP) are Practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products. The unique grower-to-consumer relationship of farmers markets sets it apart from traditional food retailers. The casual observer may not realize that achieving and maintaining this grassroots relationship requires a lot of behind-the scenes management, time, work, and, of course, money. Providing the funding needed to keep a farmers market going week after week, year after year, can be as complex and labor-intensive as running the physical market itself. The benefits of the adoption of GAPs are well understood by the perspective adopters but the level of awareness and the infrastructural and technological issues need to be handled in a systematic way through policy interventions in order to establish and maintain our self in international market of basmati rice (Pandit et al., 2015)

#### Codification of GAP

- Existing food safety standards like HACCP, ISO found to be inadequate
- Started as a voluntary effort by some leading food processors and retailers,
- Campbell Soup, Nestle, Unilever etc. develop their own codes of Good Agricultural Practices
- European retailers develop EUREPGAP requiring documentation in some 15 categories of compliances for fresh horticultural products. It becomes mandatory for imports into Europe
- Many countries and national agencies develop codes for Good Agricultural Practices and certification systems

- FAO sets of an Expert Consultation Group in November, 2003
- APEDA prepares a concept paper and BIS circulates a draft standard for India Gap

#### Relevance of GAP in India

India's basic strength lies in agriculture. But its vast potential has not been fully exploited. This market potential can be realized by reforming agriculture and making its produce internationally competitive in quality and food safety. To enable farm produce to be internationally competitive, innovative farming practices incorporating the concept of globally accepted Good Agricultural Practices (GAP) within the framework of commercial agricultural production for long term improvement and sustainability is important. Implementation of GAP would promote optimum utilization of resources such as pesticides, fertilizers, water and eco-friendly agriculture. It also takes care in integrating pre & post-harvest handling and other logistics. GAP is important in the areas where appropriated control measures need to be strengthened and farms producing raw materials to ensure sustained supply of produce of their desirable quality. The basic objectives of GAP include; ensuring safety and quality of produce in the food chain, capturing new market advantages by modifying supply chain governance, improving natural resources use, workers health and working conditions, creating new market, opportunities for farmers and exporters in developing countries, international competiveness, environmental control, farmers' health and sustainable development. As such the Basic Elements include; clean hand, clean soil, clean water and clean surface.

GAP includes Soil, Water, Crop & Fodder Production, Crop Production, Animal Production, Animal Health & Welfare, Harvest and On-farm Processing & Storage, Energy & Waste Management, Human Welfare, Health & Safety, Wildlife & Landscape as the components. Expected Benefits of adoption of GAP may be development of basic infrastructure at the field level, build up culture for good agricultural practices by the farmers, uniform approach across farms regardless of their sizes, increased awareness among the farmers as well as the consumers about the need for consumption of good quality and safe food, traceability through complete integration of food chain, improvement in the environment as well as soil fertility, worker safety and welfare, reputation in the international market as a producer of good quality and safe produce, and removal of Technical Barriers to Trade (TBTs) faced by exporters of agro products, promotion of sustainable production, integration of global accreditation system and value addition of products complies to the minimum standard acceptable to leading retail groups

GLOBALGAP is business-to-business standards for safe and sustainable food production. Consumer demands are what drive our improvement and development efforts. It promotes to know what you want. It is a consumer awareness campaign to inform regarding sustainable agriculture, workers' welfare and safety, animal welfare and the environment. It incorporates IPM and ICM in commercial agricultural production to make food Safe and sustainable for buyer and his family it supports HACCP principles

Beyond the Certificate and the benefits to farms it help in improvement of Traceability system (TRACEABILITY is the ability of a system to track the movement of food products and to record information about related attributes from Farm to Fork or to trace the same from Fork to Farm. It facilitates the withdrawal/ recall of affected food products from the supply chain in a fast, accurate and efficient manner), Input control, Record keeping, Reduced theft of inputs, Promotes farming as a business, Agronomic practices, Increased export yields, Price premiums and improved negotiation skills. It is designed and marketed for global adoption through modular approach, it permits single "integrated farm assurance" engaging end users and simplifying control systems targeting commodity production systems (oil palm, sugar, cocoa) for future expansion.

#### CERTIFICATION OPTIONS FOR GAP CERTIFICATION

Applicants can apply for certification under any of the 2 options (individual or group certification). The options are based on the constitution of the legal entity applying for certification. The following options shall be available for certification:

#### **Option 1 Individual Certification**

Individual producer applies for certification and gets certification. *The producer is defined as a person (individual) or a* 

business (individual or producer group) who is legally responsible for production of products and who has the legal responsibility for the products sold by that farming business.

#### a) Multisite without implementation of QMS (Quality Management Systems)

Individual producer or one organization owns several production locations or Production Management Units (PMU's) that do not function as separate legal entities applies and gets certification without implementation of Quality Management Systems (QMS)

#### b) Multisite with implementation of QMS

Individual producer or one organization owns several production locations or Production Management Units (PMU's) that do not function as separate legal entities applies and gets certification with implementation of Quality Management Systems (QMS) (*Details of certification process for QMS implementation is given in IGAP -03*)

#### **Option 2 Group certification**

A producer/farmer group applies for group certification and the farmer group, as legal entity gets certification. (*Details of group certification is given in Group Certification process* (*IGAP 03*). The Scheme is open to all farmers/producers or organizations engaged in IndGAP implementation who are legal entities in India. The information on how to obtain certification for Good Agricultural Produce is also available on the website of QCI (www.qcin.org). The certification shall be carried out by the Certification Bodies (CBs) duly accredited for the certification scheme as per ISO/IEC Guide 65/ISO IEC 17065 by NABCB OR approved by QCI. To operate under the Scheme, the CBs will require an extension of scope within the accreditation for ISO/ IEC Guide 65/ISO IEC 17065.

#### Compliance levels for certification

The producer is required to comply with three types of compliance criteria set out in the GAP standard. These are Critical, Major and minor, which must be fulfilled in all respects before certification. Complianceis indicated with a "Yes" (for compliant), "No" (for not compliant) on the checklist. Evidence/comments should be provided for each control criteria- these shall enable the audit trail to be reviewed after the event, and will include details of references taken during the evaluation. It is, however, obligatory to give evidence /comments for all the critical and major compliance criteria inspected in all external evaluation, self-assessments, and internal evaluation.

The level of compliance shall be established based on the following:

- a) Critical- 100% compliance of all applicable critical control points
- b) Major- 90% compliance of all applicable (missing)major control points is compulsory
- c) Minor-75% of compliance of all applicable minor control points is compulsory.

Certification Body shall maintain records of all certification activities- application registration, documents provided by applicant, on site evaluation report and evaluation and review of reports for grant of certification.

#### Extension Concern of GAP

- Methodologies for impact monitoring with particular respect to environmental impacts of agriculture.
- Social and environmental certification and labelling in crop and livestock production, fisheries and forestry; analysis of transaction costs for compliance with food safety and quality standards and production; valuechain analysis; how to reduce costs and the institutional innovations to reduce them.
- Training of trainers and institutional capacity building to ensure safety and quality of agricultural produce in particular for fresh foods and vegetables, coffee and other commodities; development of adequate laboratory facilities for product quality, lab quality assurance and control procedures; efficiency of sampling processing, etc.
- Methodologies and approaches to support farmers experiential learning to improve their technical and managerial capacities, in particular by supporting Farmers Field Schools, participatory technology development and Knowledge Attitudes and Practices approaches.
- Capacity to provide comparative experiences through knowledge management systems and support.
- Conflict management approaches and facilitation of multi stakeholder negotiations; building alliances with private sector and NGOs.

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## Factors Influencing Crop Based Diversified Farming Systems in Hilly and Terai Region of North Bengal

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#### ABSTRACT

Social, economic and psychological environment plays a major role in the livelihood of farmers practicing subsistence agriculture, livestock, forestry, plantations and allied activities, which are the major enterprises in both the hilly and terai region of North Bengal. Crop based diversified farms are more resilient to market shift, provide protection against climate change and provide more competitive environment as a strategy to ensure livelihood security through employment generation, poverty alleviation and conservation of natural resources. Hence, this paper is an attempt to understand and explore the various factors influencing crop based diversified farming systems (DFS) in hilly and terai region of North Bengal. The study concludes that psychological attributes of the farmers have mostly influenced DFS practices.

Keywords: Crop diversity, Diversified farming systems, Factor analysis, Stepwise regression, Path analysis

#### **INTRODUCTION**

Indian agriculture has been diversifying from cereals to high value crops and livestock products in accordance with the changing consumption pattern in favor of livestock, fruits and vegetables. A sustained economic growth, rising per capita income and growing urbanization are causing a shift in the consumption patterns in favor of high-value food commodities like fruits, vegetables, dairy, poultry, meat and fish products from staple food such as rice, wheat and coarse cereals. Such a shift in consumption patterns in favor of high-value food commodities depicts an on-going process of agricultural diversification (Haque et al., 2010). The concept of diversification remains incomplete and subdued if it is not supported by the diversified farming systems (DFS) (Om et al., 2008). In such diversified farming, though crop and other enterprises coexist. DFS includes a mix of different farm enterprises in which farm families allocate resources for efficient utilization of the existing enterprises for enhancing productivity and profitability of the farm. These farm enterprises are crop, livestock, aquaculture, agro-forestry, agri-horticulture, etc. (Kremen et al., 2012). DFS depends on the willingness and capacity of farmers to diversify their farms, but they need support and incentives to help survive the risks of changing from conventional to alternative production practices and to work together more collaboratively at the landscape level (Iles and Marsh, 2012).

West Bengal being one among the important diversifying agricultural states in India and having more than 65 per cent of the population engaged in agriculture and allied sectors is primarily an agrarian state. It is the sixth largest contributor to the country's GDP, which is attributed to agriculture and the allied sector. Agriculture and allied activities have observed consistently increasing state plan allocation since 2012-2013. Revising 2011-2012 to 2014-2015, Compound Annual Growth Rate (CAGR) in allocation for the sector was 36.50 percent (Government of West Bengal, 2015). In an overall agricultural scenario of West Bengal, there is a diminishing trend in acreage and production of major crops with the change in time (De and Chattopadhyay, 2010). Farmers are now interested in short duration high value cash crops like summer and winter vegetables to generate income in the farm family to raise their overall livelihood. Progressive farmers are shifted to high value vegetable and fruit-based cropping system from the traditional rice-based system and diversifying more within the allied sectors like livestock and fisheries (Chatterjee and Ray, 2013). Farming systems

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in hilly region have adopted diversified crop-based farming system apart from growing traditional cereal crops and the terai region is diversifying towards vegetable-based farming systems followed by dairy based and plantationsbased farming systems. Marginal and small farmers, dominant in hill zone, have adopted diversified farming system apart from growing traditional cereal crops and the terai zone is dominated by conventional cereal-based farming systems, followed by vegetable-based sub-system, and jute-based systems (Ray *et al.*, 2012).

Diversification is becoming popular across hilly and terai regions of North Bengal. Crop based DFS approach, therefore, is a valuable approach to addressing the problems of sustainable economic growth for farming communities. Cropping systems approach of agricultural research provided important findings to address the burning issues of sustainability and resource use efficiency in crop production. Still a need for integration of other enterprises is necessary to make more efficient use of available resources to reduce the gap between the desired and achieved and to improve the national food security (FAO, 2017).

On this backdrop, the present study explores the factors influencing crop-based DFS in hilly and terai region of North Bengal.

#### MATERIALS AND METHODS

The purposive stratified random sampling was adopted for the present study. The northern region of West Bengal was purposively selected i.e. hilly and terai regions of the state, as the major area of these regions represent different types of agro climatic, farming systems and socio economic and livelihood conditions, respectively. The four districts, two each in hilly and terai region, were selected purposively; while 8 blocks, two from each district and 16 villages, two from each block were randomly selected for the study. And in case of selection of respondents, 20 farmers from each village were sampled, thus covering a total sample of 320 respondents through simple random technique. A random sample of 20 farmers from each of four villages under each district was chosen covering a total sample of 320 respondents.

The socio-personal, socio-economic and psychological attributes of the farmers like age, education, household economic status, total cultivable land, annual income, annual expenditure, indebtedness, net farm income, mass media exposure, use of personal cosmopolite communication sources, use of personal localite communication sources, economic motivation, innovation proneness, independency, risk orientation and awareness level were considered as predictor variables (independent variables). These were measured following appropriate techniques with the help of developed schedule. The adoption level of diversified farming system (DFS), livelihood status and perceived resource use effectiveness of the DFS were considered as predicted (dependent) variables. The adoption level was measured with developed schedule following Hardikar (1998) that included 10 major aspects, each measured on 3 point continuum scale viz. fully adopted (2), partially adopted (1) and not at all adopted (0). The livelihood status was assessed following sustainable livelihood framework of DFID (1999) that included physical, social, human, financial, natural assets, each measured on 5-point continuum: very high (5), high (4), medium (3), low (2), and very low (1). Resource use effectiveness included 23 aspects, farmer's perception on each was recorded on 5point continuum: strongly agree (5), agree (4), undecided (3), disagree (2) and strongly disagree (1). The data were collected with the help of a structured interview schedule by personal interview method. To examine the relationship of the attributes of the farmers (predictor variables) with each of the adoption level of DFS, livelihood status and perceived resource use effectiveness of DFS (response variables), correlation coefficient matrix was developed. To ascertain the percent contribution of predictor variables on each above-mentioned response variable, stepwise multiple regression analyses were done. Factor analysis following Principal Component Analysis (PCA) technique was performed to conglomerate the attributes of the farmers considered under the present study.

#### **RESULT AND DISCUSSION**

The correlation analysis of socio-personal, socio-economic and psychological attributes of the farmers (independent variables) with each of the adoption level of diversified farming system (DFS), livelihood status and perceived resource use effectiveness is presented in Table 1.

The adoption level of the farmers (Y1) has showed positive and significant correlation coefficient with awareness level (r = 0.578), indebtedness (r = 0.444), education (r = 0.404), cultivable land (r = 0.395), annual

Table 1: Correlation Coefficient between Attributes of farmers and their Adoption Level of FS  $(Y_1)$ , Livelihood Status  $(Y_2)$  and Perceived resource use effectiveness under DFS  $(Y_3)$  in hilly and terai region of North Bengal (N=320)

Variables		r-value	
	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>
Age (X <sub>1</sub> )	-0.010	-0.097	0.090
Education $(X_2)$	0.404**	0.081	0.472**
Household Economic Status $(X_3)$	0.275**	0.011	0.489**
Total Cultivable Land $(X_4)$	0.395**	-0.080	0.544**
Annual Income $(X_5)$	0.319**	-0.116	0.555**
Annual Expenditure (X <sub>6</sub> )	0.284**	-0.080	0.509**
Indebtedness (X <sub>7</sub> )	0.444**	0.038	0.489**
Net Farm Income (X <sub>8</sub> )	0.065	0.397**	0.142*
Mass Media Exposure (X <sub>9</sub> )	-0.092	0.610**	0.073
Use of Personal Cosmopolite Communication Sources $(X_{10})$	0.061	-0.020	-0.021
Use of Personal Localite Communication Sources (X <sub>11</sub> )	-0.080	0.629**	0.095
Economic Motivation $(X_{12})$	0.124	0.017	0.458**
Innovation Proneness (X <sub>13</sub> )	0.165*	0.193**	0.479**
Independency (X <sub>14</sub> )	0.171**	-0.002	0.409**
Risk Orientation (X <sub>15</sub> )	0.119	0.106	0.364**
Awareness Level $(X_{16})$	0.578**	0.171**	0.697**
Adoption Level (Y <sub>1</sub> )	1	0.063	0.604**
Livelihood Status $(Y_2)$		1	0.109
Perceived Resource Use Effectiveness (Y.)			1

\*\*Significant at 1% level of confidence; \*Significant at 5% level of confidence

income ( $\mathbf{r} = 0.319$ ), annual expenditure ( $\mathbf{r} = 0.284$ ), household economic status ( $\mathbf{r} = 0.275$ ), and independency ( $\mathbf{r} = 0.171$ ) at 1% level of significance, and innovation proneness ( $\mathbf{r} = 0.165$ ) at 5% level of significance. Similar results were reported by Singha *et al.* (2012) who reported significant and positive correlation between education, extension contact, annual income, economic motivation and innovation proneness on adoption behaviour of farmers towards adoption of different enterprises under DFS.

Livelihood status of the farmers adopting crop based DFS ( $Y_2$ ) showed positive and significant correlation with use of personal localite communication sources (r = 0.629), mass media exposure (r = 0.610), net farm income (r = 0.397), innovation proneness (r = 0.193) and awareness

level (r = 0.171). Perceived resource use effectiveness of crop based DFS (Y<sub>3</sub>) showed positive and significant correlation with awareness level (0.697), adoption level (r = 0.604), annual income (0.555), cultivable land (0.544), annual expenditure (r = 0.509), household economic status (r = 0.489), indebtedness (r = 0.489), innovation proneness (r = 0.479), education (r = 0.472), economic motivation (r = 0.458), independency (r = 0.409) and risk orientation (r = 0.364) at 1% level of significance and with net farm income (r = 0.142) at 5% level of significance.

In order to find out the functional relationship between the attributes of farmers and each of their level of adoption of DFS, livelihood status and perceived resource use effectiveness, the stepwise multiple regression analyses were carried out. Stepwise regression was used. Stepwise regression is a semi-automated process of building a model by successively adding or removing variables based solely on the t-statistics of their estimated coefficients.

Results from the Table 2 shows that about 53.2% ( $R^2=0.532$ ) level of adoption of crop based DFS (Y1) is dependent on awareness level ( $X_{16}$ ), cultivable land ( $X_4$ ), economic motivation ( $X_{12}$ ), independency ( $X_{14}$ ), household economic status ( $X_3$ ), education ( $X_2$ ) and personal cosmopolite communication sources ( $X_{10}$ ). Out of these seven attributed most pronounces effect is made by awareness level determining 33.4% ( $R^2=0.334$ ) variation in level of adoption of crop based DFS. Evidently from the regression coefficient (beta coefficient) values, economic motivation and household economic status are having negatively significant relationship with level of adoption of DFS that implies the preference of relatively resource poor farmers towards DFS.

Table 3 reveals that about 61.2% ( $R^2=0.612$ ) livelihood level of farmers adopting crop based DFS ( $Y_2$ ) is determined by personal cosmopolite sources ( $X_{10}$ ), mass media exposure ( $X_9$ ), net farm income ( $X_8$ ), annual expenditure ( $X_6$ ), awareness level ( $X_{16}$ ), economic motivation ( $X_{12}$ ) and innovation proneness ( $X_{13}$ ), where, personal cosmopolite communication sources has explained about 40% variation in livelihood status of the farmers adopting DFS. Economic motivation and annual expenditure are having negatively significant relationship with level of livelihood of farmers adopting DFS as evident from negatively significant regression coefficient values which is indicative of the fact that resource rich

## Table 2: Stepwise Multiple Regression between Adoption level of DFS (Y1) and attributes of farmers in Northern region of West Bengal (N=320)

Regression model and predictors	R	$\mathbb{R}^2$	Std. error of	$\mathbf{R}^2$
			the estimate	change
Model 1: Awareness Level (X <sub>16</sub> )	0.578	0.334	0.32600	0.334
<b>Model 2:</b> Awareness Level ( $X_{16}$ ) and Cultivable land ( $X_4$ )	0.616	0.380	0.31539	0.045
<b>Model 3:</b> Awareness Level $(X_{16})$ , Cultivable land $(X_4)$ and Economic Motivation $(X_{12})$	0.661	0.437	0.30110	0.057
<b>Model 4:</b> Awareness Level ( $X_{16}$ ), Cultivable land ( $X_4$ ), Economic Motivation ( $X_{12}$ ) and Independency ( $X_{13}$ )	0.687	0.472	0.29229	0.035
<b>Model 5:</b> Awareness Level $(X_{16})$ , Cultivable land $(X_4)$ , Economic Motivation $(X_{12})$ , Independency $(X_{13})$ and Household Economic Status $(X_3)$	0.710	0.504	0.28378	0.033
<b>Model 6:</b> Awareness Level $(X_{16})$ , Cultivable land $(X_4)$ , Economic Motivation $(X_{12})$ , Independency $(X_{14})$ , Household Economic Status $(X_3)$ and Education $(X_2)$	0.723	0.522	0.27930	0.018
<b>Model 7:</b> Awareness Level (X <sub>10</sub> ), Cultivable land (X <sub>4</sub> ), Economic Motivation (X <sub>12</sub> ), Independency (X <sub>13</sub> ), Household Economic Status (X <sub>3</sub> ), Education (X <sub>2</sub> ) and Personal Cosmopolite Sources (X <sub>10</sub> )	0.729	0.532	0.27703	0.010
Coefficients (Model 7)				
Variables	Std. error	Beta coefficien	t t	Sig.
(Constant)	0.101	0.158	1.569	0.118
Awareness Level $(X_{10})$	0.052	0.536	9.308	0.000
Total Cultivable Land $(X_4)$	0.012	0.426	5.784	0.000
Economic Motivation $(X_{12})$	0.020	-0.339	-6.058	0.000
Independency $(X_{14})$	0.000	0.234	4.165	0.000

farmers used to have lower economic motivation and incur low expenditure as compared to income.

Personal Cosmopolite Communication Sources  $(X_{10})$ 

Household Economic Status (X<sub>3</sub>)

Education (X<sub>2</sub>)

Results from the Table 4 indicate that about 66% perceived resource use effectiveness under crop based DFS  $(Y_3)$  is explained by awareness level  $(X_{16})$ , cultivable land  $(X_4)$ , adoption level  $(X_{17})$ , innovation proneness  $(X_{13})$  and education  $(X_2)$ . Similar to the adoption level, in case of resource use effectiveness, awareness level has predicted 48.6 per cent level of variation (R<sup>2</sup>=0.486)

The results reported from regression analysis by Khatun and Roy (2012) also indicated some of the variables revealed in present study. They found that household-head's experience (age), educational level, asset position, dependency ratio, social status, training, access to credit, irrigation network, agro-climatic condition and the overall level of economic development of a region are the main driving force towards livelihood diversification in the study area. The most perceived use of resource effectiveness faced by the households in the more diversified area were poor asset base, lack of credit facilities, lack of awareness and training facilities, fear of taking risk, lack of rural infrastructure, and lack of opportunities in non-farm sector, while the most perceived use of resource effectiveness in less-diversified area were poor transport facilities, poor asset base, unfavourable agro-climate, lack of credit facilities, lack of awareness and training, and lack of basic infrastructure.

-0.273

0.150

0.100

-3.784

2.902

2.171

0.000

0.004

0.031

0.064

0.021

0.055

Further principal component analysis (PCA) was performed to identify operational factors that have put up through an intrinsic relational conglomeration of the variables to ultimately form a homogenous group of variables called factors. It has been found that 16 independent variables have been conglomerated into 5 factors (Table 5).
# Table 3: Stepwise Multiple Regressions between Livelihood level and attributes of farmers adopting DFS in Northern region of West Bengal (N=320)

Regression model and predictors		$\mathbb{R}^2$	Std. error of	$\mathbb{R}^2$
			the estimate	change
<b>Model 1:</b> Personal Cosmopolite Communication Sources $(X_{10})$	0.629	0.396	0.43111	0.396
<b>Model 2:</b> Personal Cosmopolite Communication Sources $(X_{10})$ and Mass Media Exposure $(X_9)$	0.699	0.488	0.39767	0.092
<b>Model 3:</b> Personal Cosmopolite Communication Sources $(X_{10})$ , Mass Media Exposure $(X_9)$ and Net Farm Income $(X_8)$	0.742	0.551	0.37307	0.063
<b>Model 4:</b> Personal Cosmopolite Communication Sources $(X_{10})$ , Mass Media Exposure $(X_{9})$ , Net Farm Income $(X_{8})$ and Annual Expenditure $(X_{6})$	0.752	0.566	0.36792	0.014
<b>Model 5:</b> Personal Cosmopolite Communication Sources $(X_{10})$ , Mass Media Exposure $(X_9)$ , Net Farm Income $(X_8)$ , Annual Expenditure $(X_6)$ and Awareness Level $(X1_{16})$	0.773	0.597	0.35502	0.032
<b>Model 6:</b> Personal Cosmopolite Communication Sources $(X_{10})$ , Mass Media Exposure $(X_9)$ , Net Farm Income $(X_8)$ , Annual Expenditure $(X_6)$ , Awareness Level $(X1_{16})$ and Economic Motivation $(X_{12})$	0.777	0.604	0.35265	0.007
<b>Model 7:</b> Personal Cosmopolite Communication Sources $(X_{10})$ , Mass Media Exposure $(X_9)$ , Net Farm Income $(X_9)$ , Annual Expenditure $(X_6)$ , Awareness Level $(X1_{16})$ , Economic Motivation $(X_{12})$ and Innovation Proneness $(X_{13})$	0.782	0.612	0.35005	0.008
Coefficients (Model 7)				
Variables	Std. error	Beta coefficien	t it	Sig.
(Constant)	0.122	1.00	8.221	0.000
Personal Cosmopolite Communication Sources (X10)	0.067	0.395	7.576	0.000
Mass Media Exposure (X <sub>9</sub> )	0.090	0.341	6.576	0.000
Net Farm Income $(X_8)$	0.000	0.209	4.753	0.000
Annual Expenditure $(X_{o})$	0.000	-0.184	-3.290	0.001
Awareness Level $(X_{10})$	0.061	0.223	4.578	0.000
Economic Motivation $(X_{12})$	0.030	-0.159	-2.672	0.008

In total, 16 variables were included in PCA, of which five principle components (PCs) with Eigen values greater than 1 were retained for analysis. These five PCs explained 67.12 per cent of total variability in the data set. A closer look at each column of Table 5 helps us to factor each component according to strongly associated variables as listed below:

Innovation Proneness (X<sub>12</sub>)

- Factor 1 has included four variables like economic motivation (X<sub>12</sub>), risks orientation (X<sub>15</sub>), innovation proneness (X<sub>13</sub>) and independency (X<sub>14</sub>), which have contributed 33.35 per cent of variance and renamed as psychological attributes.
- Factor 2 has included six variables viz. annual income (X<sub>5</sub>), household economic status (X<sub>3</sub>), annual expenditure (X<sub>6</sub>), Cultivable land (X<sub>4</sub>), age (X<sub>1</sub>) and

indebtedness  $(X_7)$ , contributing 11.20 per cent of variance are renamed as economical attributes.

0.117

2.088

0.026

0.038

- Factor 3 has included following two variables namely, education (X<sub>2</sub>) and awareness level (X<sub>16</sub>) contributing 7.96 per cent of variance are renamed as educational attributes.
- Factor 4 has included two variables viz. mass media exposure (X<sub>9</sub>) and use of personal localite communication sources (X<sub>11</sub>) contributing 7.58 per cent of variance have been renamed as communicational attributes.
- Factor 5 has included following two variables viz. net farm income (X<sub>8</sub>) and use of personal cosmopolite communication sources (X<sub>10</sub>) contributing 7.03% of variance have been renamed as farm income and exposure.

# Table 4: Stepwise Multiple Regressions between perceived resource use effectiveness under DFS and attributes of farmers in Northern region of West Bengal (N=320)

Regression model and predictors	R	$\mathbf{R}^2$	Std. error of	$\mathbf{R}^2$
			the estimate	change
Model 1: Awareness Level (X <sub>16</sub> )	0.697	0.486	0.30290	0.486
<b>Model 2:</b> Awareness Level $(X_{16})$ and Total Cultivable Land $(X_4)$	0.770	0.594	0.26990	0.108
<b>Model 3:</b> Awareness Level ( $X_{16}$ ), Total Cultivable Land ( $X_4$ ) and Adoption level ( $X_{17}$ )	0.788	0.621	0.26111	0.028
<b>Model 4:</b> Awareness Level ( $X_{16}$ ), Total Cultivable Land ( $X_4$ ), Adoption level ( $X_{17}$ ) and Innovation Proneness ( $X_{13}$ )	0.808	0.652	0.25071	0.031
<b>Model 5:</b> Awareness Level ( $X_{16}$ ), Total Cultivable Land ( $X_4$ ), Adoption level ( $X_{17}$ ), Innovation Proneness ( $X_{13}$ ) and Education ( $X_2$ )	0.814	0.662	0.24772	0.010
Coefficients (Model 4)				
Variables	Std.	Beta	t	Sig.
	error	coefficien	t	
(Constant)	0.062	2.608	41.729	0.000
Awareness Level $(X_{16})$	0.049	0.387	7.633	0.000
Total Cultivable Land $(X_4)$	0.008	0.204	4.406	0.000
Adoption level (X <sub>17</sub> )	0.053	0.221	4.380	0.000
Innovation Proneness $(X_{13})$	0.016	0.197	4.441	0.000
Education (X <sub>2</sub> )	0.019	0.113	2.552	0.011

## Table 5: Conglomeration of farmers attributes through factor analysis (N=320)

Component	Variables	Factor	or Eigen value		e	Renaming
		loading	Total	% of	Cumul-	
				variance	ative	
Component 1	Economic Motivation $(X_{12})$	0.778	5.335	33.347	33.347	Psychological attributes
	Risk Orientation (X <sub>15</sub> )	0.750				
	Innovation Proneness $(X_{13})$	0.740				
	Independency $(X_{14})$	0.651				
Component 2	Annual Income (X <sub>5</sub> )	0.705	1.791	11.192	44.539	Economical attributes
	Household Economic Status $(X_3)$	0.700				
	Annual Expenditure ( $X_{b}$ )	0.681				
	Cultivable Land $(X_4)$	0.631				
	Age (X <sub>1</sub> )	0.619				
	Indebtedness (X <sub>7</sub> )	0.508				
Component 3	Education $(X_2)$	0.829	1.274	7.959	52.498	Educational attributes
	Awareness Level ( $X_{16}$ )	0.670				
Component 4	Mass Media Exposure (X <sub>9</sub> )	0.894	1.211	7.572	60.070	Communicational
	Personal Localite Communication Sources (X <sub>11</sub> )	0.814				attributes
Component 5	Net Farm Income $(X_8)$	0.743	1.124	7.026	67.096	Farm capital & exposure
	Personal Cosmopolite Communication Sources $(X_{10})$	-0.564				

Similar to present study, Mithiya et al. (2018) conducted a study to analyze the pattern of crop diversification and the factors influencing it in different agro-climatic zones of West Bengal. The study had indicated that all the zones (except Eastern Plateau and Hilly zone), as well as the state of West Bengal as a whole, have witnessed rising crop diversification since the new millennium compared to the nineties. The Principal Component Analysis (PCA) was used to identify the factors that influenced the shift in cropping pattern in each agro-climatic zone. Eleven variables were included in the PCA. The first four Eigen values capture maximum variability and the corresponding four components were selected for PCA. Both the supply-side and the demand-side variables were taken into consideration for analyzing PCA. The demand-side factors like the size of the urban population, per capita income and supply-side variables such as the proportion of small landholders, area under High Yielding Varieties (HYV) and density of markets had played a significant role in determining crop diversification in all the agro climatic zones (except 'Eastern Plateau and Hilly zone').

## CONCLUSION

Farmers awareness level is the most prominent factor influencing crop based DFS in both the hilly and terai region of North Bengal. Psychological attributes of the farmers have also determined the adoption of crop based DFS practices. Awareness programmes followed by location specific and enterprise based training programmes on technology adoption and demonstrations are essential to enhance farmers' knowledge and acceptance of crop based DFS and adoption in their farming situations. Further, it can also be suggested that those significant socio-economic and psychological variables under crop based DFS should get more emphasis and care through concerted efforts while formulating different development strategies and programmes for farmers in the area of study. The diversification of farming in present study considered that farmers would not only undertake seasonal crops farming, but also animal husbandry, fishing, dairy, horticulture, etc. for economic activities as either self-employed or/ and supplementing their incomes. Present study reveals that combination of any particular crop cultivation with any other enterprises may enable the farmers to develop managerial expertise and also reduce per unit cost of production. Moreover, diversification will provide more employment and income to reduce vulnerability of poor farmers and it will support the policy makers and planners who aim to double the farm income. Therefore, careful considerations need to be given by researchers, extensionists, development partners and policy makers to devise better specific strategies to build the capacity of the farmers to make the hill and terai farming systems better with improved farm livelihood.

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## Observational Analysis of the Effectiveness of Farm and Non-farm Entrepreneurial Training Programme of Krishi Vigyan Kendra

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## ABSTRACT

Prominence of training in improving the competencies of entrepreneurs in both farm and non-farm sectors is well established, as such, many entrepreneurship training programmes are being conducted throughout the world. However, the way and manner in which such training programmes are administered is of great concern to stakeholders as well as scholars. To evaluate the success of entrepreneurship training programmes conducted at Krishi Vigyan Kendra, a combination of methods were used. A participant observation of training in action was done to ascertain the effectiveness of the training. Knowledge test was conducted to ascertain the increase in knowledge of the trainees and feedback was obtained on various aspects of the training. Data was analyzed using SPSS and descriptive statistics. Results show trainers presented at the level of trainees and trainees were motivated to learn. Voice of the trainers was audible enough for trainees to hear and there was a sequential presentation of topics. The subject matter was nearly covered and eye contact was maintained properly for most of the training time. Emphasis was made on key points and there was a clear explanation of concepts. Trainees were encouraged to participate in various ways and they were involved in forming learning objectives. Training objectives were almost completely covered, there was clarity of explanation and handled the sessions nicely. The Overall Effectiveness Index of training for KVK was 83 per cent. There was 45 percent increase in knowledge of the trainees as a result of the training. Most of the trainees rated the perceived overall effectiveness of the training between 81-100 per cent. It is recommended that there should be proper time management and training materials should be made available for trainees to encourage practice and mastery of skills by trainees.

Keywords: Employment, Entrepreneurship, Participant observation, Training, Youths

### **INTRODUCTION**

Entrepreneurship training is very much critical in building the competencies of entrepreneurs in both farm and nonfarm sectors. In economies characterized by low labor demand and high rates of youth unemployment, entrepreneurship training has the potential to enable youth to gain skills and create their own jobs (Premand *et al.*, 2012). For an entrepreneur to function well, certain mindsets, skills and capabilities are required. Since research suggests that, several of these mindsets, types of knowledge, and skills can be acquired in educational institutions and training programs firmly within the broader discussions around entrepreneurship promotion (Valerio *et al.*, 2014), makes entrepreneurship education and training very vital in economic development. Given, the above, a number of international, regional, national, and local actors

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are taking part in the global experiment of entrepreneurship education (EE) and entrepreneurship education and training (EET) (Valerio *et al.*, 2014). In India, close to 686 parastatal organizations, over 1000 educational institutions and Non Governmental Organizations (NGO) are engaged in conducting entrepreneurship development programmes. Krishi Vigyan Kendra is one of such major district-level institutions which have been charged with the responsibility of impacting entrepreneurial skills and creating increased competencies among entrepreneurs.

Valerio *et al.* (2014) has clearly mentioned that entrepreneurship can contribute to economic development through high-growth enterprises or, as in the case of necessity-driven entrepreneurship, through enterprises that can serve as an important source of income and employment for vulnerable populations. Given this, it is expected that trainings should be of high quality to deliver the appropriate and necessary skills required to enable entrepreneurs to establish high quality enterprises which will provide employment for countless number of youths and other segments of the population.

Despite a global interest in education and training for entrepreneurship, many (if not most) high-profile efforts have not been rigorously evaluated, and global knowledge about these programs' impact remains thin (Valerio et al 2014). It is on this backdrop that an observational analysis was conceived to look at the quality of entrepreneurship training programmes carried out by Krishi Vigyan Kendras.

It is believed that training will enhance the skills of youths and empower them to take up self-employment through entrepreneurship development and management. Despite these training programmes, the rate of unemployment is still very high in India especially among youths. This therefore calls for an assessment of the training programmes conducted especially in Krishi Vigyan Kendras. This paper therefore looks at holistic approached and mixed methods to observe and analyzed the instructional methodologies used in conducting entrepreneurship training programmes and suggests specific recommendations that if implemented accordingly, could bring about marked improvement in future training programmes.

Training is defined as a method of preparing people for certain activities dictated by technology. It is not sufficient to say that training is been conducted, the quality of the entrepreneurship training programmes is of great concern. Little studies have been done in this area and those done have made conclusions on data collected after training programmes from trainees and trainers.

Participant observation of training in action could be the best option to access the effectiveness of training programmes as it provides first-hand information about many aspects of the training. According to Suvedi *et al.* (2008) participant observation is all about gathering information regarding behavioural actions and reactions through direct observation, interview with key informants, and participants in the activities been observed, however, participant observation itself cannot provide sufficient information for evaluation, it has to be combined with feedback from trainees at the end of the training and discussions with experts. Nain and Kumar (2001) tried the similar methodology at Regional Rural Development Institute and reported grey areas of skills and suggested trainers' training in skills of instruction and andragogy. Present study is an effort to find out the effectiveness of RUDSETI training programmes through a variety of methods.

## MATERIALS AND METHODS

Krishi Vigyan Kendra Shikohpur is a well-known institute for capacity building of both farm and non-farm entrepreneurs. Indian Council of Agricultural Research (ICAR) sanctioned its establishment at Shikohpur Gurgaon in the year 1983 under the administrative control of ICAR-Indian Agricultural Research Institute (IARI), Pusa New Delhi. It was finally established in August 1984 and located at Shikohpur (Gurugram) in Haryana state and is about 50 Km from IARI New Delhi and 15 Km from district headquarters. Many successful entrepreneurs have emerged in the KVK's areas of operations as a result of increased commitment and dedication in providing essential training and other interventions. Many training programmes have been conducted by this institution which at this junction is worth observing to know some pertinent facts.

To achieve this, participant observation was conducted in a training programme entitled 'Dress Making for Women Entrepreneurs'. The training lasted for about forty days and an observation was made for two days at the beginning of the training, two days midway, and two last days of the trainings. An observational guide was used by the researcher to elicit certain information on different aspects of the training which cannot be easily obtained using the questionnaire or other secondary sources of information. The observational guide was prepared based on critical review of literature and expert opinion. A knowledge test was prepared and administered before and after the training programme. This was to assess the knowledge gained by the entrepreneurs as a result of the training. In addition to the above, post-training evaluation was carried out using a structured questionnaire to elicit information about trainees' perception about various facets of the training. Rating scale was used to measure various aspects of the training. Data was analyzed using descriptive statistics. Method used by Reddy et al. (2012) was used to calculate the overall effectiveness index. Eight indicators were considered and for each a score was obtained. Overall effectiveness index was calculated using the formula below: Obtained scores of all nine indicators

Overall effectiveness index (OEI) = -

 $- \times 100$ 

Maximum score for all nine indicators

## **RESULTS AND DISCUSSION**

On the basis of review of pertinent literature, a tool was devised consisting of 20 instructional skills. Each skill was observed on a 5 point rating scale (5 as highest and one as lowest). The training session was used as a unit of observation. Table 1 reveals that trainers presented at the level of trainees (4.7), there was a motivation of trainees (4.7), and voice of the trainers was audible enough for trainees to hear (4.7). There was a sequential presentation of topics (4.6), the subject matter was nearly covered (4.5), eye contact was maintained (4.5), and emphasis was made on key points (4.5). There was a clear explanation of concepts (4.2), and practical sessions were properly conducted (4.2). Trainees were encouraged to participate in various ways (4.0) and they were involved in forming learning objectives (4.0). Handling of theoretical sessions

Table 1: Observation of instructional skills possessed by the trainers in KVK

S. No.	Training Component	Average rating on 5 Scale (Max. score 5 & min. score 1)
1.	Training Objectives clarification	3.0
2.	Presenting at level of trainees	4.7
3.	Explanation of concepts	4.2
4.	Subject matter coverage	4.5
5.	Sequential presentation of topics	4.6
6.	Motivation of trainees	4.7
7.	Eye contact	4.5
8.	Purposeful movement	3.0
9.	Voice of trainer	4.7
10.	Use of trainees' ideas	2.5
11.	Use of teaching aids	3.0
12.	Emphasis on key points	4.5
13.	Involvement of trainees in forming learning objectives	4.0
14.	Exposure of trainees through field vi	isits 3.2
15.	Inviting questions from trainees	3.0
16.	Encouragement of trainees participat	ion 4.0
17.	Handling of practical sessions	4.2
18.	Handling of theoretical sessions	3.9

was good (3.9) and trainees were exposure through field visits (3.2). Training objective clarification, purposeful movement of the trainer, use of teaching aids, and invitation of questions from trainees all had a low mean score of 3.0. Trainers couldn't make much use of trainees' ideas (2.5).

	Table 2:	Feedback	on different a	spects of	the 7	Fraining
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S. No.	Training Component	Average rating on 5 Scale (Max. score 5 & min. score 1)
1.	Coverage of training objective	4.1
2.	Relevance of the course	3.9
3.	Practical exposure	4.2
4.	Presenting at the level of trainees	4.1
5.	Clarity of explanation	4.1
6.	Handling of sessions	4.1
7.	Facilities for training	4.2
8.	Training environment	4.6

	Obtained scores of all nine indicators	
Overall effectiveness = $-$		$- \times 100$
index (OEI)	Maximum score for all nine indicators	
33.3		
= 83.0 %		
40		

In Krishi Vigyan Kendra, it was observed that the training environment was very good hence a mean score of 4.6. Facilities for training were adequate (4.20 and there was a good practical exposure of trainees (4.2). Training objectives were almost completely covered, trainers presented at the level of trainees, there was clarity of explanation and good handling of sessions. All had a mean score of 4.1 each. Relevance of the course had a low mean score of 3.9.

Overall Effectiveness Index of training for KVK was 83 per cent. Reddy *et al.* (2012) also reported an overall effective index of 69.38 per cent. This shows that KVK training was highly effective even though there are various aspects that can be improved. Knowledge test was administered before and after the training to know the knowledge gained as a result of the trainings. The mean test score was 30 per cent before the training and whereas after training it was 75 per cent. This shows that there was 45 per cent increase in knowledge of the trainees as a result of the training. Kumar *et al.* (2016) reported an average increase of 29.03 per cent in the training of field veterinarians.

Table 3: Perceived overall effectiveness of	training	by trainees
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Perceived effectiveness rating (%)	Percentage
1 - 20	0.00
21 - 40	0.00
41 - 60	14.00
61 - 80	20.00
81 - 100	66.00

It was found that in Krishi Vigyan Kendra, most of the trainees had rated the perceived overall effectiveness of the training between 81-100 per cent, 20 per cent of the trainees had rated the perceived overall effectiveness of the training between 61-80 per cent and only 14 per cent of the trainees had rated the overall effectiveness of the training between 41-60 per cent.

Data from Table 4 revealed that most of the respondents (70.00%) suggested that more machines should be provided so that everyone will have access for hands-on training and practice. More than half (60%) of the respondents suggested that duration of the training should be increased, whereas, 55.00% of the trainees suggested that group projects should be encouraged among trainees. This is so that students can learn from each other and hence encourage team work. Half (50.00%) of the trainees suggested that off-campus training environment needs to be improved. This is because an

Table 4: Suggestions for improving training effectiveness

Suggestions	Percentage
More dressmaking machines should be provided	70.00
More time should be given for practical sessions	40.00
Duration of training should be increased	60.00
Off-campus training environment needs more improvement	50.00
Group projects should be encouraged among trainees	55.00

enabling environment will help trainees to concentrate and learn more skills. Less than half (40.00%) of the trainees suggested that more time should be allowed for practical sessions.

Based on the observations made during the training in action, the author recommends that proper time management should be observed during the training sessions. Every activity done during the training programmes should be clearly explained so that trainees will know its implication and how to apply the knowledge gained to a practical situation. All the trainees should be encouraged to participate in the training programmes as some of them were shy to express themselves, for which special sessions may be arranged, trainees should be encouraged to ask many questions during the training so that they may have clarity on areas they don't understand. At the end of each day, feedback should be sought from the trainees for improvement of subsequent training programmes.

## CONCLUSION

There are a number of success stories from both farm and non-farm sectors indicating the success of KVK entrepreneurship training programmes. Findings from this research also support the effectiveness of their training programmes. Notwithstanding, there are many aspects of the training that need improvement so as to ensure that training become more beneficial and sustainable. Before the training commences, both trainers and trainees should meet and make training objectives quite clear. There should be a clear understanding of where they are at present and where they intend to go after the training. Logistics and training materials were not adequate and hence it may be suggested that adequate training materials should be provided like machines, arrangements should be made for renting if they cannot be purchased at once. This will enable trainees to practices more even out of the training venue. Duration of the training should be sufficient to ensure that trainees are able to master the skills that they are thought very well. In the case of training programmes like stitching, mentorship programmes should be arranged for trainees which will make it possible for them to be attached to professional tailors for period of time. They can also work on projects like sewing school and nursery school uniforms etc. This will help them become experts within a short period of time.

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## A Study on Knowledge about Recommended Package of Practices of Paddy Growers of Baramulla District, Jammu and Kashmir

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#### ABSTRACT

The present study was conducted in Agricultural Zone Wagoora of district Baramulla of Jammu and Kashmir state. Four villages were selected purposively on the basis of area under rice cultivation. From each selected village, 25 paddy growers were selected randomly but only those paddy growers were included who cultivated paddy over an area of  $\frac{1}{2}$  acre or more. Thus, total 100 growers were selected for the study. The "Ex-Post-Facto" research design was used for investigation. The findings indicated that 53.00 per cent growers were in medium age group, 62.00 per cent were educated up to middle school level, 52.00 per cent farmers had medium size family comprising 6-10 members, 35.00 per cent respondents possessed land holding ranging between 11-20 kanals, 74.00 per cent farmers had agriculture as their main occupation, 56.00 per cent farmers had annual income up to Rs. 2 lakhs, 58.00 per cent were having 11-20 years of experience in paddy cultivation, 62.00 per cent farmers had medium level of mass media exposure, 58.00 per cent had medium scientific orientation, 72.00 per cent respondents had low extension contacts and 54.00 per cent farmers had low social participation.

Keywords: Agriculture, Growers, Knowledge, Paddy, Rice

## **INTRODUCTION**

Rice is life, for most people of Asia. Rice has shaped the cultures, diets and economies of thousands of millions of people. It is central to the Asian way of life; deeply embedded in the cultural heritage, spirituality, traditions and norms. Almost one fifth of the world's population depends on rice cultivation for their livelihoods. In Asia, where about 90 per cent of rice is grown, has more than 200 million rice farms, most of whom cultivate rice on less than one hectare. Rice based farming is the main economic activity for hundreds of millions of rural poor in this region. Rice is the most important food crop of India covering about one-fourth of the total cropped area and providing food to about half of the Indian population (Ram, 2015).

As a matter of fact, rice is the life line of people in the Asian countries and among them India is one of the most important producer as well as consumer of rice. Rice is the leading food crop of world cultivated over an area of about 160.8 million hectares with the production of about 746.8 million tons globally (Anonymous, 2016a). In terms of area and production, it is second to the wheat. Among the rice growing countries, India has the largest area (43.38 mha) followed by China and Indonesia. In respect of production, India ranks second next to China 200 million tons of rice. In India, rice is cultivated over an area of 43.38 million hectares with a production of 104.32 million tones and productivity of 3093 kg/ha. Rice accounts for about 41.36 per cent of total food grains production and 44.34 per cent of cereals production of the country (Anonymous, 2017).

The area under rice in Jammu and Kashmir is 0.3 million hectares with a productivity of 2123.4 kg/ha and in Kashmir valley rice is grown over an area of 1.44 lakh hectares with a production of 3.8 lakh tons and a productivity of 2688.3 kg/ha (Anonymous, 2016b).

In Baramulla District of J&K, the area under rice during 2016-17 has increased from 8094 to 8514 hectares whereas production during the said period has decreased from 194.39 to 144.39 thousand metric tons (Anonymous,

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2016). It has been found that the production levels over the decade have remained stagnant mainly due to poor and deteriorating soils. One of the probable reasons could be that the farmers are not adopting the recommendations of SKUAST-Kashmir with respect to rice crop. In view of this fact the present study was conducted with the following objectives:

- 1. To study the socio-economic profile of paddy growers.
- 2. To know the knowledge of paddy growers regarding recommended package of practices.

## MATERIALS AND METHODS

The present research study was conducted in Baramulla district of Jammu and Kashmir state. In Baramulla district, Agricultural Zone Wagoora were purposively selected for the research. Four villages in agricultural zone Wagoora were randomly selected for research. From each selected village, 25 growers were selected and a total sample of 100 paddy growers were selected for the research work. Only those growers were considered for the survey who had minimum 1/2 acre land under paddy cultivation. An interview schedule was developed with the help of scientists of SKUAST-Kashmir. Personal interview method was used for data collection. Data was collected by administering the structured interview schedule to the respondents. The questions were asked in local language i.e. Kashmiri. For the analysis of collected data suitable statistical procedures (frequency and percentage) were used.

## **RESULTS AND DISCUSSION**

The data in Table 1 reveals that, majority (53.00%) of the respondents belonged to middle age group, followed by 25.00 per cent belonged to young age group and 22.00 per cent in old age group. This finding is in line with the findings of Sadhna Pandey *et al.* (2020).

It is clear from the Table-1 that, majority (62.00%) of the respondents were educated up to middle school, 10.00 per cent were educated up to intermediate, 9.00 per cent were educated up to high school, 8.00 per cent had education up to primary school level, 6.00 per cent were found illiterates, and only 5.00 per cent of the respondents were graduates and above. The results are in line with the results of Kiran *et al.* (2010).

It is clear from the Table 1 that, majority (52.00%) of respondents were having family size of 6-10 members

Table 1:	Selected	characteristics	of F	Rice growers (	(N=100)
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Category	Respondents	
	Frequency	Percentage
1. Age		
Young -18 to 35 years	25	25.00
Middle-36 to 60 years	53	53.00
Old- above 60 years	22	22.00
2. Education		
Illiterate	6	6.00
Primary school	8	8.00
Middle school	62	62.00
High school	9	9.00
10 + 2	10	10.00
Graduate and above	5	5.00
3. Family size		
Small (upto 5 members)	31	31.00
Medium (6-10 members)	52	52.00
Big (above 10 members)	17	17.00
4. Total Land holding (20 Kanal	s=1 ha)	
4-10 kanals	19	19.00
11-20 kanals	35	35.00
21-30 kanals	28	28.00
Above 30 kanals	18	18.00
5. Occupation		
Only Agriculture	74	74.00
Agriculture + Business	21	21.00
Agriculture + Service	5	5.00
6. Annual income		
Low (up to 2 lakh)	56	56.00
Medium (2-4 lakh)	31	31.00
High (above 4 lakh)	13	13.00
7. Experience in paddy cultivati	on	
Up to 10 years	16	16.00
11-20 years	58	58.00
Above 20 years	26	26.00
8. Extension contacts		
Low	72	72.00
Medium	23	23.00
High	5	5.00
9. Mass media exposure		
Low	28	28.00
Medium	62	62.00
High	10	10.00

#### Table 1 contd....

Category	Respondents			
	Frequency	Percentage		
10. Scientific orientation				
Low	31	31.00		
Medium	58	58.00		
High	11	11.00		
11. Social participation				
Low	54	54.00		
Medium	38	38.00		
High	8	8.00		

followed 31.00 per cent and 17.00 per cent of the respondents were having family size of up to 5 members and above 10 members respectively. The findings are in agreement with the findings of Karangami (2017).

Table 2: Practice wise knowledge level of paddy growers

The data in Table 1 shows that, majority (35.00%) of the respondents were having land holding of 11 to 20 kanals, followed by 28.00 per cent and 19.00 per cent of the respondents had above 21-30 kanals and 4-10 kanals of land holding respectively. Whereas 18.00 per cent of the respondents were having land holding above 30 kanals. The results are in line with the results of Anup *et al.* (2010).

The data presented in Table 1 reveals that, majority (74.00%) of the respondents were engaged only in agriculture, while 21.00 per cent of the respondents were engaged both in agriculture and business and 5.00 per cent of the respondents were engaged both in agriculture and service. The results are in line with the results of Prakashkumar *et al.* (2012).

It is clear from the Table 1 that, majority (56.00%) of the respondents were having low annual income, 31.00

S.No.	Practices	F	ull	Partial		No	
		knov	vledge	knov	wledge	knowledge	
		F	Р	F	Р	F	Р
1	Variety (Jhelum)	27	27	0	0	73	73
2	Nursery sowing time (April-15th May)	100	100	0	0	0	0
3	Seed rate for nursery raising/kanal *(2.5-3kg)	41	41	59	59	0	0
4	No. of ploughings (2-3)	67	67	33	33	0	0
5	Seedling age for transplanting (25-30 days)	21	21	79	79	0	0
6	Seedlings/hill (2-3)	0	0	0	0	100	100
7	FYM/Kanal (500kgs)	22	22	78	78	0	0
8	Urea/kanal (12kgs)	43	43	57	57	0	0
9	Split doses of urea (3)		34	66	66	0	0
10	DAP/kanal (6.5kgs)	45	45	55	55	0	0
11	MOP/kanal (2.5kgs)		05	95	95	0	0
12	Micro-nutrient applied (ZnSO <sub>4</sub> )	37	37	63	63	0	0
13	Spacing (15x15 cm)	07	07	93	93	0	0
14	Frequency of irrigation (once in 6 days)	27	07	73	73	0	0
15	Weedicide (Butachlor)	54	54	46	46	0	0
16	Dosage of Butachlor/kanal (75g)	10	10	90	90	0	0
17	Major disease (rice blast)	36	36	64	64	0	0
18	Chemical used for rice blast management (Carbendazium)	32	32	68	68	0	0
19	Major pest (paddy grass hopper)	100	100	0	0	0	0
20	Chemical used for pest management (chloropyriphos)	91	91	09	09	0	0
21	Days to attain maturity (150-165 days)	46	46	54	54	0	0
22	Yield/kanal (3.5-3.75q)	100	100	0	0	0	0

\*kanal = 0.1 ha; I ha = 20 kanal; 1 acre= 8 kanal; F= Frequency, P= Percentage

per cent of the respondents were having medium level of annual income and 13.00 per cent of the respondents with high level of annual income. The findings are in agreement with the findings of Chayal *et al.* (2010).

It is clear from the Table 1 that, majority (58.00%) of the respondents were having 11-20 years of experience in paddy cultivation, followed by 26.00 per cent and 16.00 per cent of the respondents having above 20 years and upto 10 years of experience in paddy cultivation respectively. The results are in agreement with the results of Samarpitha *et al.* (2016). The data presented in Table 1 reveals that, majority (72.00%) of the respondents were having low level of extension contacts, followed by 23.00 per cent of the respondents had medium level of extension contacts and only 5.00 per cent were having high level of extension contacts.

From Table 1 it is evident that, majority (62.00%) of the respondents were having medium level of mass media exposure followed by 28.00 per cent and 10.00 per cent of respondents having high and low level of mass media exposure respectively. This trend might be due to the fact that majority of the respondents were medium farmers with medium level of education. Though almost every household possessed television, they were not keen on watching television. This result is in agreement with Balaksrishnan (2011).

From Table 1 it is clear that, majority (58.00%) of the respondents were having medium level of scientific orientation followed by 31.00 per cent and 11.00 per cent of the respondents having high and low level of scientific orientation respectively. It might be due to the reason that majority of the farmers being middle to old age were continuing the farming practices followed by their forefathers. It was observed that they were forced to follow scientific methods of farming in order to attain higher yields. This result is in agreement with Ramu (2005).

From Table 1 it could be seen that, majority (54.00%) of the respondents had low level of social participation followed by 38.00 per cent and 8.00 per cent of respondents having medium and high level of social participation respectively. The results are in line with the results of Sriharinarayana (2013).

Table 3 also revealed that, majority (58.00%) of the respondents were having medium level of knowledge,

Variable	Categories	Growers			
		Frequency	Percentage		
Knowledge	Low (18-22)	23	23.00		
	Medium (23-27)	58	58.00		
	High (28-32)	19	19.00		

followed by 23.00 per cent and 19.00 per cent of the respondents were having high and low level of knowledge respectively. The findings are in agreement with the findings of Vijayakumar (2012), Mukherjee *et al.* (2019).

## CONCLUSION

The data in the study revealed that majority (53.00%) of growers were middle aged, (62.00%) educated up to middle school level, (52.00%) belonged to medium size of family, (35.00%) possessed land holding of 11-20 kanals, 74.00 per cent had agriculture as their main occupation, 56.00 per cent had annual income up to Rs. 2 lakhs, 58.00 had 11-20 years of experience in paddy cultivation, 62.00 were observed having medium level of mass media exposure, 58.00 per cent had medium scientific orientation, 72.00per cent had low extension contacts and 54.00per cent respondents had low social participation. Majority (58.00%) of the paddy growers had medium level of overall knowledge followed by 23.00 per cent of the respondents had low and 19.00 per cent of the respondents had high level of overall knowledge regarding recommended package of practices of paddy.

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## Adoption of Direct Seeded Rice Cultivation Technology among Farmers of Haryana – A Sociological Analysis

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## ABSTRACT

Rice is the most prominent crop of India since it is the staple food of more than 70 per cent of population of the country. Rice is grown in 18 districts of Haryana. Out of which seven districts are in high productivity group. The study was conducted in Kurukshetra district of Haryana state. From this district, two blocks namely Thanesar and Pehowa were selected randomly. A total of 200 rice growing farmers were selected, who were using direct seeded rice cultivation technology (100) and conventional transplanted rice cultivation technology (100). The findings regarding adoption level of respondents about various aspects of direct seeded rice technology were studied like method of sowing, seed rate, its depth of sowing and its time of sowing etc. It was found nearly half of the respondents, who were using above 70.0 per cent sized of land holdings had high level of adoption of direct seeded rice cultivation technology were increased yield than conventional method, reduced work load like labour, water saving from first to subsequent irrigation, higher net returning etc.

**Keyword:** Adoption, Cultivation technology, Direct seeded rice, Socio-economic factors, Reasons for adoption, Reasons for non-adoption etc.

## INTRODUCTION

Rice is leading crop of the world and more than half of the population depend on rice for their daily sustenance. The total rice-wheat production in Asian countries is 314.5 million tonnes, about 25 per cent of world food production. Rice is the main staple food crop of India contributing 43 per cent to nation's food grain production covering about 42.86 million hectares area with a total production of 95.98 million tonnes and productivity of 2.24 t ha-1. Direct seeding refers to the process of establishing a rice crop from seeds sown in the field rather than by transplanting seedlings from the nursery. It is most effective method of reducing cost, labour and water. This technique avoids three basic operations such as puddling, transplanting and standing water thus saving of substantial of water. Direct seeded rice (DSR) provides an option as it saves labor, water and make paddy cultivation cost effective. It matures earlier (7-10 days) than the transplanted crop due to the absence of transplanting shock and allows timely planting of succeeding wheat crop. It also ensures the timely sowing in a stipulated time frame. Direct seeded

rice accounts for 35 per cent of the total rice cultivated area in India. It is now fast replacing traditional transplanted rice in areas with good drainage. However, the productivity of direct seeded rice is low as compared to transplanted. Planting time is the major factor that determines the productivity of a crop. Optimum planting time for a crop is location specific (Singh *et al.*, 2013).

Early or delay in sowing leads to lower production of direct seeded rice. Optimum sowing time thus needs to be standardized for every agro-ecological situation for success of direct seeded rice. Rice grain yields declined as seeding date was delayed. Direct seeding of rice with subsequent aerobic soil conditions eliminates the need for ponding water, thus reducing the overall water demand and providing opportunities for water and labour savings. In Asia, with the increasing shortage of water for irrigation, more research and extension efforts are being made toward the adoption and fine tuning of DSR production technologies to make DSR more sustainable. However, it is also important to understand and predict possible risks or threats that DSR may have in the long run. DSR is now

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considered to be an emerging production system in Punjab and other parts of India and Asia. Direct seeding helps to reduce water consumption as it eliminates the need for nursery raising, seedling uprooting, puddling, and manual transplanting. A farmer also saves the cultivation cost that is to be used during transplanting operations. Direct Seeded Rice helps in making full use of family labour and having less dependence on hired labour (Chauhan, 2013).

Direct seeding offers certain advantages viz., it saves labour, faster and easier planting helps in timely sowing, less drudgery, early crop maturity by 7-10 days, less water requirement, low production cost and more profit, better soil physical conditions for following crops and less methane emission. The yield potential of direct seeded rice is equivalent to the transplanted rice under good water management and weed control conditions. Rice production in Asia requires 32 man days per hectare for a direct seeded crop as compared to 63 man days per hectare for a transplanted crop. At a specific location, maximum grain yield can be achieved by planting the crop at the optimum time, which may vary from variety to variety. In direct seeded rice, weeds are the major constraints as compared to transplanted rice. The weed flora in direct seeded rice is diverse and consists of grasses, broad-leaves and sedges. Low productivity of direct seeded rice is mainly due to heavy crop-weed competition due to early emergence of weeds along with crop seedling due to favorable soil conditions and their rapid growth result in severe competition for nutrients, space and light etc. Further the weed flora emerges in several flushes during the crop growth period. Weeds may cause substantial losses in yield through production of growth inhibiting compound a phenomenon referred as allopathic. The risk of crop yield loss due to competition from weeds by all seeding methods is higher than for transplanted rice because of the absence of the size differential between the crop and weeds and, the suppressive effect of standing water on weed growth at crop establishment. The yield losses due to weeds in direct seeded rice vary from 5-100 per cent. The integrated weed control is essential for raising direct seeded rice (Min et al., 2011).

In different districts, very less area was sown under rice with this technique in Punjab. Following questions usually strikes to mind! Whether the farmers know about the cultivation of DSR. What are the problems faced by the farmers in this technique? Why the farmers are not adopting this technique? What is the future scope of the DSR and how this technique can solve the problem of water depletion? Keeping in view of the above facts and importance of this method towards sustainable production of rice for the country as a whole and Haryana in particular, the study was conducted with the objectives;

To know the factors associated with adopters and nonadopters of direct seeded rice method along with constraints.

## MATERIAL AND METHODS

The study was conducted in Kurukshetra district of Haryana state. From this district, two blocks namely Thanesar and Pehowa were selected randomly. A total of 200 rice growing farmers were selected, who were using direct seeded rice cultivation technology (100) and conventional transplanted rice cultivation technology (100). Interview Schedule was prepared as per objectives of the study. Farmers were surveyed with the help of Interview Schedule. Statistical techniques were used as per the nature of data.

*Instruments:* The questions were framed which clearly indicate their meaning to the respondent and cover relevant aspects of problems according to the objectives of the study. Interview schedule was prepared with the help of various books, bulletins, journals, periodicals, government publications etc.

*Statistical Analysis:* The collected data were coded, tabulated, analyzed and interpreted with the help of appropriate statistical techniques. The descriptive statistical tools such as frequency, percentage and chi-square to draw the inference from the study.

## **RESULTS AND DISCUSSION**

Success of any crop depends upon various aspects like method of sowing, seed rate, depth of sowing and its time of sowing etc. It was found from the data that 100 per cent, 94 per cent and 93 per cent of the respondents had fully adopted the recommended method of sowing, land preparation and depth of sowing of DSR respectively. Majority of the respondents knew the recommended seed treatment, herbicides, disease, insect, pest control etc., while 24 per cent and 23 per cent respondents had not adopted recommended seed rate and dose of fertilizers respectively. Rohila *et al.* (2016) conducted a study among farmers of four districts of Haryana namely Yamuna Nagar, Kurukshetra, Karnal and Kaitha. The study has focused

Aspects	Level of adoption					
	Fully adopted (%)	Partially adopted (%)	Not adopted (%)			
Method of sowing and Depth of sowing	96	2	2			
Land preparation	94	4	2			
Seed treatment	91	6	3			
Recommended herbicides used	90	7	3			
Disease, insect, pest control	85	9	6			
Sowing time	78	13	9			
Recommended variety sown	75	19	9			
Interval schedule of irrigations followed	74	14	12			
Recommended seed rate used	45	31	24			
Recommended and timely dose of fertilizers	43	34	23			

Table 1: Level of adoption among farmers of direct seeded rice method (n=100)

Responses were multiple

on adoption level of Direct seeded rice (DSR) farmers and extension strategy to increase the adoption of DSR cultivation. Economic motivation of farmers was 70.83 per cent belonged to low to moderate level, whereas 67.5 per cent of respondents belonged moderate to high innovation proneness. The overall adoption level of DSR technology was low to moderate, since 70 per cent of respondents belonged to low to medium category (Table 1).

Analysis revealed that nearly half of the respondents (49.00%) who were using above 70.0 per cent sized of land holdings had high level of adoption of direct seeded rice method. Contrary to that 37.00 per cent and 14.0 per cent respondents who were adopting 35.1-70.0 per cent and upto 35.0 per cent sized of land holdings had medium and low level of adoption respectively. Kaur *et al.* (2011) were also found the same results (Figure 1).



Figure 1: Adoption of area under direct seeded rice method (N=100)

The factors associated with level of adoption of respondents of direct seeded rice method were studied. Age was found significantly associated with level of adoption. Analysis revealed that maximum number of the respondents (44.00%) who belonged to young age group had high level of adoption of Direct Seeded Rice method. On the other hand, 75.00 per cent respondents had low level of adoption who belonged to old age group (Table 2).

Significant association was found between family income and level of adoption of direct seeded rice method. Nearly half of the respondents (47.62%) who earned annual income above Rs. 2,00,000 had high level of adoption regarding direct seeded rice method. Size of land holding and level of adoption was found significantly associated. Majority of the respondents (55.56%) between 10.01 to 25.0 acres had high level of adoption of direct seeded rice method. Contrary to that 66.67 per cent marginal respondents (upto 2.5 acre) had low level of adoption of direct seeded rice method. Social participation was found significantly associated with level of adoption of direct seeded rice method. Half of the respondents (50.00%) with high level social participation had high level of adoption. Contrary to that 75.44 per cent respondents with low level social participation had low level of adoption of Direct Seeded Rice method (Table 2).

Mass-media exposure and level of adoption of direct seeded rice method was found significantly associated. Analysis revealed that majority of the respondents (52.17%) with high level of exposure to mass media had medium

Age			Total	
	Low (upto 35%)	Medium (35.1-70%)	High (Above 70%)	
Young (up to 30 years)	5(20.00)	9(36.00)	11(44.00)	25(25.00)
Middle (31-50 years)	32(54.24)	25(42.37)	2(3.39)	59(59.00)
Old (above 50 years)	12(75.00)	3(18.75)	1(6.25)	16(16.00)
Total	49(49.0)	37(37.0)	14(14.0)	100(100)
$\chi^2  cal = 12.90^*$				
Family income (Rs.)				
Low (45000-100000)	11(64.71)	5(29.41)	1(5.88)	17(17.00)
Medium (100001 - 200000)	35(56.45)	24(38.71)	3(4.84)	62(62.00)
High (Above 200000)	3(14.29)	8(38.09)	10(47.62)	21(21.00)
$\chi^2 cal = 13.58^*$				
Size of land holding (acre)				
Marginal (upto 2.50 acre)	2(66.67)	1(33.3)	0	3(3.00)
Small (2.51 - 5.0 acre)	4(22.22)	10(55.56)	4(22.22)	18(18.00)
Semi-Medium (5.01-10.0 acre)	42(60.00)	23(32.85) 5(7.15)		70(70.00)
Medium (10.01-25.0 acre)	1(11.11)	1(11.11) 3(33.33)		9(9.00)
$\chi^2  cal = 14.74^*$				
Social participation				
Low (1)	43(75.44)	11(19.30)	3(5.26)	57(57.00)
Medium (2)	4(12.12)	23(69.70)	6(18.18)	33(33.00)
High (3)	2(20.00)	3(30.00)	5(50.00)	10(10.00)
$\chi^2  cal = 15.68^*$				
Mass media exposure				
Low (upto 3)	30(58.82)	19(37.25)	2(3.93)	51(51.00)
Medium (4-6)	14(53.84)	6(23.08)	6(23.08)	26(26.00)
High (above 6)	5(21.74)	12(52.17)	6(26.09)	23(23.00)
$\chi^2 cal = 11.87^*$				
Socio-economic Status				
Low (12-18)	9(60.00)	4(26.67)	2(13.33)	15(15.00)
Medium (19-24)	46(77.96)	11(18.65)	2(3.39)	59(59.00)
High (25-31)	4(15.38)	12(46.16)	10(38.46)	26(26.00)
$\chi^2 cal = 28.62^*$				

Table 2: Association between socio-economic factors and level of adoption of farmers regarding direct seeded rice method

Figures in the parenthesis denote percentage

\*Significant at 5 per cent level

level of adoption of Direct Seeded Rice method. Contrary to that 58.82 per cent respondents with low exposure to mass media had low level of adoption (Table 2).

Significant association was found between socioeconomic status and level of adoption. Analysis revealed that maximum number of the respondents (46.16%) who had high socio-economic status had medium level of adoption of Direct Seeded Rice method. On the other hand, 60.00 per cent respondents who had low socioeconomic status had low level of adoption. On the other hand, factors like caste, subsidiary occupation, type of family, size of family and education of the respondents







were found non-significantly associated with level of adoption regarding Direct Seeded Rice method (Figure 2).

Analysis revealed that reasons for adoption of Direct Seeded Rice method were mainly: increased yield than conventional method (71.00%), reduced work load like labour (68.00%), water saving from first to subsequent irrigation (64.00%), higher net returning (63.00%), not required any special skill (57.00%), reduced the risk in unfavourable weather condition (49.00%) and time devoted on other activities (36.00%). Kumar and Ladha (2011) and Din *et al.* (2013) focused on various benefits from direct seeding compared with puddled transplanting, which typically include similar yields, savings in irrigation water, labour, production costs, higher net economic returns and reduction in methane emissions (Figure 2).

Analysis revealed that reasons for non-adoption of direct seeded rice method were mainly: DSR method does not increase the yield at all (69.00%), lack of knowledge (65.00%), more complex system and technical assistance required (62.00%), high prices of herbicides, chemical fertilizers, pesticides and fungicides (57.00%) lack of technical guidance (48.00%), non-availability of specially designed drill (42.00%) and DSR method does not save money (41.00). Mukteshawar and Shehrawat (2015) revealed that farmers were undecided about new agricultural practices and no effect of technology on crop production (Figure 3). It was concluded that there was no declining trend of direct seeded rice method among progressive farmers in the field of the study. Nearly half of the respondents who were using above 70.0 per cent sized of land holding had high level of adoption of direct seeded rice method. Contrary to that more than half of the respondents who were adopting 35.1-70.0 per cent and upto 35.0 per cent sized of land holding had medium and low level of adoption respectively. Training should be imparted for weed management, seed treatment, disease, variety etc, to farmers regarding DSR method at cluster level.

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## Quality of Health Services and State Intervention for cancer in South Western Region of Punjab

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### ABSTRACT

Malwa region of Punjab once known for prosperous, agricultural and hard-working peasantry, has now infamously got the label of cancer capital of India. Government of Punjab is also very particular about cancer patients as far as early detection, management and prevention of this disease is concerned. Study attempted to analyze the quality of health services available to the cancer patients in the region. The present investigation was conducted to assess the quality of health services and state intervention for cancer in south western region of Punjab. Two districts i.e. Bathinda and Sri Muktsar Sahib were randomly selected. Majority of the respondents (41.2%) had seen very good quality of infrastructure available in the public followed by private and charitable hospital in the sample area. Seventy per cent of the respondents found health services accessible to them and ranked it good. Health services were inaccessible to 5.00 per cent of the respondents and they found it bad. One third (36.2%) of the respondents had spent more than Rs. 6000 on a single visit to the hospital for the treatment of their patient. Half (53.7%) of the respondents was not aware of the government sponsored schemes running in the state for cancer patients. Under Mukhya Mantri Punjab Cancer Raahat Kosh (MMPCRK), Government of Punjab earmarked Rs. 50.00 crores for the treatment of all cancer patients. Forty five per cent of the respondents had availed the benefit of MMPCRK scheme of government in the region. Only 3.00 per cent of the respondents availed the benefit of Bhagat Puran Singh Sehat Bima Yojana scheme (BPSSBYS) in the region.

Keywords: Accessible, Affordability, Cancer, Health services, Quality

## **INTRODUCTION**

Of late, Punjab which enjoyed the status of "Food Bowl of Nation", has become infamous for wide spread prevalence of cancer to the extent that it is been referred to "Cancer Bowl" at various platforms According to Cancer awareness and state wise door to door campaign, the state average of cancer cases of Punjab (911/million) is much higher than that of the national average (800 per million) of cancer prevalence. The cases of cancer per million are highest in the Malwa region (1089) as compared to Doaba (881) and Majha (647) respectively. South Western part (Cotton Belt) of Malwa region has become infamous as cancer region of Punjab with highest average of 1168 per million people, thus corroborates the common perception that cancer is most widespread in South Western Punjab (GOP, 2013).

Ever rising urbanization, industrial pollution, undesirable lifestyles, poverty abundance syndrome and

social stress and strains have contributed to rising incidence of non-communicable diseases (NCDs) like the cancer, heart diseases, diabetes, hypertension, arthritis, mental disorders, respiratory disease and accidents (Reddy et al., 2011; Thakur et al., 2008; Singh et al., 2018; Yadav et al., 2017). Amongst non-communicable diseases, the onset of cancer is attributed both to the internal factors as well as external factors. The average prevalence rate for cancers in India is around 100 cases per lakh while in the advanced economies such as the US, it is around 300 per lakh. This comparatively lower prevalence of the disease in an otherwise 1.3 billion plus people is because risk of cancer increases with age and 65 per cent of Indians are younger than 35 years. On the contrary, the US has only around 27 per cent of its citizens under the age of 21 years. As per a report "Call for action: expanding cancer care for women in India 2017", India is the third country after US and China in terms of high number of cancer cases. In India, one out of three patients does not survive beyond five

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years or more after being detected with cancer. With over 15 lakh new cases reported every year and a large population turning old, the country is staring at a catastrophe (Patel, 2018). The prevalence of cancer and number of patients in India do not necessarily show the real picture of the healthcare crisis we are facing.

Inspite of a good deal of scientific advancement in fields of diagnosis and treatment, threat of cancer looms large on Punjab in general and rural Punjab in particular. Cancer is a great threat not only to health of the person concerned but it plays havoc with whole family of the victim. It not only disturbs the socio-economic fabric of the family but dwindles the whole development status. To meet the financial cost and repay the financial debt, the households suffering from cancer have to cut down their own essential needs. Development status of individual and family got affected, if one had to sacrifice one or more of the essential components of quality of life i.e. food, clothing, housing, education, health and social ceremonies (Singh *et al.*, 2013; Parkin *et al.*, 2001).

The Bhabha Atomic Research Centre has tested groundwater samples from four districts of the Malwa region of Punjab (Bathinda, Mansa, Faridkot and Ferozpur) in collaboration with Guru Nanak Dev University of Amritsar, and the results indicated that about 42 per cent of total samples have uranium concentration above the Atomic Energy Regulatory Board (AERB) permissible limit of  $60 \,\mu\text{g/L}$  for drinking water. The World Health Organization has set the recommended level for uranium in drinking water to 15  $\mu\text{g/L}$  (WHO, 2011).

Acharya Tulsi Regional Cancer Treatment and Research Institute, Bikaner is being a tremendous job in catering the medical needs of cancer patients of the region at an affordable cost. Train no. 339 (infamous as the cancer train to the Bikaner) routinely carries at least 80-100 cancer patients who make the overnight journey with their families for treatment at the government's regional cancer center. There is a long line at one counter to get appointments. A crowd presses against another counter, where an employee fills out vouchers that will enable the patients to get reimbursed by the national railway for taking the cancer train (Zwerdling, 2009; Sengupta, 2011; Das, 2016). Government of Punjab is also very particular about cancer patients as far as early detection, management and prevention of this disease is concerned. There are various schemes for benefit and welfare of cancer patients like Mukh Mantri Punjab Cancer Rahat Kosh Scheme, Punjab Narogi Society and Bhagat Puran Singh Sehat Bima Scheme- a scheme from which cancer patients get financial help for their treatment and investigations. Even otherwise once a person is diagnosed as having cancer, everything (investigations and treatment) is free in all government hospitals of the state.

Hence, realizing the gravity of the situation, the state government has risen to the occasion and has come up with various state initiatives for cancer patients. The present research paper is an endeavor to gauge the state initiatives, with specific objective to study the quality of health services and state intervention for cancer in Malwa region of Punjab.

## MATERIAL AND METHODS

The south western region of Punjab is comprised of eight districts namely Bathinda, Sri Muktsar Sahib, Ferozepur, Mansa, Faridkot, Sangrur, Fazilka and Barnala which constituted the sample frame for the present study. At the first stage two districts i.e. Bathinda and Sri Muktsar Sahib (hereafter, Sri Muktsar Sahib will be referred as Muktsar in the text) were randomly selected to make the study representative of whole South Western region. At the second stage two blocks were randomly selected from each selected district to obtain a total of four blocks. At third stage three villages from each block were again randomly taken for the purpose of investigation. So, the present study was conducted across four blocks. From four selected blocks twelve villages were randomly selected from South Western region of Punjab. After the selection of the villages a list of all the person suffering from cancer or had cancer (though recovered presently) during the period of 5 years preceding the study comprised the sample for study. The present study is based on the primary data procured on the basis of records maintained by the hospitals both Public and Private, ANMs (Auxiliary Nurse Midwives), Chemists, Sarpanches and Change Agents who were contacted for this purpose. At the final stage out of 160 respondents, 56 males and 104 females from all the villages were selected. Thus, total sample size comprised of 160 cancer patients from all the twelve villages of selected districts

**Composite Index of Quality of Infrastructure Available in Hospital:** Composite index of quality of infrastructure available in the hospitals was constructed by taking into consideration a number of selected indicators in public, private and charitable hospitals such as Beds, Beds + X ray machine, Beds + X rays + Biopsy, Beds + X rays + Biopsy+ Sonography, Beds + X rays + Biopsy + Sonography + Radiotherapy and Beds + X rays + Biopsy + Sonography + Radiotherapy + Chemotherapy. These items were accorded weights by the selected judges.

Quality	of infrastructure	Index
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Infrastructure	Weightage
Beds	0.25
Beds + X ray machine	0.5
Beds + X ray machine + Biopsy	0.75
Beds + X ray machine + Biopsy + Sonography	1
Beds + X ray machine + Biopsy + Sonography + Radiotherapy	1.25
Beds + X ray machine + Biopsy + Sonography + Radiotherapy + Chemother	1.5 apy
	Infrastructure Beds Beds + X ray machine Beds + X ray machine + Biopsy Beds + X ray machine + Biopsy + Sonography Beds + X ray machine + Biopsy + Sonography + Radiotherapy Beds + X ray machine + Biopsy + Sonography + Radiotherapy + Chemother

Category	Range
Very bad	Up to 1.05
Bad	1.06-2.1
Average	2.2-3.15
Good	3.16-4.21
Very good	4.22-5.25

**Composite Index to measure accessibility:** Composite index to measure accessibility available to cancer patient was constructed by taking into consideration a number of selected indicators such as Private hospital, Public hospital, Train facility, Bus facility, Tax facility and Ambulance availability. These facilities were accorded relative weights by the judges selected for this purpose.

Accessibility	Weightage
Nearby private hospital facility	0.25
Nearby public hospital facility	0.5
Train Facility	0.75
Bus Facility	1
Taxi Facility	1.25
Ambulance Facility	1.5
Catalogue	Damag
Category	Kange
Bad	up to 1.75
Average	1.76-3.50
Good	3.61-5.25

## **RESULTS AND DISCUSSION**

There were three type of health service available in and around the *Malwa* region of Punjab viz. public, private and charitable hospital. Guru Gobind Medical College and Hospital, Faridkot was the Government hospital. Six private hospitals were functioning in the district Bathinda namely Punjab Cancer Hospital, Advanced Cancer Diagnostic Treatment & Research Centre, Adesh Institute of Medical Sciences and Research, Max Super Specialty Hospital and Bansal Hospital and Cancer Centre. Acharya Tulsi Cancer and Research Institute, Bikaner though was situated in the adjoining state of Rajasthan was most sought after because of its affordability and accessibility. Study attempted analyzed the quality of health services available to the cancer patients in the region.

Quality of health services available: Data in Table 1 reveals that the distribution of respondents according to the quality of health services available to them in the study area. This was assessed by computing the index of quality of health services available to them in various hospitals that is public, private and charitable. It was computed on the basis of accumulated scores of various facilities available to them in hospitals. On the basis of assigned scores, health services were categorized on five point scale of very bad, bad, average, good and very good. Majority of the respondents (41.2%) had seen very good quality of infrastructure available in the public followed by private and charitable hospital in the sample area. Public health facilities available to the respondents in the study area were found very good (41.3%) and good (2.5%) by the respondents but few public health services available were also ranked very bad (5.0%) and bad (7.5%). However, private health services were ranked good (5.6%) and very good (13.1%) and only one charitable hospital (Acharya Tulsi Cancer and Research Institute, Bikaner) was found very good by one fifth (23.1%) of the respondents.

Table 1: Distribution of respondents according to quality of health facilities available to them

Scale	Public Hospital	Private Hospital	Charitable Hospital	
Very bad	8 (5.00)	-	-	
Bad	12 (7.50)	-	-	
Average	3 (1.87)	-	-	
Good	4 (2.50)	9 (5.62)	-	
Very good	66 (41.25)	21 (13.12)	37 (23.12)	

**Treatment cost per visit:** Financial costs of cancer care were a burden to people diagnosed with cancer, their families and society as a whole. National Cancer care expenditures had been steadily increased in the last decade. Costs also were likely to increase as new and more advanced treatments were adopted as standards of care (Chataut, Pandey and Rao, 2015). Cancer care was becoming expensive day by day, and in India where most of the healthcare was self- funded, most of the patients do payments out of-pocket for cancer care. It is beyond the reach of most rural patients to take cancer treatment on their own (Banavali, 2015).

Distribution of the respondents on the basis of treatment cost per visit to the hospital is presented in the Table 2. The data reveals that in south western region, one third (36.2%) of the respondents had spent more than Rs. 6000 on a single visit to the hospital for the treatment of their patient. Another 28.7 per cent of the respondents spent between Rs. 4000-6000 on a single visit to the hospital followed by 25.6 per cent, who spent between Rs. 2000-4000 and just 9.3 per cent of the respondents who spent less than Rs. 2000 were. The cost of treatment per visit included consultation fees, travelling cost, medicinal cost, accommodation cost if needed, dietary cost or any specialized treatment cost. In Bathinda district, half of the respondents (50.0%) had spent more than Rs. 6000 on a single visit to the hospital for the treatment of their patient because most of the respondents were treated from Rajasthan and Faridkot which were far away. Another 22.3 per cent of the respondents spent between Rs. 2000-4000 on a single visit to the hospital followed by 19.73 per cent between Rs. 4000-6000 and less than Rs. 2000 were just 7.89 per cent of the respondents. Whereas, in Muktsar

district majority of the respondents (36.9%) had spent between Rs. 4000-6000 on a single visit to the hospital for the treatment of their patient. Another 28.5 per cent of the respondents spent between Rs. 2000-4000 on a single visit to the hospital followed by 23.8 per cent more than Rs. 6000 and less than Rs. 2000 were just 10.71 per cent of the respondents. Majority of the respondents from Muktsar district mostly visited to Guru Gobind Medical College and Hospital, Faridkot and Acharya Tulsi Cancer and Research Institute, Bikaner.

Overall, data revealed that more than third of the respondents had spent more than Rs. 6000 for a single visit to the hospital for the treatment of their patient.

Time taken to reach hospital: It was observed in the Table 3 that in south western region of Punjab, nearly half (43.7%) of the respondents had to spent more than 4 hours to reach the hospital whose treatment were under process from Bikaner, Chandigarh or Ludhiana. It took 8 to 9 hours to reach Acharya Tulsi Cancer and Research Institute, Bikaner by train and by bus it took more than 9 hours to reach the place. The Abohar -Jodhpur Passenger train no. 339 leaves Bathinda at around 9.25 pm and covers a distance of about 325 km with 26 halts to reach Bikaner in the state of Rajasthan at 6 am. Sometimes, it's an hour or two late. Many problems were faced by cancer patients while traveling from Bathinda to Bikaner such as poor sitting facility at the platform, overcrowding in the train and unavailability of medical facilities in case of any medical emergency in the train (Das, 2016; Kaur, 2013; Singh et al., 2013).

The distinguishing and sorry feature of this train is that above 60 per cent of its commuters were cancer

Treatment cost	Bathinda			Sri Muktsar Sahib			South Western Region		
per visit (Rs)	(n,=76)			(n <sub>2</sub> =84)			(N=160)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
	(n=22)	(n=54)	(n=76)	(n=34)	(n=50)	(n=84)	(n=56)	(n=104)	(n=160)
< 2000	1	5	6	3	6	9	4	11	15
	(4.55)	(9.26)	(7.89)	(8.82)	(12.00)	(10.71)	(7.41)	(10.58)	(9.37)
2000-4000	3	14	17	9	15	24	12	29	41
	(13.64)	(25.93)	(22.36)	(23.47)	(30.00)	(28.57)	(22.22)	(27.88)	(25.62)
4000-6000	5	10	15	15	16	31	20	26	46
	(22.73)	(18.52)	(19.73)	(44.12)	(32.00)	(36.90)	(37.04)	(25.00)	(28.75)
> 6000	13	25	38	7	13	20	20	38	58
	(59.09)	(46.30)	(50)	(20.59)	(26.00)	(23.81)	(37.04)	(36.54)	(36.25)

Table 2: Distribution of the respondents on the basis of treatment cost per visit

Note: Figures in the parentheses indicate percentage

Time taken	Bathinda			Sri	Sri Muktsar Sahib			South Western Region		
to reach	(n <sub>1</sub> =76)				(n <sub>2</sub> =84)			(N=160)		
hospital	Male	Female	Total	Male	Female	Total	Male	Female	Total	
(hours)	(n=22)	(n=54)	(n=76)	(n=34)	(n=50)	(n=84)	(n=56)	(n=104)	(n=160)	
> 2	7	21	28	10	29	39	17	50	67	
	(31.82)	(38.89)	(36.84)	(29.41	(58.00)	(46.42)	(30.36)	(48.08)	(41.88)	
2-4	6	6	12	2	9	11	8	15	23	
	(27.27)	(11.11)	(15.78)	(5.88)	(18.00)	(13.09)	(14.29)	(14.42)	(14.38)	
< 4	9	27	36	22	12	34	31	39	70	
	(40.91)	(50.00)	(47.36)	(64.71)	(24.00)	(40.47)	(55.36)	(37.50)	(43.75)	

Table 3: Distribution of the respondents on the basis time taken to reach the hospital

Note: Figures in the parentheses indicate percentage

patients of all ages who come from all across Punjab. This 12-coach train has gained its name (Cancer Train) from a sudden increase in cancer cases in Punjab. The ticket was priced at Rs 210, but for cancer patients the eight hour journey to Bikaner is free, while one accompanying attendant gets a concession of 75 percent.

About 41.88 per cent took less than two hours to reach hospital which are nearby them like Punjab Cancer Hospital, Advanced Cancer Diagnostic Treatment & Research Centre, Adesh Institute of Medical Sciences & Research, Max Super Specialty Hospital which are situated in Bathinda. Only 14.38 per cent of the respondents took 2-4 hours to reach hospital like Guru Gobind Medical College and Hospital Faridkot. Whereas, from Bathinda district, nearly half of the respondents both male and female (47.3%) took more than four hours to reach the hospital. Most of the respondents from the region prefer to visit Bikaner hospital for the treatment.

**Basis of accessibility:** Study in Table 4 further examined the accessibility of health services to the respondents. Accessibility was measured through the transport facilities available to them. It was computed on the basis of computed scores of various facilities accessible to them nearby. On the basis of scores assigned by the respondent, accessible was categorized according on the three point scale i.e. poor, average and good. Seventy per cent of the

 Table 4: Distribution of the respondents on the basis of accessibility

Scale	N=160	
Bad	8(5.00)	
Average	41(25.62)	
Good	111(69.37)	

respondents found health services accessible to them and ranked it good. Health services were inaccessible to 5.00 per cent of the respondents as they found it bad.

Awareness and benefits availed from government sponsored scheme: Distribution of the respondents on the basis of awareness of and benefits availed from government schemes is presented in Table 5. The results reveals that in south western region of Punjab, less than (46.3%) of the respondents were aware about state or center government sponsored schemes for cancer patients. However 41.3 per cent availed benefits from different schemes (Mukh Mantri Punjab Cancer Rahat Kosh Scheme, Bhagat Puran Singh Scheme and Punjab Narogi Society). Punjab Narogi Society provides financial assistance under State Illness Fund to cancer patients and patients of other life threatening diseases those belonging to BPL families could only avail the benefit of these schemes. In Bathinda district half of the respondents (51.3%) was aware of the schemes as compared to respondents of Sri Muktsar Sahib (48.6%).

Half of the respondent did not availed any benefit from the government sponsored schemes, because form of some respondents were rejected by the authorities or some of them were not aware about any scheme, some of them had not applied for the scheme, some had applied many times but they didn't know the status of their cases, some respondents submitted their incomplete forms. In Bathinda district, study found two respondents avails the benefit from central level sponsor scheme for cancer treatment i.e. Prime Minister National Relief Fund (PMNRF) of Rs. 3,00,000.

*Government sponsored schemes:* Government of Punjab is quite dynamic about cancer patients as far as

Particulars		Bathinda $(n_1 = 76)$		Sri	Sri Muktsar Sahib (n <sub>2</sub> =84)		South Western Region (N=160)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
	(n=22)	(n=54)	(n=76)	(n=34)	(n=50)	(n=84)	(n=56)	(n=104)	(n=160)
Awareness*	13	26	39	20	15	35	33	41	74
	(59.09)	(48.15)	(51.31)	(58.82)	(30.00)	(41.66)	(58.92)	(39.42)	(46.25)
Benefits availed	13	16	29	14	23	37	27	39	66
	(59.09)	(29.63)	(38.15)	(41.18)	(46)	(44.04)	(48.21)	(37.5)	(41.25)

Table 5: Distribution of the respondents on the basis of awareness and benefits availed from government sponsored schemes

*Note:* Figures in the parentheses indicate percentage

\*Respondents were considered under aware category if he/she knew at least one government sponsored scheme

early detection, management and prevention of this disease is concerned. There was various schemes for benefit and welfare of cancer patients like Mukh Mantri Punjab Cancer Rahat Kosh Scheme (MMPCRKS) and Bhagat Puran Scheme - a scheme from which cancer patients get financial help for their treatment and investigations. Even otherwise once a person was diagnosed with the disease, investigations and treatment was free in all government hospitals as well as in private hospitals of the state (Bal *et al.*, 2015).

The Table 6 examines that forty five per cent of the respondents has availed the benefit of MMPCRK scheme of government in the region. Under Mukh Mantri Punjab Cancer Raahat Kosh (MMPCRKS) Government of Punjab earmarked Rs. 50.00 crores for the treatment of all cancer patients. An amount of 1.50 lakhs was promised for treatment of each cancer patient Government employee and those having health insurance cover are not legible under this scheme (Kaur and Sharma, 2017). Only 3.00 per cent of the respondents availed the benefit of Bhagat

Puran Singh Sehat Bima Yojana scheme in the region. In which Rs. 50,000 was accorded for the treatment to the patients who possessed this card with one year validity. Two male respondents from Bathinda districts had got financial assistances of Rs. 3, 00,000 from Prime Minister National Relief Fund (PMNRF) to partially defray the expenses involved in the cancer treatment.

Free travel facility in Punjab Roadways & PRTC Buses was provided for cancer patients for availing treatment. Bus concession forms are available in every public or private hospitals of Punjab. Patients had to fill the form and submit it in the hospital only. Later on, the form will be attested by the concern doctor from whom the treatment was under process and he will give recommendations. Cancer patient can travel free from both ways for the periodic check-ups in the hospital along with one accompanying person. The free travel certificate is valid for 6 months from the date of issue. There will be no alteration in the form unless attested by issuing officer.

Table 6:	The distribution of	f respondents of	on the basis of	benefits from	government s	ponsored schemes
		1			0	1

Scheme	Bathinda			Sri Muktsar Sahib			South Western Region		
	(n <sub>1</sub> =76)			(n <sub>2</sub> =84)			(N=160)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
	(n=22)	(n=36)	(n=58)	(n=29)	(n=46)	(n=75)	(n=51)	(n=82)	(n=133)
MMPCRKS	10	14	24	13	23	36	23	37	60
	(45.45)	(38.88)	(41.37)	(44.82)	(50.00)	(48.00)	(45.09)	(45.12)	(45.11)
Bhagat Puran Singh	1 (74.54)	2 (5.55)	3 (5.17)	1 (3.44)	-	1 (1.33)	2 (3.92)	2 (2.43)	4 (3.00)
PM Modi	2 (9.09)	-	2 (3.44)	-	-	-	2 (3.92)	-	2 (1.50)
Free Bus/Train travel	9	20	29	15	23	38	24	43	67
	(40.90)	(55.55)	(50.00)	(51.72)	(50.00)	(50.66)	(47.05)	(52.43)	(50.37)

Note: Figures in the parentheses indicate percentage

Sources	Bathinda (n <sub>1</sub> =76)			Sri Muktsar Sahib (n <sub>2</sub> =84)			South Western Region (N=160)		
	Male (n=22)	Female (n=54)	Total (n=76)	Male (n=34)	Female (n=50)	Total (n=84)	Male (n=56)	Female (n=104)	Total (n=160)
NGOs	-	2 (3.70)	2 (2.63)	-	-	-	-	2 (1.92)	2 (1.25)
Village Panchayat	-	1 (1.85)	1 (1.31)	-	-	-	-	1 (0.96)	1 (0.62)
Charity	2 (9.09)	10 (18.51)	12 (15.78)	3 (8.82)	-	3 (3.57)	5 (8.92)	10 (6.73)	15 (9.37)

Table 7: Distribution of the respondents on the basis of benefits availed from other sources

Note: Figures in the parentheses indicate percentage

Same way free train travel was also available for cancer patients from Bathinda to Bikaner. Same procedure was done by Achrya Tulsi cancer hospital Bikaner. The certificate is valid till the last follow up of the patient along with one accompanying person. Half of the respondents (50.3%) in the region get the bus concession while traveling for the follow ups in the hospital along with one accompanying person.

**Benefits availed from other sources:** Distribution of the respondents on the basis of benefits availed from other sources is presented in Table 7. Ten per cent of the respondents had availed the benefit in the form of charity by some research scholars of USA who visited various villages to collect the data of cancer patients and one female respondents got financial assistance from the village panachayat members. Two per cent of the respondents had availed benefits from various NGOs in the sample area.

## CONCLUSION

There is no doubt that Punjab is considered as a 'Development state' but it seems that to sustain the same level of development in the years to come will be difficult and more challenging. The direct cost was main contributor towards the direct illness. However, private health services were ranked good (5.6%) and very good (13.1%) and only one charitable hospital (Acharya Tulsi Cancer and Research Institute, Bikaner) was found very good by one fifth (23.1%) of the respondents. more than third of the respondents had spent more than Rs. 6000 for a single visit to the hospital for the treatment of their patient. In Bathinda district, nearly half of the respondents both male and female (47.3%) took more than four hours to reach the hospital. Health services were inaccessible to 5.00 per

cent of the respondents as they found it bad. In Bathinda district half of the respondents (51.3%) was aware of the schemes as compared to respondents of Sri Muktsar Sahib (48.6%). The cost of the drug should be reduced by the generic substitutes. The limit of exiting social health insurance should be a provision of add-on-insurance to cover costly diseases.

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## Impact of Lockdown due to COVID-19 on Apparel and Knitwear Industries of Ludhiana

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### ABSTRACT

The lockdown due to spread of COVID-19 has been hard-hitting for apparel and knitwear industries of Ludhiana. An attempt was made in the present study to explore the problems due to lockdown and future strategies of Ludhiana industry from 50 industrial units. The data was collected in the lockdown period using a questionnaire. The major concerns of the industry were migration of labour, order cancellations, unavailability of raw material, capital crunch, supply chain disruption and decreased demand because of less footfall of customers in the retail stores even in unlock periods. Though some ray of hope was reflected as 72 per cent industries started producing face masks and PPE kits during lockdown but the industry has to go a long way to tackle with the lockdown problems and their aftermaths and make robust future strategies to overcome the losses. Sourcing alternative raw material from local markets, providing pick and drop facilities to labour to avoid infection, supply chain integration, product line diversification and exploration of new markets was the plan framework of Ludhiana industry for mitigating with the problems arisen due to COVID-19 and its wave of spread in the coming months.

Keywords: Capital crunch, Migration, PPE kits, Product line diversification, Supply chain

## **INTRODUCTION**

The COVID-19 pandemic was confirmed to have spread in the state of Punjab on March 9, 2020 when an Indian man who came from Italy tested positive. Slowly the novel virus spread its roots in all the major districts of the state including the industrial city of Ludhiana which is Punjab's largest city and is famous for its woollens (Pathare, 2020). It is often known as the Manchester of India due to its high manufacturing capacities especially in knitwear (Anonymous, 2014). Due to the spread of the virus, the Prime Minister of India announced a Janta curfew on March 22, 2020 followed by the first phase of lockdown from March 25 to April 14, 2020. This lockdown was then extended in second phase till May 3, 2020 and the third phase of lockdown was till May 17, 2020. Some relaxations were given in phase four of lockdown which lasted till May 31, 2020. This period of lockdown was highly taxing for the industries of Ludhiana because they had to shut down and there was no work at all (Juneja, 2020). The present study was executed with the objective of studying the impact of this lockdown on apparel and knitwear industries of Ludhiana.

## MATERIALS AND METHODS

A questionnaire was framed on google form. It comprised of the background information pertaining to the industries like name, size, year of inception, mode of procuring raw material, target markets etc. and specific questions relating to their working, problems, opportunities in the lockdown period and future strategies to combat against the prevailing conditions. The google form was shared using the social media platforms and data was collected from 50 industrial units of Ludhiana. Few of the industries included in the study were Vardhman Pvt. Ltd, Nahar Pvt. Ltd, Eveline International, Kuddu Hosiery Pvt. Ltd, Sportking Industries, Superfine Knitters, Khanna Knit wears etc. The data was analysed using the Statistical Package for Social Sciences (SPSS) software.

## **RESULTS AND DISCUSSION**

The data was collected from fifty respondents (one from each industry). The designation of the respondents varied viz. Chief Executive Officer (CEO), Director, Merchandiser, Production Head, Senior Designer, Marketing Manager or Human Resource Manager

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Parameter	Freq-	Percen-
	uency	tage
Size of the industries		
Small	20	40
Medium	17	34
Large	13	26
Year of inception		
Before 1960	4	8
1960-1980	11	22
1980-2000	13	26
After 2000	22	44
Product Range Manufactured		
Knitted garments	28	56
Woven garments	9	18
Yarns	7	14
Fabrics	4	8
Trims and accessories	1	2
Others	1	2
Source of procurement of raw mate	rial	
Local industries	25	50
Other states	10	20
Import from other countries	15	30
Destination for selling the finished p	oroducts	
Local markets	30	60
Interstate markets	15	30
Export to other countries	5	10

 
 Table 1: Background Information of the industries under study

depending upon their willingness to take the survey and return the filled questionnaire to the researcher (Table 1).

As far as background information of the industries was concerned, the data reveals that 74 per cent industries were small and medium while 26 per cent were large in size. Majority of the industries (44%) were established after the year 2000 while a very few (8%) were old industries and came into inception before 1960.Fifty six percent of the industries were making knitted garments followed by those making woven garments, yarns, fabrics, trims etc. again reflecting on the dominance of Ludhiana in making knitwears. Fifty percent of the industries under study were sourcing their raw material from local markets, 20 per cent from interstate markets while 30 percent were directly procuring raw material from countries like China, Taiwan, Cambodia etc. Most of the industries were domestic industries selling their finished products like garments, fabrics etc. to local and other interstate markets while only 10 percent industries were totally export oriented and selling their products to international companies located in China, Bangladesh, Mexico, Vietnam etc.

Lockdown was the right decision: According to the collected data from 50 industrial units of Ludhiana, the lockdown had put a lot of strain on the industrial sector, still 84 per cent of the respondents were of the view that lockdown from April 25 to May 31, 2020 was the right decision taken by the government keeping in mind the seriousness of the spread of the Corona virus (Figure 1).



Figure 1: Opinion of the respondents about lockdown due to COVID-19

**Lockdown announced without prior notice:** The respondents were of the view that lockdown was a hasty decision and came without proper warning or notice as confirmed by 58 per cent respondents. Due to this, the industries were closed down in panic so there was no time to manage the already produced merchandise or the one which was in pipeline leading to huge inventory losses (Figure 2).

**Opening of industries amidst the lockdown:** There was a mixed response on government's idea to open up the industries amidst the lockdown period by providing stay facilities to the labour within the industry premises with regular medical check-ups as 38 per cent respondents agreed, 44 per cent disagreed and 18 per cent were not



Figure 2: Opinion of respondents about lockdown announcement without prior notice

sure about this. This might be because providing stay and medical facilities is out of question for small and medium enterprises because of limited space and resources and majority of the industries under study belonged to MSME sector (Figure 3).

*Working in industries with 50 per cent labour:* During lockdown, the government wanted to ensure physical distancing so it allowed industries to run with 50 per cent labour only. This was considered as a good initiative by 60 per cent respondents as they thought that some work is still better than no work and less workforce would be effective in maintaining physical distancing which is the need of the hour (Figure 4).

*Complete shutdown of industries:* The data reveals that 64 per cent of the industries were completely shut down



Figure 3: Views of respondents for opening of industries amidst lockdown being right



Figure 4: Views of respondents for working with half strength of workforce being right

due to lockdown, while 28 per cent were able to work from home through online mode on their designing and IT related aspects. These were mostly the large and medium sized industries (Figure 5).

**Problems faced due to lockdown by apparel and knitwear industries of Ludhiana:** The lockdown was one in a lifetime experience for maximum people. It bought many problems with it few of which were visualized and practically experienced and were actually a cause of worry for the respondents.

**Shortage of raw material:** Eighty six percent of the respondents opined that raw material availability was a major difficulty due to global lockdown. Even the industries who were sourcing their raw material locally informed that their supplier is dependent on Chinese import



Figure 5: Opinion of respondents on industries being completely shut down due to lockdown

only so directly or indirectly, the raw material was procured from China due to its low price and huge variety. As the lockdown imposed restrictions on all import and exports so shortage of raw material was a major concern by majority of the respondents.

*Lack of labour:* Labour movement to their native states resulted in extreme shortage leading to production issues and it was the concern of 94 per cent respondents. The respondents were of the view that labour shortage will add to lead time delays resulting in cancellation of future orders. Further, 88 per cent respondents were also facing difficulties due to panic created by the lack of authentic and reliable information amongst their workforce leading to unnecessary chaos.

Maintaining physical distance amongst the workforce: Maintaining social distancing amongst the uneducated workforce was a big problem as shared by 62 per cent respondents, while the rest thought that it can be done through regular training. Further, 82 per cent of the respondents agreed that it is the responsibility of the employers to educate their workforce about sanitation and hygiene at this sensitive hour.

**Complete disruption of supply chain and capital crunch:** The non-integration and management issues of the supply chain of the products were a major threat for 94 per cent respondents. All respondents opined that capital shortage due to liquidity issues will add to the woes of the Ludhiana industry. Forty eight percent of the respondents were of the view that the normal working in their premises can be resumed only after 5-6 months as of now and till that time, the industry will have to suffer huge losses.

**Cancellation of orders:** Cancellation of orders and accumulation of dead stock due to global recession and no business was a challenge according to 94 per cent respondents. An overwhelming proportion of the respondents i.e. 96 per cent were concerned due to no summer business this year. This was due to the fact that the lockdown period of 68 days was the suitable time for production of summer merchandise, which has been completely thrashed due to shutdown of the industries.

**Decreased demand of garments after lockdown:** Fifty four percent of the respondents were also concerned with the decreased demand of garments after the lockdown period as the discretionary income of majority of people

has diminished. About 50-75 per cent loss in business has already taken place due to the lockdown as stated by 80% respondents. Additional expenditure on ensuring medical safety of their employees clubbed with reduced business opportunities is creating trouble according to 76 per cent respondents.

**Ray of hope/Opportunities for the apparel and** *knitwear industries of Ludhiana:* An area of hope that existed in the industry came from the fact that lockdown resulted in opportunities for creating new products like face masks and PPE kitsas stated by 72 per cent respondents. These industries started making such alternate products whose demand was created due to the current pandemic. Further, the respondents added that now there is an opportunity to set up domestic industrial plants for making raw material in India itself to overcome dependence on countries like China. This is possible through governmental support and signing of MOU's with large global brands (Figure 6).

*Future Strategies to be adopted by industries to combat the present situation:* The data collected for future strategies to be taken by the Ludhiana industry reflect the following initiatives:

- 1. Seventy six percent of the industries were planning of buying raw material from local markets or selecting alternative raw material easily available to cope up with shortage of Chinese raw material.
- 2. Seventy eight percent of the industries were planning to provide pick and drop and hostel facilities to their



Figure 6: Views of respondents about new opportunities of business in lockdown

labour to overcome absenteeism and ensuring their health and hygiene.

- 3. To boost up the future sales, product line diversification and exploration of new markets are the most appropriate options. This is reflected in responses of 76 per cent respondents.
- 4. As far as clearance of dead stock is concerned, the industries are planning for their alternate uses to make new products and to give promotional offers to their customers for increased selling as stated by 76 per cent respondents, while few were supportive of keeping the stock for next season as well.
- 5. The industry is looking for government support in the present situation. 92 per cent respondents wanted a respectable subsidy package for the industry especially for the MSME sector. Reduction in water and electricity charges and import and export incentives are the need of the hour according to 80 percent respondents.

## CONCLUSION

The study concluded that though the apparel and knitwear industries of Ludhiana are facing brunt of COVID-19 pandemic and the impact of lockdown has been huge resulting in great business losses but still the industry supported the government's decision about the lockdown. The industry is motivated to work hard in this period of global pandemic and also has taken advantage of new opportunities like making of face masks and PPE kits. The future strategies have been well planned by the industries and their promoters and are all set to be executed with governmental support in place.

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## Comparative Assessment of Strengths, Weaknesses, Opportunities and Threats (SWOT) and Constraints of Public and Private Farm Advisory Services in Meghalaya

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#### ABSTRACT

The SWOT and constraint analysis was applied to examine the setting of organization of the public and private farm advisory services (FAS) and for determining their effectiveness, capabilities and efficiency in Ri-Bhoi district of Meghalaya. KVK, Ri-Bhoi, Umsning block as public extension organization and RRTC, Umran block as private extension organization were selected randomly for the study. Using ex-post facto research design, data were collected from a random sample of 120 farmers and 20 extension officials through personnel interview and focus group discussion with extension officials of both organisations. All the strengths, weaknesses, possible opportunities as well as threats of the two extension systems are compared, with the response received from the respondents from the prepared schedule. Constraints of the farmers and two organization Krishi Vigyan Kandra (KVK) and Rural Resource Training Centre (RRTC) official perceive constraints about the organization is analysed from the response received from the questionnaire. Further the constraints as perceived by farmers and officials in adoption of technologies were enlisted. Then respondents were asked to rank them on the basis of their perception towards the constraints. The major strengths of KVK were the quality of personnel and for RRTC was its brand name. Finance for extension activities and multiple responsibilities were the most frequently experienced constraints expressed by officials of KVK and RRTC. Both public and private organisations have their own strengths and there is need to converge their strengths for overall development of farming community.

Keywords: Constraint analysis, Farm advisory services, Meghalaya, SWOT analysis

## INTRODUCTION

Over a period of time, extension services for catering to the needs of the farmers have increased. Extension services have now become an integral part of all the agricultural development efforts by the State Departments of Agriculture, various agricultural research organizations including State Agricultural Universities (SAUs), ICAR agricultural research institutes, Krishi Vigyan Kendras (KVKs), and other private non-profit organizations including NGOs, CSR institutions, input agencies and marketing agencies, etc. Indeed, there are now pluralistic extension systems operating in the country. The key objectives of both the public and private sector extension organizations is more or less the same *i.e.*, enhancing the food production, ensuring the food and nutrition security and livelihood security of the rural people (Christoplos,

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2003). Yet some differences can be noticed between them. Public and private sector extension organizations differ in such aspects as nature, approach of the extension services, mode of operation, organizational structure, provision of various kinds of farm advisory services and their level of performance and impact on farmers' lives. While public sector extension organizations focused more on transfer of technology for achieving the food security of the nation, private sector extension organizations focused more on organizing the farm families and engaging themselves in socio-economic empowerment of famers mostly with mandate of donor agency. Since there are pluralistic extension service systems catering to varied needs of farmers, new extension teaching methods and approaches are being continuously designed, tested, validated and upscaled by both public and private sector extension service organisations there is need to understand the efficiency,

strengths and weaknesses of each type of extension organization and constraints faced by farmers and extension personnel in that may come in the way of adoption of various technologies.

## MATERIAL AND METHODS

The study was conducted in Meghalaya as very few studies have been conducted in North-East Hill region. The Ri-Bhoi district was selected purposively as presence of many NGOs, ICAR Research Complex for NEH Region Post Graduate Institute (CAU), KVK are situated in this district. From the list available for FASs available in Ri-Bhoi district, two extension service organizations: KVK, Ri-Bhoi as Public sector extension service organisation and RRTC a Non-Government organisation as Private extension service organization were selected randomly to see their comparative performance. From Ri-Bhoi district, two different blocks i.e., Umsning where KVK as Public Sector extension services organization in delivering farm advisory services (FAS) and Umran where RRTC is delivering farm advisory services (FAS) were selected randomly. In next stage, from each block, one adopted and non-adopted village having similar agro-eco system for both public and private organization were selected randomly. Thus to study KVK, the Umsning block and for RRTC Umran were selected. In third stage, from the block Umsning, Nongthymnai village was selected as adopted village and Nongrah as non- adopted village having similar agroecological situation. Similarly, from Umran block, Nariiang village was selected as adopted village and Parila as nonadopted village having similar agro-ecological situation. Totally four villages were selected from two blocks. To select the respondents' simple random sampling technique was utilised. From each adopted and non-adopted village, 30 farmers were selected randomly for each organization, totalling 120 farmers (60 from adopted villages and 60 from non-adopted villages). Further, in order to study the extension services organization on FAS and their functionaries, 10 extension functionaries from both the organization will be selected, totalling 20 extension functionaries. So, total sample size was 140 (120+20).

SWOT is a technique for analysing the internal and external environments of an organisation through the identification and assessment of its strengths, weaknesses, opportunities, and threats (SWOT). SWOT analysis entails a distillation of the findings of an internal and external audit that draws attention, from a strategic perspective, to the critical organisational strengths and weaknesses and the opportunities and threats facing the organisation (Kotler and Armstrong, 2011). The SWOT analysis was applied to examine the setting of the organization extension service and for determining their effectiveness, capabilities and efficiency. The SWOT analysis of KVK and RRTC was done through an interview schedule and focused group discussion with Extension officials of both organisations was used to get information on all aspects of SWOT of the two organizations.

The constraints analysis serves to identify constraints and opportunities that have the potential to either impede or facilitate achievement of objectives. Constraints analysis is done through analysing the perceived constraints that come in the way of adoption of various technologies. The perceived constraints in adopting the farm advisory services for both farmers and officials of the KVK and RRTC were analysed with the help of the Rank Based Quotient technique (RBQ) developed by Sabarathnam and Vennila (1996). The frequencies of ranks given by the farmers and officials for each of the constraints were calculated and substituted in the below mentioned formula to compute rank of the constraint 'j' (expressed in terms of percentage) as

$$\operatorname{RBQ}_{j} = \sum_{i=1}^{r} \left[ \frac{f_{i}(n+1-i)}{Nn} \right] \ge 100$$

Where,

- r = Number of ranks
- i = Index of rank (i = 1, 2, ..., r)

 $f_i$  = Number of respondents (farmers and officials) reporting a particular constraint under rank 'i' n = Number of constraints identified j = Index of constraint (j= 1,2,...,n) N = Total number of respondents

(x is the multiplication sign)

It is noted here that there are as many number of ranks as are the number of constraints hence r is equal to n, but the notations of (i and j) and that of (r and n) have been intentionally kept different in order to avoid confusion owing to the mathematical fact that once the expression on right hand side has been summed over all values of index 'i' then the result on the left hand side should be independent of 'i'.

### **RESULTS AND DISCUSSION**

Here an attempt has been made to ascertain the strengths, weaknesses, opportunities and threats of both public and

private extension service organisations. Strength, weakness, opportunities and threats of the organization is given in the Tables 1 to 4.

*Strengths:* One of the major strengths of KVK, Ri-Bhoi was the quality of personnel in terms of qualification, training and experience. The quality of staff has also affected the linkage of KVK staff with farmers. KVK, Ri-Bhoi has the strength of both forward and backward linkages. The staff composition of KVK, Ri-Bhoi is such that its multidisciplinary team is capable of handling programmes at different angles. Another major strength of KVK, Ri-Bhoi is its technological backstopping. Being an ICAR organisation, it has support of research institution. Burman *et al.* (2010) found that the KVKs have good linkage with the research organizations like State Agriculture Universities (SAUs), ICAR Institutes and UP Council of Agricultural Research.

Rural Resource and Training Centre (RRTC) has a brand name in the Northeast region which provides credibility to this organisation. Its brand value also attracts quality personnel. Having well on farm demonstrations and training facilities at its centre, farmers and other rural visitors get first-hand experience of latest technologies. Its focus on capacity building interventions has developed its credibility for imparting quality training in the region.

Weaknesses: One of the major weaknesses of KVK, Ri-Bhoi was lack of financial resources for operational costs as major part of budget allotted goes to meeting expenses for salary of staff, leaving little for operational costs. Vacancies of posts and turnover were also other weaknesses. Anderson and Feder (2003) in their study recorded that there is a need for funding of public extension but due to financial issues and poor extension delivery lead to less role of public service providers. Other weaknesses are related to logistic support and long chain of communication within the system for financial communication and other decisions. Though KVKs have sufficient staff strength, hardly all positions are filled up. Being situated in difficult area, there is high turnover of staff which not only affects the completion of projects and programmes but also existing staff lack confidence in various disciplines. Whereas, major weaknesses perceived

Table 1: C	comparison of	of Strengths	of KVK, I	<b>Ri-Bhoi and RRTC</b>
			,	

Krishi Vigyan Kendra (KVK), Ri-Bhoi	Rural Resource and Training Centre (RRTC)
1. Highly qualified, competent and experienced personnel at	1. Presence of highly qualified personnel.
KVK for all activities.	2. Farmers received first-hand experience of the improved
2. Good training programmes have produced credible staff.	technology
3. Good communication among farmers and KVK staff	3. Brand name of the RRTC
4. Multidisciplinary team of KVK with more holistic approach.	4. Presence of abundant facilities.
5. KVK attached with the headquarters for research and scientific	5. Quality training given to the farmers and building their
backstopping	capacity

Table 2: Comparison of	Weaknesses of	KVK and RRTC
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Krishi Vigyan Kendra (KVK), Ri-Bhoi	Rural Resource and Training Centre (RRTC)
1. Lack of financial resources, more than 75 percent budget of the organi-	1. Lack of financial support for the organization
zation goes on salaries, very little amount is left for operational costs.	2. Lack of man power
2. Lack of logistic support and no transport and equipment facilities.	3. Lack of proper management in the organization
3. Presence of long channel for financial communication with much loss to	4. Lack of coordination among the staff and the
the organization	farmers
4. Bureaucracy and long channels of communication in the organization.	
5. Conflicts within the organization and intended beneficiaries.	
6. Lack of full staff strength with high staff turnover leaves some Projects/	
programmes unfinished.	
7. Lack of confidence on subject without supervision	
by RRTC officials were lack of financial support and problems related to human resource management and lack of coordination among farmers and extension personnel.

**Opportunities:** The opportunities of KVK, Ri-Bhoi and RRTC were analysed and summarized in Table 3. With respect to opportunities available, KVK, Ri-Bhoi has the opportunity for collaboration with ICAR, line departments and other public sector extension Service organisations. There is also potential for improved effectiveness and efficiency of ginger and turmeric for organic commercialization. RRTC also have good brand name and can have collaboration with all stake holders including public research and extension organisations. These collaborations provide RRTC with technologies required for trainings and their transfer to ultimate users. Reardon et al. (2011) in Uttar Pradesh observed that public sector extension sources (State extension staff, KVKs, All-India Radio, university extension, and plant protection units) were utilised as a source by 25 per cent of farmers. In Madhya Pradesh, 37 per cent of the farmers had contacted State extension staff (Reardon et al., 2011) for services. Other farm service providers in Madhya Pradesh were All-India Radio and television (21 per cent), and KVKs (12%). Private sector sources total 25 per cent of all information sources. **Threats:** Major threats as perceived by KVK officials related to untimely availability of budget and undue delay in supply of inputs which may lead to loss of credibility of KVK, Ri-Bhoi services among farmers. KVK, Ri-Bhoi being a resource centre at district may have to face increasing workload of staff and they have to report too many and tend to deviate from objectives and purpose of KVK, Ri-Bhoi. This finding is in line with study of Nath *et al.* (2016).

The major threat as perceived by RRTC officials arise out of their dependency on donor agencies. Moreover, there is competition with other private extension service organisations in the area. RRTC is focused in capacity building of rural people, their scope of activities and use of extension methods is limited.

Inadequate funding for extension activities was perceived the most serious constraint by KVK, Ri-Bhoi staff with the highest RBQ value of 98.33. Improper planning of extension program (96.6%), farmers' resistance to adopt new technology (93.0%) and shortage of extension staff (92.0%) were the other constraints expressed by the KVK officials in the order of seriousness. Administrative and bureaucratic bottlenecks were perceived as the least ranked constraint. multiple responsibilities of

Krishi Vigyan Kendra (KVK), Ri-Bhoi	Rural Resource and Training Centre (RRTC)
1. Improved collaboration with all division of ICAR for	1. Good opportunities for collaboration with public research and
effective transfer of technologies	extension organizations
2. Collaboration opportunities among line departments,	2. Sufficient amount of technologies for the training as well as
ministries, and other system actors in the organization.	delivery
3. Potential for improved effectiveness and efficiency of	3. Great opportunities for collaboration with all stakeholders.
ginger and turmeric for organic commercialization.	4. Use of ICT in delivering of technologies
4. There are great opportunities for collaboration and	
convergence with stakeholders	

Table 3: Comparison of Opportunities of KVK, Ri-Bhoi and RRTC

#### Table 4: Comparison of Threats of KVK and RRTC

Krishi Vigyan Kendra (KVK), Ri-Bhoi	Rural Resource and Training Centre (RRTC)
1. Inadequate and untimely budgets	1. Possibility of retirement with fatigue and withdrawal of
2. Farmers loss of faith for KVK due to untimely	investments from donors.
supply of inputs	2. Misunderstanding of the major role of the RRTC by the farmers
3. Workload besides the mandates activities	3. Competition from other private organization and other
4. Lack of single line of command in the KVK system	extension agencies.
5. Deviation from objectives and purpose of the KVK	4. Limited use of alternative extension method in the organization.
6. Weak feedback from research	

the extension personal as the most important constraint in RRTC (95.0%) followed by shortage of extension staff (93.3%), Limited information on improved technology (92.0%) and Administrative and bureaucratic bottlenecks (91.6%). Non availability of audio-visual aids and other facilities as the least important constraints as the organization is well equipped with these facilities with RBQ value of 70.

**Constraints perceived by adopted farmers of Extension Service Organizations:** The perceived constraint of the farmers under the KVK, Ri-Bhoi is given in the Table 5. Lack of technically skilled extension workers was the top most constraint felt by 65.5 per cent KVK adopted farmers. The major technology related constraints *i.e.*, new improved technology is difficult to understand and use (57.4%), incompatibility of new technology with social value (56.6%), high cost of input to adopt new technology (54.8%) and lack of ready market to sell produce of improve technology (53%) were expressed as constraints by the farmers. Lack of timely extension services and delay in input delivery (51.6%) and insect and pest problem (34.8%) were the least ranked constraints by the farmers under KVK, Ri-Bhoi.

The results of constraints as perceived by farmers of RRTC are given in Table 6. The constraints given in Table 6 show that 63.7 per cent of farmers of village adopted by RRTC felt that officials contact only the progressive farmers. Also 63.7 per cent of farmers expressed that new improved technology is difficult to understand and use and about 60.7 per cent of farmers opined lack of timely extension services and delay in input delivery. Incompatibility of new technology with social value (49.6%) and high cost of input to adopt new technology (22.9%) were ranked as the eighth and ninth constraints by the farmers of RRTC. Ayansina et al. (2015) stated that the private extension services were doing better and were more liked by the beneficiaries. The authors also reported that there existed a significant difference in the benefits achieved by respondents between public and private organisations. The increased yield, farm income, skill acquisition, and

Table 5: Constraints perceived by adopted farmers of KVK, Ri-Bhoi

S.No.	Constraints perceived by Farmer Respondents	<b>RBQ</b> value	Rank
1.	Lack of technically skilled extension workers	65.5	Ι
2.	New improved technology is difficult to understand and use	57.4	II
3.	Incompatibility of new technology with social value	56.6	III
4.	High cost of input to adopt new technology	54.8	IV
5.	Lack of ready market to sell produce of improve technology	53.0	V
6.	Failure of extension services to match in accordance to farmers needs	52.9	VI
7.	Officials Contact only the progressive farmers	51.8	VII
8.	Lack of timely extension services and delay in input delivery	51.6	VIII
9.	Insect and pest problem	34.8	IX

#### Table 6: Constraints perceived by adopted farmers of RRTC

S.No.	Constraints perceived by Farmer Respondents	<b>RBQ</b> value	Rank
1.	Officials Contact only the progressive farmers	63.7	Ι
2.	New improved technology is difficult to understand and use	63.3	II
3.	Lack of technically skilled extension workers	61.0	III
4.	Lack of timely extension services and delay in input delivery	60.7	IV
5.	Failure of extension services to match in accordance to farmers needs	56.2	V
6.	Lack of ready market to sell produce of improve technology	54.8	VI
7.	Insect and pest problem	54.0	VII
8.	Incompatibility of new technology with social value	49.6	VIII
9.	High cost of input to adopt new technology	22.9	IX

improved education in private extension organizations were observed.

**Constraints perceived by Officials of Extension Service Organizations:** In case of the two organizations KVK, Ri-Bhoi and RRTC, twelve different constraints were listed and ranking of the constraint was done according to their perceived importance. Responses of officials were collected and ranked accordingly.

The results in Table 7 enlist constraints relating to the officials of KVK, Ri-Bhoi. Inadequate funding for extension activities was perceived the most serious constraint by KVK staff with the highest RBQ value of 98.33. Improper planning of extension program (96.6%),

farmers' resistance to adopt new technology (93.0%) and shortage of extension staff (92.0%) were the other constraints expressed by the KVK officials in the order of seriousness. Administrative and bureaucratic bottlenecks were perceived as the least ranked constraint. Nath *et al.* (2016) also reported that majority of the KVK scientists (100%) of NE Region of India has problem of insufficient and irregularity of fund flow to carry out their activities followed by more work load due to some external schemes (90.74%) and insufficient staff (81.48%).

The results in Table 8 indicate that multiple responsibilities of the extension personnel as the most important constraint in RRTC (95.0%) followed by shortage of extension staff (93.3%), limited information

#### Table 7: Constraints perceived by Officials of KVK

S.No.	Constraints perceived by Officials	<b>RBQ</b> value	Rank
1.	Inadequate funding for extension activities	98.33	Ι
2.	Improper planning of extension program	96.60	II
3.	Farmers resistance to adopt new technology	93.00	III
4.	shortage of extension staff	92.00	IV
5.	Problem of transportation	91.66	V
6.	Multiple responsibilities	86.66	VI
7.	Farmers unwillingness to participate in extension activities	85.00	VII
8.	Non availability of audio-visual aids and other facilities	83.30	VIII
9.	Limited information on improved technology	78.33	Х
10.	Scope of work is limited only to project activities	78.00	XI
11.	Lack of training opportunities for extension personnel	81.66	IX
12.	Administrative and bureaucratic bottleneck	71.66	XII

#### Table 8: Constraints perceived by Officials of RRTC

S.No.	Constraint perceived by Officials	<b>RBQ</b> value	Rank
1.	Multiple responsibilities	95.0	Ι
2.	Shortage of extension staff	93.3	II
3.	Limited information on improved technology	92.0	III
4.	Administrative and bureaucratic bottleneck	91.6	IV
5.	Farmers unwillingness to participate in extension activities	90.0	V
6.	Problem of transportation	88.3	VI
7.	Farmers resistant to adopt technology	86.6	VII
8.	Lack of training opportunities for extension personnel	85.0	VIII
9.	Scope of work is limited only to project activities	75.0	Х
10.	Improper planning of extension program	73.3	XI
11.	Inadequate funding for extension activities	76.6	IX
12.	Non availability of audio visual aids and other facilities	70.0	XII

on improved technology (92.0%) and administrative and bureaucratic bottlenecks (91.6%). Non availability of audiovisual aids and other facilities as the least important constraints as the organization is well equipped with these facilities with RBQ value of 70.

Thus, major constraints in adoption of technology as perceived by farmers of KVK adopted villages were lack of technical expertise and new technology difficult to understand and use and their incompatibility with their social values. Whereas farmers of the adopted village by RRTC felt that officials contact only the progressive farmers and technology do not reach everyone. Other constraints to adopt technology were new improved technology is difficult to understand and use, lack of timely extension services and delay in input delivery. As far as officials' perceptions were concerned, inadequate funding for extension activities was perceived the most serious constraint by KVK staff followed by improper planning of extension program and farmers' resistance to adopt new technology. Multiple responsibilities of the extension personnel as the most important constraint in RRTC followed by shortage of extension staff, limited information on improved technology and administrative and bureaucratic bottlenecks.

#### CONCLUSION

It was found that the Major strengths of KVK lie in its multidisciplinary teams of qualified personnel with adequate training and experience, and in its research and technological backstopping from ICAR Research Complex for North-Eastern Region located at Umiam. Major strength of Rural Resource and Training Centre (RRTC) is the very good brand name in the Northeast region and its credibility for providing capacity building interventions to villagers for livelihood security. Having several livestock demonstration units on its farm and excellent training facilities at its centre is another strength. Major weakness of both organisations was related to financial resources. KVK, Ri-Bhoi and RRTC have the opportunity for collaboration with to improve the transfer of technology programme. Major threats as perceived by KVK, Ri-Bhoi officials was untimely availability of budget and undue delay in supply of inputs while major threat as perceived by RRTC officials arise out of their dependency on donor agencies. Major constraints for the adoption of technology as perceived by the respondents' farmers of KVK, RiBhoi adopted villages were lack of technical expertise and new technology difficult to understand and use and their incompatibility with their social values. Whereas farmers of the adopted village by RRTC felt that officials contact only the progressive farmers and technology do not reach everyone. As per officials' perceptions, inadequate funding for extension activities was perceived the most serious constraint by KVK, Ri-Bhoi staff. Multiple responsibilities of the extension personnel are the most important perceived constraint of RRTC. Thus it can be concluded that analyzing the organization strength, weakness, opportunity and threat timely can help to improve the efficiency of the organization.

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# Assessment of Changing Consumer Behaviour in the Wake of COVID-19

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#### ABSTRACT

This study is focused on Covid-19 pandemic which has brought a shift in the consumer buying behaviour. As the cases of virus infection are increasing, the fear of losing one's life has gripped the consumer mind. There has been a drastic change observed in consumer buying behaviour and payment mode during the current crisis. Consumers are now buying more essential stuff related to grocery items, personal and home care stuff. In initial stage of pandemic in India people had started stock buying as they were afraid of the consequences of unknown crisis. Likewise, the consumers were grappling with the flooding information of Covid crisis 24/7 on social media. Subsequently, the false news, incomplete and misleading information floating on social media account has been a major pinning point. Therefore, the consumer gradually inclined towards the online platform for buying the basic stuff such as personal care items, home care items and clothing etc. Moreover, it has been found that the consumer choice of payment mode switched to digital payment. And there has been an increase in level of satisfaction among consumer about the online payment mode as per the call of crisis they have switched toward online buying and the consumer felt more ease and safe about shopping at home. Certainly, the social media have created a moderate influence on consumer attitude of purchase as well as the crisis has forced the choice of purchase in the emerging new normalcy.

Keywords: Covid-19, Consumer behaviour, Digital payment, Social media, Stock buying

#### **INTRODUCTION**

With the COVID-19 pandemic changing life as we know it, it is expected that a new normal world emerge. This includes changes in lifestyle, and consequently consumer behaviour as well. The global scenario itself went through a lot of change from pre to post lockdown series. The crisis has engulfed about millions of people across the globe, there are many people around the globe who feel that they are about to see the worst stage to hit the ground.

Patil and Patil (2020) in their study stated that about 48.50 per cent of consumers had opined that COVID-19 has brought new normalcy on buying behaviour. As the number of cases is still growing, people are drenched with thought of fear to go to store as they do in their normal days and buy essential and non- essential items for household. The mentality of consumer has been greatly influenced by the present crisis. Media can be an imperative factor to avert the panic buying among the consumers and limit the spread of misinformation (Arafat *et al.*, 2020).

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However, the social media in the crisis situation is not so far to provoke consumer mind. Subsequently, the false news, incomplete and misleading information floating in social media has been a major pinning point.

The originality of news passed from the source to receiver diminished its authenticity because of misinterpretation of information which now a day cause panic buying among consumers. In the whole scenario of lockdown and unlock series that there has been number of survey conducted by retailers and e-commerce agencies and it has been observed that now people have started accepting the change and with this transformation they are moving toward healthy and essential buying of grocery items, personal care items and home care items.

Despite of end route to digitalization, people in India still feel safe to shop in offline mode rather than online because of internet theft and phishing cases, people are not so confident to give their account details in any online applications. Coincidently, the current crisis has somehow kicked the consumer to switch in digital payment world, while the COVID-19 has crashed the physical transactions. ET Government (2020) has reported that among Indian consumers the usage of digital payment mode has been on rise by around 42 per cent in the lockdown period as compared to pre-lock down period.

The sudden intrusion of the COVID-19 crisis has carried out a lot of change in consumer behaviour of consumption and buying style, whereas the idea behind writing this paper is to examine the state of transition in consumer behaviour and the social impact on consumer attitude and knowledge in purchasing commodities for household consumption. So the study was conducted with the following specific objectives:

- 1. To examine change in behaviour of consumer amid covid-19 pandemic.
- 2. To explore the social impact on consumer attitude and knowledge related to consumption of goods and services amid covid-19.

#### MATERIALS AND METHODS

Covid-19 had deep impact on health and economy across the globe. Nowadays consumers have become more conscious about their health. This has been lead to change in their lifestyle and preference of consumption pattern as well. The survey was based on online mode of data collection using google forms. The questionnaire link was circulated via whatsapp and email and further circulated likewise in Punjab and neighbouring states. A total of 400 responses were received. Simple frequency and percentages were worked out for statistical analysis.

#### **RESULTS AND DISCUSSIONS**

**Change in behaviour of consumer amid covid-19:** The corona virus pandemic has taken the whole world by storm. With uncertainty around, the daily lives of consumers witness some highly unique and unheard-of changes. The consumer behaviour in India also changed rapidly over the course of the crisis.

**Consumer behaviour amid current crisis:** Amid the continuing Covid-19 crisis, consumers are compelled to change their behaviour with the ongoing crisis. The data presented in Table 1 reveals that majority (86.50%) of the respondents stated that their preference of buying products has been changed. Subsequently 13.50 per cent of the

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Parameters	Frequency	Percentage
1. This pandemic has changed you	ur preferen	ce of buying
products		
Yes	346	86.50
No	54	13.50
2. Your priorities now as consumer	are	
Buying essential goods	338	84.50
Buying both essential and non-essentia	al 62	15.50
goods		
3. Shortage of products at your near	rby store	
Yes	74	18.50
No	138	34.50
Sometimes	188	47.00
4. Stocking up on products due to f	ear to shorta	age
Yes	232	58.00
No	168	42.00
5. If yes, duration of stocking up or	n products	
Weekly	138	59.48
Fortnightly	42	18.10
Monthly	52	22.41

respondents expressed no change in their preference of buying behaviour. In the following situation the respondents were found to be more inclined towards essential goods (84.50%) as their priorities and least 15.50 per cent of the respondents still prioritize both essential and non-essential goods in their day to day life in post lockdown. Nearly 47 per cent of the respondents stated that in their area they had found shortage of products. Indeed the flashing of covid-19 news 24/7 on screen has created a grappling situation among respondents. The fear of virus and shortage has created a chaotic circle which resulted in stocking up on products. About 58.00 per cent of the respondents have stocked up products and it has been found that more than half (59.48%) stock up on weekly basis rather than stock up for more than months.

*Items purchased/availed services during lockdown:* As regards the items purchased and services availed during lockdown period, it is evident from the data presented in Table 2 that majority (80.00%) of the respondents purchased personal care products occasionally in lockdown period. As fear of covid-19 has grabbed the mind of the consumer so, the consumers do not want to take a chance to get infected. Likewise, more than half (52.50%) of the

Parameters	Regularly	Occasionally	Never
Personal care products	50(12.50)	320(80.00)	30(7.50)
Processed food items	117(29.25)	210(52.50)	73(18.25)
Home care products	180(45.00)	210(52.50)	10(2.50)
Dairy products	307(76.75)	91(22.75)	2(0.50)
Confectionary items	15(3.75)	176(44.00)	209(52.25)
Beverages	10(2.50)	132(33.00)	258(64.50)
Stationary items	17(4.25)	178(44.50)	205(51.25)
Medicines	4(1.00)	245(61.25)	151(37.75)
Electrician/Plumber services	4(1.00)	88(22.00)	308(77.00)
Gardener services	2(0.50)	98(24.50)	300(75.00)
ATM services	40(10.00)	263(65.75)	97(24.25)
Banks services	64(16.00)	116(29.00)	220(55.00)

Table 2: Items purchased/services availed during lockdown (n=400)

Note: Figures in parentheses indicate percentages

respondents occasionally purchased processed food so that they can store and use it for more number of days and home care products to maintain proper hygiene and sanitation at home. Further, it has been observed that majority (76.75%) of the respondents purchased dairy products on regular basis as essential item followed by more than half of the respondents who never purchased confectionary (52.25%), beverages (64.50%) and stationary items (51.25%) in lockdown period. 61.25 per cent of the respondents purchased medicines occasionally because of their medical issues or precautionary measures to avoid visiting hospitals in pandemic situation. There are list of services such as electrician/plumber, gardener, ATM and bank services which people used to have on regular basis during pre-pandemic situation but in the lockdown period, they either never used these services or used it occasionally.

**Consumers' choice of payment mode during lockdown:** Though it's been more than year of digitalization in India, people have not adopted the digitalization mode completely. Consequently, the pandemic and lockdown has simultaneously instigated the consumers to step in e-payment mode. It is not easy to move a large mass towards the digital world in a click, this will take some time as many conditions have framed a doubt situation such as phishing, fraud cases etc. In Figure 1 the data reveals that more than half (54.00%) of the respondents used both e-payment and cash whereas, 24.00



Figure 1: Consumers' choice of payment mode during lockdown (n=400)

per cent of the respondents used e-payment and 22.00 per cent are still using cash mode in lockdown situation. According to a report by Capgemini Research Institute (2020) stated that about 74% of consumers in India will go for digital mode of payment in coming next few months, which shows the behavioural change of consumer and adoption of new ways to new marketing situation.

**Consumer satisfaction with the online purchases in present crisis:** As regard of satisfaction with online purchase among consumer amid covid-19, it is evident from the data shown in Figure 2 that more than half (60.50%) of respondents feel satisfied with online purchase,



Figure 2: Consumer satisfaction with the online purchases in present crisis (n=400)

while 39.50 per cent of the respondents do not feel satisfied. In nutshell, when there is still spike in numbers of covid-19 the consumer is more concerned about its health and family well-being that's why he/she feel more safe of home shopping rather than going out in the crowd and coming in contact with others. Although, some respondents feel that offline mode is better as they can touch the products, look for its durability, quality and other aspects which online purchase perhaps lack because of exchange of brand, the choice consumer make while online purchase. According to the YouGov (2020) survey stated that only half of the consumers were satisfied with the online purchase as they face problems such as cancellation of orders, received partial delivery, payment issues and received low quality products.

The social impact on consumer attitude and knowledge related to consumption of goods and services amid covid-19: With continuation of rise in number of covid-19 there is a flooding of news all over the social media channel and people talks. Likewise, people and their circle absorbing all kind of information which has undoubtedly shocked consumer attitude and knowledge related to consumption of goods and services in the current crisis.

**Consumer awareness and attitude during the current crisis:** The daily spike in number of covid-19 cases shocked consumer attitude and knowledge related to consumption of goods and services. The data presented in Table 3 showed that majority (96.50%) of the respondents attitude toward consumption pattern has been changed because of the current crisis. In case of the pre-pandemic situation where the consumer never thought to sanitize before unwrapping of the packets, now they are more concerned about the hygiene. At least 3.50 per cent of the respondents still live their same life without bothering about covid-19.

Table 3: Consumer awareness and attitude during the current crisis (n=400)

Parameters	Yes	No
Do you wash/ sanitize the food and non food item packets before consumption?	386(96.50)	14(3.50)
Does the crisis and social media forced you to stop consume certain products/services?	314(78.50)	86(21.50)

*Note:* Figures in parentheses indicate percentages

About 78.50 per cent of the respondents have changed their items of consumption and services for time being because of covid-19 terror. Such as meat consumption has been dropped down for some time and people who enjoy meal outside have been stopped going out to avoid the crisis. According to Patil and Patil (2020) their study stated that social media and news channels are responsible in influencing the consumer consumption behaviour amid covid-19 crisis.

Social media used by consumer to search information for purchasing commodities: In regard to social media used by consumer to search information, the data given in Figure 3 reveals that more than half (52%) of the respondents were using Google. And 35.50 per cent of the respondents were observed to search information on all the social media sites for purchasing commodities. Further, it can be concluded that social media evolution has just made everything available in just one click away. Therefore, these platforms has so strong influence that give a number of options available for user to seek more information about offers and best purchasing sites.

Social media influence on consumer decision making during the current crisis: The 24/7 news channels covering single topic covid-19 since 3 months has disturbed the consumer mindset as well as have changed their lifestyle. The data given in Figure 4 revealed that the consumer mind was found to be moderately influenced by the social media i.e., more than half (56.50%) of the respondents felt the drift of social buzz in their decision making attitude since post lockdown. As the social media buzzing with the pandemic updates followed by campaigns such as karo



Figure 3: Social media used by consumer to search information (n=400)



Figure 4: Social media influence on consumer decision making during the current crisis (n=400)

namaste, use of hand sanitizer and masks, to safe hands challenge were also noted as triggers in consumer day to day activities during the present crisis.

Factors that affected consumer purchase amid covid-

**19:** In regard to the factors that affected consumer purchase attitude, it has been revealed from the data presented in Figure 5 that durability and quality of the product have greater affect on consumer purchase during lockdown period as reported by 41.50 per cent and 40.00 per cent of the respondents respectively. Emotion factor had some affect on purchase behaviour as reported by almost 50 per cent of the respondents. Whereas brand name, price and prestige did not have any affect on consumer purchase

attitude during lockdown period as reported by more than 40 per cent of the respondents. Nanda *et al.* (2019) too pointed out similar kind of consumer behaviour that there was no affect of brand name and prestige on consumer purchasing attitude.

#### CONCLUSION

In nutshell of the above study it has been observed that as the covid-19 has progressed, the consumer behaviour has been drifted away to the new normal. Consumer changed their preference of buying habit by cutting back on most of the items which they used to buy in pre-pandemic period. Consequently, the consumer grappling with the fear of covid-19, the psychological core of consumer mindset has been turbid, it created a conflict in behaviour of consumer buying and taking certain services amid covid-19. The consumer is concerned about their health and its family safety in following that they have started stocking up on products mostly personal and home care items. It has been observed that mostly people have restricted their movement in overcrowded areas meanwhile, the consumer switched towards online mode to shop at home. This has resulted in change in payment mode as the consumer gradually adopting the digital payment because of the pandemic crisis. Definitely the social media buzz and people talks have created a moderate influence on consumer attitude of purchase. At last, ultimately we have to change with the change in nature, fight back by way of positive mindfulness.



Factors

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# Incidence of Poverty and Livelihood Status of Farmers in Bihar: Village Level Evidences

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#### ABSTRACT

The study is based on the longitudinal information collected under Village Dynamics of South Asia (VDSA) project supported by the Bill & Melinda Gates Foundation (BMGF) in the selected villages of Bihar. An attempt has been made to explore the incidence of poverty and livelihood status of farm households between 2010-11 and 2014-15 using descriptive and econometric techniques. The study has shown that the incidence of poverty among farm households is high, but has shown an impressive decline of 34 per cent during the study period. The decline in poverty during period was higher in semi-marginal households (45.8%) than other categories of farm households. The implementation of targeted programmes of social security and public distribution system (PDS) might have contributed to faster reduction in poverty among weaker section of rural society. The total value of assets of the farm households, except of transport vehicles has considerably enhanced due to either possession of new assets, rejuvenation, and/ or value appreciation of the existing assets. There has been about two fold increase in the total value of assets during the period. The decline in poverty and increase in electrification and communication network might be responsible for phenomenal increase in domestic assets on farm households. There has been spectacular increase in access of farm households to toilet, electrification, cooking gas and communication facilities in villages, which indicate improvement in livelihood in rural Bihar. The investment on human capital or skill development along with the complementarities among various types of infrastructures, institutions and development programmes need to be ensured to accelerate the process of poverty alleviation and livelihood improvement in rural Bihar.

Keywords: Asset, Bihar, Farm households, Farmers, Livelihood, Poverty

#### **INTRODUCTION**

Bihar, with a population of about 104 million, is the third most-populated state in India after Uttar Pradesh (200 million) and Maharashtra (114 million). The state supports about 9 per cent of population with 2.9 per cent of the geographical area and the most densely populated state (1106/Sq Km) of the country. Till recently, it was also one among the slowest growing states of the country but the growth rate of state's Gross Domestic Product (GDP) has considerably accelerated during the past 10 years, with state economy growing at about 10 per cent per annum. However, the state continues to be the economically most backward among the states of India, with one of the lowest annual per capita income (Rs. 31.3 thousand) and highest incidence of poverty (34.1%). Further, prevalence of

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under-nutrition and malnutrition alongwith high mortality rate among children is rampant in the State. Agriculture continues to be a significant sector as it contributes about 19 per cent to the state Net Domestic Product and provides employment to about 67 per cent of rural work force. Agricultural households constitute about 51 per cent of the total rural households in the state, dominated by marginal and small landholder farms (Anonymous 2018). The dominance of marginal and small-scale farms (< 2 ha) and low labour productivity as main features of rural Bihar are expected to continue in the foreseeable future as pressure of population on land resource is still increasing. These marginal and small farmers, with declining resource base, require a steady flow of income from farming as well as other income-generating activities. There have been extensive studies on different aspects of farm business, but the dynamics of the household income and livelihood status has seldom been explored with a panel micro-level data set. The understanding of nature, pattern and dynamics of the household income and livelihood status in one of the most poverty stricken states of India is critical to outline the pathways for alleviating poverty and improving livelihood of rural households in Bihar. In the present paper an attempt has been made to study poverty level, asset possession, access to facilities to households and their participation to different programmes for rural development which have direct bearing on poverty and their livelihoods.

#### MATERIALS AND METHODS

This study is based on high-frequency primary data collected for five years under the ICAR-ICRISAT collaborative project entitled, "Tracking Change in Rural Poverty in Household and Village Economies in South Asia." All the 38 districts of Bihar were grouped into two categories, that is, the more developed ones and the less developed ones on the basis of certain development indicators namely; agricultural development, socioeconomic status and infrastructure parameters. A sample of two districts that is; Patna from more developed districts and Darbhanga from less developed districts were selected randomly for detailed investigation. A sample of one block from each district and two villages from each sample block were randomly selected. The census was conducted in each sample village and information pertaining to demographic characteristics, land, dwelling houses, the facilities available in each dwelling house, livestock, agricultural and domestic assets, and financial information were obtained from all the households in the identified villages, which were further grouped into four categories. The first group comprised households owning less than 0.40 hectare of land. These households were termed as 'Sub- marginal households'. In the second step, the remaining households were equally distributed among tertile groups, with the bottom, middle and top groups being referred to as the 'small', 'medium' and 'large' households, respectively. Thus, four groups were created in each village. Thereafter, 10 households were selected from each group randomly making sample size of 40 households per village and total 160 households from all the selected villages of Bihar. At first, the income of the household was worked out in terms of its earnings from

the farm, farm labour, non-farm labour, salaried jobs, business, caste occupation, remittances, pension, subsidy and benefit from government programmes and thereafter, poor and non-poor households were identified on the basis of their income. The data collected were analyzed using descriptive statistics (percentage, frequency counts and means).

#### **RESULTS AND DISCUSSION**

While analyzing poverty related data, it was observed that the overall incidence of rural poverty was 62.3 per cent in Bihar in 1993-94 which was much above the all India level of 37.3 per cent. It declined to 55.7 per cent in 2004-05 and further declined to 34.1 per cent in 2011-12 as against national level poverty levels of 42.0 per cent, and 25.7 per cent, respectively. Hence, the incidence of poverty has continuously declined in Bihar during last two decades. It was mainly due to faster economic growth, particularly in agriculture and service sectors (Singh et al, 2014). A comparative analysis of rural poverty among different categories of farm households revealed that the poverty among sub-marginal households has been much higher than incidence of poverty in other categories of farm households during the period under study (Table 1). However, the incidence of poverty declined from 48.4 per cent in 2010-11 to 13.9 per cent in 2014-15 in villages under study. It was mainly due to rapid economic growth in Bihar during the period. The State GDP grew at the annual rate of 7.6 per cent (at 2011-12 prices) during 2011-15. It has further been observed that the incidence of poverty declined with increase in ownership of land by households, indicating inverse relationship between poverty level and ownership of land (Chand et al., 2015). Hence, land still plays an important role in alleviating poverty and improving livelihood status in rural Bihar. Promotion of non-farm rural employment observed to be the most appropriate option for increasing crop productivity and improving livelihoods of small landholders in Bihar (Singh et al., 2018). It is suggested to promote additional income generating activities in the tribal areas and reduce their shear dependence on farming activity for livelihood security (Patil et al., 2019).

The decline in poverty was higher in sub-marginal households (45.8%) than corresponding decline in other categories of farm households during 2010-11 to 2014-15. The implementation of targeted programmes of social

Year	Sub-marginal (<=0.4 ha)	Marginal (0.4 to 1 ha)	Small (1 to 2 ha)	Medium (> 2 ha)	A11
2010-11	69.8	58.2	49.5	9.1	48.4
2011-12	46.8	45.9	15.1	3.4	32.2
2012-13	47.3	42.6	12.9	3.2	30.4
2013-14	30.7	31.6	18.1	2.9	24.2
2014-15	24.0	19.4	14.1	1.6	13.9
Decline in poverty over five years (%)	45.8	39.3	35.4	7.5	34.5

Table 1: Year and household category wise population below poverty line in villages under study (%)

Source: Authors' estimates based on VDSA Field Survey, 2010-11 to 2014-15

security, emphasis by government on development of rural infrastructure and improvement in functioning of Public Distribution System might have contributed towards faster reduction in poverty among weaker section of rural society. The majority of households of sub- marginal category belong to farm and non- farm labour households. Hence, an increase in average rural wage from Rs. 127 in 2010–2011 to Rs. 208 in 2013–2014 in these villages had accelerated the process of declining poverty in this category of households (Kumar *et al.*, 2016).

Asset of farm households: Household assets are defined broadly to include natural, physical, human, financial and social capital at the disposal of the households. These assets are stocks, which may depreciate over time or may be expanded through investment. Based on access to a particular set of assets for a given period, the household then decide which activities it will select and the intensity of involvement in that activity. Possession of household assets is strongly associated with the levels of poverty as well as livelihood status of farming households. Sources of assets have a detrimental effect on the ability of households to pursue successful household livelihood strategies and levels of human security are determined by access to and the quality of sources of assets. Lack of access to or control over the asset is detrimental for improving livelihood status of farming households. Table 2 depicts the value of assets of an average farm household in villages under study. The households own numerous assets and listing complete inventory is neither desirable nor comprehendible. Therefore, almost all measurable assets were clubbed together and classified under five broad groups, viz. (i) farm machineries, (ii) livestock, (iii) transport, (iv) domestic assets including items of communication, and (v) residential houses. The farm machineries group

includes all machineries, tools, and implements which were used on farm. The livestock assets comprised farm animals, which were being reared by the households. The transport group included motor bikes, cars, bicycles, and other means of transport including 'Jugars'-locally fabricated means of rural transport. The domestic assets included all items used to carry domestic chores and also to communicate. The residential houses encompassed all sorts of structures being used for habitation of family members and animals and storage of farm produce.

The total value of assets of the farm households except transport vehicles has considerably enhanced due to either possession of new assets, rejuvenation, and/ or value appreciation of the existing assets. There has been about two-fold increase in the total value of assets in this short span of five years, viz. 2010-11 to 2014-15. Among main assets owned by farm households, residential house is the most important asset because it is necessary for living of family members of all categories of households.

Farm equipment was also an important asset, possessed by all the farm households in 2010 and the value of assets increased with some minor variation due to either depreciation or addition of some machineries and implements. The value of farm machineries in 2014-15 increased probably due to subsidy available to farmers for purchase of agricultural machineries under Rashtriya Krishi Vikas Yojana. Domestic assets constitute about onefourth of total value of assets in 2010 and their value increased by about three fold during period under study. The proportion of value of domestic assets also increased to 37.5 per cent in 2014-15. The decline in poverty and increase in electrification and communication network might be responsible for phenomenal increase in domestic assets on farm households.

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Assets	2010-11	2011-12	2012-13	2013-14	2014-15
Farm machineries/implements	44.2(10.3)	39.1(8.2)	40.0(8.2)	40.6(7.9)	45.6(5.8)
Livestock	21.2(5.0)	13.7(2.9)	15.6(3.2)	19.2(3.7)	19.7(2.5)
Transport vehicles	20.8(4.9)	14.7(3.1)	21.1(4.3)	17.0(3.2)	15.7(2.0)
Domestic assets	113.3(26.5)	131.2(28.1)	132.8(27.2)	149.8(29.0)	293.7(37.5)
Residential houses	227.9(53.3)	268.7(57.5)	278.8(57.1)	289.9(56.1)	408.4(52.2)
Total	425.4(100.0)	467.4(100.0)	488.3(100.0)	516.5(100.0)	783.1(100.0)

Table 2: Per household value of assets on farm households in Bihar (in '000 rupee)

Source: Authors' estimates based on VDSA Field Survey, 2010-11 to 2014-15

Note: Figures in parentheses indicate percentage to value of total assets in the respective year

All the farm households had their own residential house and invested, on an average, Rs 1.86 lakh, accounting for more than three- fourth of investment on total assets owned by them. Type of residential house of Farmers has also been examined. Residential houses are categorized in four groups namely; pucca (brick walls and RCC roof), semi – pucca (brick walls with tiles roof), kutcha (mud walls with tiles roof) and *thatched* (mud walls with thatched roof). An increase in proportion of *pucca* residential houses and decline in proportion kutcha and thatched houses of farmers clearly indicates an improvement in living condition of farming communities in villages of Bihar (Himanshu 2019). However, one- tenth of farming households were still living in kutcha and thatched residential houses. Some of them had high severity of poverty and they were living in un-hygienic condition, which needs institutional intervention for improving their livelihoods.

Access to facility: Access to facilities is an important foundation for improving livelihood of weaker section in rural area which generates strong linkages to other economic sectors. Rural livelihoods are enhanced through providing facilities like; hygienic living, toilet, safe drinking water, safe cooking facility and access to mass communication. There have been marked improvements in availability of facilities in rural area (Table 3). The lack of access to clean water and sanitation facilities for rural communities is responsible for high incidence of water borne diseases which accelerate the cycle of poverty.

Government launched a massive programme for improving access to toilets to achieve open defecation free (ODF) status across rural India by December, 2018. Analysis of data revealed that various facilities for improving livelihoods in rural area observed increasing trend during period under study. Access to toilet increased among farm households from 42.5 per cent in 2010-11 to 53.8 per cent in 2014-15. Number of electrified farm households also continuously increased from 49.5 per cent in 2010-11 to71.8 per cent in 2014-15, mainly due to launch of Rajiv Gandhi Rural Electrification programme in the state.

There was no tap water facility available to farm households in most of villages under study; however, the community tap water facility was available in only one study village, which also became non – operative. Hand pipe water is considered as safe drinking water and about 34.4 per cent of households had their own hand pipe in their dwelling house in 2010-11 which increased to 54.2 per cent in 2014-15. There were sufficient number of public hand pumps available in villages and all households had access to the hand pumps for drinking purposes, however,

Table 3: Access to Facilities on Labour households during 2010-11 to 2014-15 (% of households)

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Particulars	2010-11	2011-12	2012-13	2013-14	2014-15	
Toilet	42.5	43.2	44.2	51.7	53.8	
Electricity	49.5	56.3	59.4	67.5	71.8	
Safe drinking water	34.4	41.9	49.4	49.4	54.2	
Cooking gas	14.2	25.6	31.9	30.6	33.8	
Cable connection	0.6	0.6	13.1	12.5	15.6	

Source: Authors' estimates based on VDSA Field Survey, 2010-11 to 2014-15

some farm households were also found using ponds/ pyne for bathing purposes. Only 14.2 per cent farm households were using cooking gas in 2010-11, which increased to 33.8 per cent in 2014-15. The majority of them did not afford cooking gas but depend on residue, collected wood and dung cake for cooking purposes. During five years of study period, it was observed that farm households showed increasing interest towards cable connection in their households but most of them had less expensive DD antenna.

Hence, it may be said that access to facilities increased to farm households during last five years but still the majority of them were deprived of various facilities for improved livelihood. It can only be accomplished by public intervention by providing subsidy to needy households. Based on the findings of the study, it is recommended that the farmer should be given more opportunities to participate in various income generating activities in both agriculture and non-agricultural ventures and rural development programmes, which would enhance their livelihood diversification activities (Barrett *et al*, 2001).

Access to development Programmes: Various programmes for welfare and development of the rural households are implemented by different departments of Union and State governments. The social security systems in the form of pensions to vulnerable groups and welfare funds for various categories of rural households are reasonably well spread. Universal public distribution system in Bihar helps improving food security. These measures have prevented abject poverty to a great extent. But from the point of view of capabilities as well as entitlements, Bihar is still much behind in helping rural society in comparison to other states in tackling the problems of the poor. More than 20 development and welfare programmes are being implemented in rural Bihar for the benefit of rural households and the majority of these programmes are targeted to the weaker section including farm households.

Analysis of data related to various development and welfare programmes revealed that Public Distribution System (PDS) was the most popular programme for farm households because three- fourth of farm households had access to this programme. Food grains and kerosene oil are provided through PDS to Below Poverty Line (BPL) families and only kerosene oil to Above Poverty Line (APL) families. Social security schemes were the second popular scheme among farm households because their participation showed increasing trend during period under study. It includes old age pension, pension for physically handicapped and widow pension. About 12.5 per cent farm households had access to these schemes in 2010-11 and increased to 16.4 per cent in 2014-15. Hence, it may be said that the coverage of social security schemes observed increasing trend in Bihar during the period under

Development Scheme	2010-11	2011-12	2012-13	2013-14	2014-15
Public Distribution System	77.5	76.9	78.1	77.6	77.6
Mid-day Meal	1.9	26.9	36.4	35.7	32.1
Social Security Schemes (Pension)*	12.5	15.0	13.6	18.4	16.4
Agril. Development Project	5.0	13.1	30.9	1.8	Neg.
Anganwadi	8.1	6.9	10.5	15.5	16.4
Drought/Flood relief	5.0	8.8	00	00	00
CM Cloth& Bicycle programme	00	7.5	1.8	15.1	16.3
MANREGAS	1.9	2.5	00	0.6	00
Indira Awas Yojna	2.5	00	00	00	00
KCC& SHG	17.5	17.5	00	8.6	0.6
Other Programmes**	3.2	0.6	00	00	00

Table 4: Proportion of farm households obtained benefit through different govt. programmes (Figures in %)

Source: Authors' estimates based on VDSA Field Survey, 2010-11 to 2014-15

Figures in parentheses indicate per labour household benefit from respective scheme/project

\*Includes Old age Pension, Pension for physically handicapped and Widow pension.

\*\*Includes Family planning and other ad hoc assistance

study. In mid- day meal scheme, students (children) are provided mid-day meal in the school which not only help increasing enrolment and attendance in the school but improve health of children by reducing malnutrition among children, particularly children belonging to poor households. The coverage of mid –day scheme was very low in 2010-11 (1.9%) but it covered more than 30 per cent of farm households in terminal years of the study. The access to various agricultural development programmes namely; National Food Security Mission (NFSM), Rastriya Krishi Vikas Yojana (RKVY), National Horticulture Mission (NHM) etc. varied much widely among farm households under study. It was about 31 per cent in 2012-13 and became negligible in 2014-15.

Anganwadi project was started by the Union government in 1975 as part of the Integrated Child Development Services program to combat child hunger and malnutrition. Anganwadi centres also provide basic health care in villages. It is a part of our public health-care system. Basic health-care activities include contraceptive counseling and supply, nutrition education and supplementation, as well as pre-school activities. The Centre is also used as depots for oral rehydration salts, basic medicines and contraceptives. About 8.1 per cent farm households had access to Anganwadi centres of their village in 2010-11 and coverage was increased to 16.4 per cent by 2014-15.

A few farm households got benefit from MNREGA and Indira Awas Yojna during initial years of study (2010-11) but none of farm households got benefit from these two important schemes meant for poor and socially backward community. Really these projects lost their steam during last few years in Bihar, particularly in villages under study. Flood and drought relief programmes are not a regular programme because it operates in the year of drought and flood only. Bihar faced serious drought in 2010 and devastating flood in some parts of Bihar in 2011 and few farm households got some relief. But it is evident from information available in villages under study that it is only cosmetic programme for farm households.

CM Cloth and Bicycle programme was launched in Bihar for providing school dress and bicycle to girls' student in school which has been a successful programme in the state. About 7.5 per cent farm households got benefit from this project in 2011-12 and its coverage increased to 16.3 percent in 2014-15 in villages under study. Self Help Group (SHG) is not a popular programme in Bihar and the progress of Kisan Credit Card (KCC) programme is also unsatisfactory. During 2010-11, the coverage was about 17.5 per cent of farm households but their coverage observed declining trend. Farm households had more access to social security schemes than agricultural development programmes.

#### CONCLUSION

The study has shown that the incidence of poverty among farm households in the selected villages of Bihar is high, but has shown an impressive reduction of 34 percent during 2010-11 to 2014-15. The implementation of targeted programmes of social security and PDS might have contributed to faster reduction in poverty among weaker section of rural society. Among various development programmes PDS is the most common which helped reducing poverty and strengthening food security in rural Bihar. However, social security programmes seem to be more robust than economic development programmes including agricultural development. The investment on human capital or skill development in rural area will be equally important in the endeavor for alleviating poverty and improving livelihood status. Finally, the complementarities among various types of infrastructures, institutions and development programmes need to be ensured to accelerate the process of poverty alleviation and improving livelihood in rural Bihar.

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### Screening the Undergraduate Courses for Developing Massive Open Online Courses (MOOCs) in Agricultural Education: Application of Paired Comparison Method

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#### ABSTRACT

The transformation of how education is imparted from the physical books of the distance education to self-learning tools in the form of e-learning courses to the recently introduced Massive Open Online Courses (MOOCs) have provided immense opportunities for the students. The paper takes into consideration the existing strength of the agricultural content available for the students and the expected courses desired by the teaching community. A paired comparison test was used to determine the difference between the two courses suitable for MOOC development arranged in pairs. The results reveal that the non-credit courses (R scale value= 1.174) offered by the agricultural universities need special consideration for the development of MOOCs. The findings imply the current development of content in agricultural education, which should be more focused on the non-credit courses being interdisciplinary and offered to the postgraduate students.

Keywords: Agriculture, Courses, Education, ICT, MOOC

#### INTRODUCTION

The National Agriculture Research System under the aegis of the Indian Council of Agricultural Research (ICAR) comprises of 716 Krishi Vigyan Kendras (KVKs), 652 Agricultural Technology Management Agencies (ATMAs) at the district level along with an extensive network of higher agricultural education institutions in the form of over 64 state agricultural universities, three central agricultural universities, four ICAR deemed-to- be universities as well as four central universities with agricultural faculty. In the current situation, the management of e resources- specifically, e books, e journals, e encyclopaedias, e theses, databases on Compact Disc Read-Only Memory (CD-ROMs), email, internet and the library catalogue is a necessity to benefit a thriving community of research scholars and faculty members who need these e resources for their reference (Haridasan and Khan, 2009). Expert Systems are the computer applications with the potential to undertake reasoning and analysis functions in well-defined subject areas at greater proficiency levels matching that of a human expert. It could be applied in

the subject areas already having full-fledged experts for problem-solving. It generates useful knowledge from information sources like text, images, video, audio, and other forms using Information Technology (IT) for further storage and retrieval (Rafea, 1998). Most of the commercial crop production systems can be applied to Expert Systems in the field of agriculture (McKinion and Lemmon 1985). Mobile applications have proven to be an excellent medium for fetching information by the farmers at their fingertips with the convenience of their location. The mobile app stores are now also overflown with applications specific to agriculture (Kuhariæ et al., 2017). It is quite imperative to select the best application to meet the desired needs of the farmers with a combination of different possible options. The deployment of ICTs varies from sectors like electronic resources/library automation to less explored sectors like the development of Massive Open Online courses for better learning opportunities through the web.

Massive Open Online Courses (MOOCs) in agriculture help in capacity building of a broad group of

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individuals than compared to the conventional method, which can only train a few in a restricted geographical boundary (Murthy et al., 2011). The National Agricultural Research System (NARS), notably The National Academy of Agricultural Research Management (NAARM), Hyderabad, has implemented few ICT initiatives in recent years to harness the potential of ICTs for an enhanced reach of information (NAAS, 2014). MOOCs have also been implemented by a few agricultural universities in collaboration with IIT Kanpur and Commonwealth of Learning to impart learning to a selected group of learners (ET, 2015). The current paper provides an overview of the course development in MOOCs as felt by the faculty members of the agricultural university, which will be imperative to understand the development of new courses in the agricultural domain. There are little empirical pieces of evidence on comprehending and analyzing MOOCs in India. Murthy (2017) studied that there is a vast scope for MOOCs in agriculture for various purposes- distance, vocational, skill-building, etc., catering to the needs of students, farmers, policymakers, etc. The implementation of MOOC using open and freely available technologies is very useful and can also be replicated and integrated into any larger MOOC initiatives taken up on a larger scale. Duncombe (2016) emphasized the importance of research on assessing potential markets, business models and indicators for connecting with the ICT revolution with relevance to mobile phones. Jorgenson and Vu (2016) provided empirical evidence on the rapid spread of ICT into different parts of the world, resulting in measurable effects on the economic development of nations which have immense possibilities in the fast-growing economies like India and China. It was further propounded that the growth of ICTs, particularly mobile telephony, can also lead to enhanced socio-economic development in developing countries (Dev et al., 2018).

#### MATERIALS AND METHODS

A study was conducted at Bidhan Chandra Krishi Viswa Vidyalaya (BCKV), West Bengal, India, in which a total of 80 scientists/professors engaged in teaching undergraduate, postgraduate, and doctoral courses in agriculture were selected randomly. The research design used for the study was a paired comparison technique that yields interval-level scaled scores that are created from ratings made by each respondent for all possible pairs of items under consideration (Lavrakas, 2008). The subjects suitable for the development of the MOOCs were the variable in the

study. The experts were asked to identify the priority area in agriculture in which MOOCs need to be developed. The data was collected with the help of the questionnaire method in January and March 2019. Out of the 80 respondents selected for the study, 69 questionnaires that were complete in all respects were included for the final analysis. The analysis of data was conducted through the method of paired comparisons (Edward, 1969). The specific objective of the study is to identify the priority area in agricultural education in which MOOCs should be developed.

Edwards, 1957 reported that Thurstone developed the law of comparative judgment published in 1927 as a psychological scaling method to justify "ordering of stimuli along a psychological continuum." It helps to quantify the subjective aspects differentiating the stimuli on a continuum of an interval scale. The number of pairs for 'n' stimuli is calculated with the formula n (n-1)/2. The stimuli so developed should be distinct and well understood. The random arrangement of stimuli in each of the pairs is made to eliminate bias. The respondents were required to mark one course which they preferred than compared to the other for the development of the MOOC course. The ten pairs so developed is presented below:

- Non-credit courses and (B) Undergraduate (UG) courses
- (C) Postgraduate (PG) courses and (D) Computer courses
- (E) Research methodology courses and (A) Non-credit courses
- (B) Undergraduate (UG) courses and (C) Postgraduate (PG) courses
- (D) Computer courses and (A) Non-credit courses
- (E) Research methodology courses and (B) Undergraduate (UG) courses
- (C) Postgraduate (PG) courses and (E) Research methodology courses
- (B) Undergraduate (UG) courses and (D) Computer courses
- (A) Non-credit courses (C) and Post graduate (PG) courses
- (D) Computer courses and (E) Research methodology courses

#### **RESULTS AND DISCUSSION**

From the frequency preferences related to the priority in MOOCs development, F-matrix was obtained. It was further divided by the total number of valid respondents, i.e., 69 to get P-matrix. The rearrangement of the P-matrix concerning the lowest and highest column sum was made followed by the Z-matrix hierarchy of agricultural course preferences of the respondents. The different tables so obtained for the five courses are presented in Tables 1, 2, 3, and 4, respectively.

Table 4 reveals that the agricultural course, which is deemed the most relevant for the development of online

courses in the form of MOOCs is Non-credit courses (scale value 1.174). Non-credit courses are the six compulsory courses of fundamental awareness in science for the agricultural students enrolled in the master's program. An exemption from the course is provided to the Ph.D. students if they have already studied the same in the master's course. These courses cover the domain of Library management, writing/comprehension and communication skills, management of Intellectual property rights in agriculture, introductory laboratory management course, studies on disaster management, and understating ethics in agriculture and rural development programmes in the country. These courses are meant to instill a scientific

Table 1:	F-matrix	for the fi	ve agricultural	courses ju	idged by	v 69 res	pondents
						,	

Agricultural Courses	Non-credit courses (A)	Undergraduate (UG) courses (B)	Postgraduate (PG) courses (C)	Computer courses (D)	Research methodology courses (E)
Non-credit courses (A)	-	28	16	8	11
Undergraduate (UG) courses (B)	41	-	10	14	58
Post graduate (PG) courses (C)	53	59	-	43	50
Computer courses (D)	61	55	26	-	41
Research methodology courses (E)	58	11	19	28	-

#### Table 2: P-matrix corresponding to F-matrix

Agricultural Courses	Non-credit courses (A)	Undergraduate (UG) courses (B)	Postgraduate (PG) courses (C)	Computer courses (D)	Research methodology courses (E)
Non-credit courses (A)	0.5	0.405	0.231884	0.115942	0.15942
Undergraduate (UG) courses (B)	0.594203	0.5	0.144928	0.202899	0.84058
Post graduate (PG) courses (C)	0.768116	0.855072	0.5	0.623188	0.724638
Computer courses (D)	0.884058	0.797101	0.376812	0.5	0.594203
Research methodology courses (E)	0.84058	0.15942	0.275362	0.405797	0.5
Sums	3.586957	2.716594	1.528986	1.847826	2.818841

#### Table 3: Rearranged P-matrix - smallest to highest column sums

Agricultural Courses	Postgraduate (PG) courses (C)	Computer courses (D)	Undergraduate (UG) courses (B)	Research methodology courses (E)	Non-credit courses (A)
Post graduate (PG) courses (C)	0.5	0.623	0.855	0.724	0.768
Computer courses (D)	0.376	0.5	0.797	0.594	0.884
Undergraduate (UG) courses (B)	0.144	0.202	0.5	0.84	0.594
Research methodology courses (E)	0.275	0.405	0.159	0.5	0.84
Non-credit courses (A)	0.231	0.115	0.405	0.159	0.5
Sums	1.526	1.845	2.716	2.817	3.586

Agricultural Courses	Postgraduate (PG) courses (C)	Computer courses (D)	Undergraduate (UG) courses (B)	Research methodology courses (E)	Non-credit courses (A)
Post graduate (PG) courses (C)	0.5	0.313	1.058	0.595	0.732
Computer courses (D)	-0.316	0.5	0.831	0.238	1.195
Undergraduate (UG) courses (B)	-1.063	-0.834	0.5	0.994	0.238
Research methodology courses (E)	-0.598	-0.24	-0.999	0.5	0.994
Non-credit courses (A)	-0.736	-1.2	-0.24	-0.999	0.5
Sums Z	-2.213	-1.461	1.15	1.328	3.659
Mean Z (Dividing by 5)	-0.4426	-0.2922	0.23	0.2656	0.7318
Add largest negative deviation	+0.4426	+0.4426	+0.4426	+0.4426	+0.4426
Rank (scale value R)	0.000 (5 <sup>th</sup> )	0.150 (4 <sup>th</sup> )	0.672 (3 <sup>rd</sup> )	$0.708 (2^{nd})$	1.174 (1 <sup>st</sup> )

Table 4: Z-matrix hierarchy of agricultural courses preferences of the respondents

temperament among all the students irrespective of the master's discipline, to conduct better research with a thrust on sustainability and moral ethics. It was introduced from the academic year 2010 onwards, requiring faculty from diverse disciplines to teach the courses at the university level. It may be this reason that the development of MOOCs on non-credit courses is considered as the most crucial priority among the faculty members.

Research methodology courses occupied the second position in the vital priority area for MOOCs development in agriculture (Scale value 0.708). The importance of research methodology can be understood as a useful tool to minimize waste of time and resources. The general expectation of using sound research methodology is to publish the work in acclaimed journals for better visibility of the research without any uncertainty in the process adopted (Nayak, 2009). The course is already a mandatory course for postgraduate students in the agricultural domain. A specialized course through the development of MOOCs would be of use to the students in all fields of agriculture. Aditya et al. (2014) studied the use of social networking for academic purposes, which inferred that social media was utilized effectively by the students in meeting their educational requirements. The potential of social media could further be leveraged in the form of MOOCs where the students can interact in group/ forums and resolve their queries with ease.

The third priority area, as perceived by the scientists/ professors, is undergraduate courses in agriculture (scale value 0.672) followed by computer courses (0.150) and postgraduate courses. The computer courses are mainly offered by the department of statistics in agricultural universities across the country. A specialized MOOC on computer course is felt to imbibe the latest skills in computers to the students. Further, the MOOCs could also be strengthened with specialized content on creativity. A study on the development and validation of the emodule on creativity conducted by Bishnoi *et al.* (2019) concluded that such a module was highly acceptable among the students. The addition of such a component of creativity would lead to increased interest among the student's community and doing away with the monotony associated with the courses.

#### CONCLUSION

It may be concluded from the study that the development of MOOCs in the domain of non-credit courses is an essential requirement for imparting quality education to the agricultural students. The faculties also opined that MOOCs powered by the Internet of Things (IoT) in agricultural courses especially related to multidisciplinary aspects is deemed essential to impart quality education among the students. Language dependency, static information, minimum use of Web 3.0, scheduled program, and no continuous feedback mechanism are the major drawbacks of the current ICT initiatives. Future researchers can consider the following points to develop this study:

- Use target-based ICT platforms used by the private sector to reach the students.
- Assess the performance of both the platforms run in the ICAR system and the private sector.

- Assess IoT systems in e-learning and MOOCs for useful analysis of student learning.
- Implement the methodology in different geographical locations and compare the findings.

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## A Scale to Measure Attitude of Farmers towards Technological Demonstration

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#### ABSTRACT

A scale was developed to measure the attitude of farmers towards technological demonstration based on Likert's technique. A tentative list of 40 statements was drafted keeping in view the applicability of statements suited to the area of study. The statements collected were edited in the light of the informal criteria suggested by Edward and Kilpatrick. These statements were framed in such a way that they expressed the positive or negative attitude of the farmers. The score of each individual item on the scale was calculated by summing up the weights of the individual items. Finally, the scale consisted of 10 statements (7 positive and 3 negative) whose t value was greater than 2.0. Reliability was tested with 25 respondents and its value was 0.70 and validity of the scale was cross checked with the non-sample respondents and 't' was found significant at five percent.

Keywords: Attitude, Technological demonstration, Reliability, Validity

#### **INTRODUCTION**

In agriculture extension, demonstrations are tool used to teach various agricultural techniques and technologies to the farmers. It may also be considered as showcase of new or improved technologies. The importance of demonstration was first recognized over a century ago by agriculturalist Seeman Knapp. Farms that are used to teach agricultural techniques and technologies are known as demonstration farms. Demonstrations serve as venue to research and test new methods alongside traditional ones. It could help the researcher or scientist to uptake of new concepts that emerge through demonstrations.

Farmers like to see how a new idea works and also what effect it can have on increasing their crop production. Both purposes can be achieved by means of a demonstration. The basic theme behind technological demonstrations is the principle of extension i.e., 'Seeing is believing' and 'Learning by doing'. A good practical demonstration is an invaluable method in extension work. Technological demonstration viz., On-farm testing (OFT), Front line demonstration (FLD) can help to accelerate the adoption of idea also farmers can learn new ways of doing things without having to do it on their farms. The situation urgently demands a technological breakthrough to tackle

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multiple issues in the era of climate change. (Paul *et al.*, 2013).

The need for demonstration can't be overlooked particularly in India where the majority farmers are marginal to small. There are number of practices in agriculture which are very economical and low cost technology but farmers could not adopt only because they don't believe that such a low cost technology can increase their yield up to 20-30 per cent. In such cases demonstrations plays a vital role in convincing the farmers or change the attitude of farmers towards any technology. Attitude plays a pivotal role in influencing one's behavior with respect to a particular psychological object (Singh *et al.*, 2010).

Attitude is defined as the degree of positive or negative effect associated with some psychological object (Thurstone, 1946). Psychological object may be any symbol, phrase, slogan, person, institution, idea, towards which people can differ with respect to positive or negative effect. (Netravathia and Chauhan, 2014). Attitude is a very important component of behavior as it plays significant role in forming the overt and covert behavior of a farmer (Singh *et al.*, 2016). It is very crucial attribute of an individual in adoption of any idea. Thus, this is an effort to construct a suitable scale to measure the attitude of farmers towards technological demonstrations.

#### MATERIALS AND METHODS

*Item collection:* As a first step in developing the attitude scale towards technological demonstration a number of statements about technological demonstration were gathered by discussion with academicians, subject matter specialists, researcher and scientists who are directly or indirectly exposed to such knowledge system. A tentative list of Fifty one statements was drafted keeping in view the applicability of statements suited to the area of study.

*Scrutiny and editing of attitudinal statements:* In light of the informal criteria for editing statements as suggested by Likert (1932) and Edward and Kilpatrick (1948) the collected statements were carefully scrutinized and edited. Ambiguous, repeated and restructured statements were necessarily discarded and 40 statements were retained for further analysis.

*Judges rating on attitudinal statements:* In order to judge the degree of "Unfavourableness" to "Favourableness" of each statement on the five point continuum.

A proforma was designed with these 40 statements, each having five response categories, viz., Strongly Agree, Agree, Undecided, Disagree, Strongly Disagree. A representative sample of respondents comprising of 50 agricultural scientists was drawn. They were supplied the questionnaire through e-mail and some of them were personally interviewed and asked to respond in any one of the five response categories against each statement according to their perception.

**Analysis of statements and scoring:** The favourable statements were given a scoring pattern of 5 to 1 and a reverse scoring pattern was adopted for the unfavourable statements. Summation of scores for the individual statements yielded the total score obtained by an individual respondent.

First, the frequency distribution of scores obtained by the fifty respondents was done. In order to evaluate the individual statements, the method suggested by Edwards (1969) was followed. Twenty five percent of respondents with the highest total scores and also twenty five percent of the respondents with the lowest total scores were taken as the criterion groups. The 't' values for the statements were calculated as:

$$t = \frac{\overline{x_{H}} - \overline{x}_{L}}{\sqrt{\frac{\sum(\underline{x}_{H} - \overline{x}_{H})^{2} + \sum(\underline{x}_{L} - \overline{x}_{L})^{2}}{n(n - 1)}}}$$
Where,  

$$\sum(\underline{x}_{H} - \overline{x}_{H})^{2} = \sum x^{2}_{H} - \frac{(\sum x_{H})^{2}}{n}$$

$$\sum(\underline{x}_{L} - \overline{x}_{L})^{2} = \sum x^{2}_{L} - \frac{(\sum x_{L})^{2}}{n}$$

 $\bar{x}_{H}$  = the mean score on a given statement for high group  $\bar{x}_{L}$  = the mean score on a given statement for low group n= total number of subjects

Only those statements with significant 't' values were retained and incorporated in the final scale. Thus, the scale to measure attitude towards technological demonstration consisted of 10 statements.

#### **RESULTS AND DISCUSSION**

Validity and reliability of the scale: A panel was formulated with twenty five experts comprising of senior scientists, principal scientists to establish content validity of the measuring instrument developed. Each statement of the measuring scale was administered to the group of experts with two response categories, namely agree and disagree. The experts were asked whether each of the 10 statements could relate to the particular area of the investigation or not. Statements having 20 per cent rejection rate were considered for exclusion from the final scale, although none of the statements were found to have a rejection rate of 20 per cent or above (Table 1&2).

The scale was presented by applying split-half technique with thirty non-sample respondents in order to find out its reliability. The coefficient of internal consistency obtained was 0.70.

#### CONCLUSION

The constructed scale will be useful for measurement of the attitude of farmers towards technological demonstrations laid by Krishi Vigyan Kendra's or other government agency.

Table 1: Selection of the statements	for the scale and their 't' values
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Statement	t-value
Food and nutritional security could be brought by using new methods of farming.	1.90
Farmers get new information about new techniques of agriculture through demonstration.	1.85
New techniques are good, but majority of farmers could not use them due to their economic condition.	2.90
Use of new technique, comparatively provides more benefits to the farmers.	1.20
Yield can be increased through information by the farmer.	1.56
There is increase in the social and economic condition of farmers through the improved technique showed in the demonstration.	1.76
These demonstrations should increase employment opportunities.	2.71
Farmers do not give the information to other farmers obtains through demonstrations.	1.40
Farmers are not getting opportunity of demonstration on their field frequently.	0.65
By taking these demonstrations you can farm in better way.	0.98
A good farmer takes more knowledge through these demonstrations.	0.90
Farmers will get more problems, if KVK does not demonstrate the technology.	3.97
Farmer can become an innovative farmer by adopting the new technique	2.04
KVK laid the demonstrations on time.	5.26
Farmers believe that the techniques showed in the demonstration are right and effective.	1.96
Traditional methods are less risky than new methods of farming used in demonstration.	0.31
Pest infestation increases in the crops by the use of new techniques.	2.52
These demonstrations are not much useful for you.	1.25
There is no increase in your technical knowledge through the technology shown in the demonstration.	0.66
Farmers must adopt new techniques for more benefits.	1.92
Farmers can get more benefit by participating in the Field day.	1.30
There is risk in immediate adoption of new techniques.	1.46
After the demonstration farmers get trainings on the demonstrated technology.	4.67
Through the training technical knowledge can be immediately adopted in their occupation.	0.65
Farmers get opportunity only few times to participate in the field day.	2.14
You adopt the new techniques later, after the majority of farmers get practiced and satisfied with the technology.	0.16
KVK perform soil testing before laying down the demonstrations.	1.62
Farmers get benefited by the resources available in the KVK.	2.86
These demonstrations are beneficial to protect the crops from climatic change.	1.29
There should be time to time inspection on farmer's field by the KVK scientist during demonstration.	0.64
There is inspection on farmer's field by the KVK scientist after completion of demonstration.	2.01
These demonstrations have laid out by your initiative with KVK scientists.	0.22
You were trained to make the right solution of pesticides.	3.08
Varieties showed in the demonstration are available for farmers.	1.26
Farmers should adopt the new technique only after getting the complete information about it.	0.36
Demonstrations laid by the KVK is useful for farmers	1.70
Do you see the demonstrations on your neighbours field.	1.56
Farmers do not get benefited by participating in the demonstrations, kisan mela, Farmer's day.	2.55
Farmers must try the new techniques given by the KVK on their field.	1.48
Farmers adopt the new technique when they have seen the result of technique on the other farmers.	1.70

Statement	SA	Α	UD	D	SD
KVK laid the demonstrations on time. (+)					
After the demonstration farmers get trainings on the demonstrated technology. (+)					
Farmers will get more problems, if KVK does not demonstrate the technology. (+)					
You were trained to make the right solution of pesticides. (+)					
New techniques are good, but majority of farmers could not use them due to their economic condition. (+)					
Farmers get benefited by the resources available in the KVK. (+)					
These demonstrations should increase employment opportunities. (+)					
Farmers do not get benefited by participating in the demonstrations, kisan mela, Farmer's day. (-)					
Pest infestation increases in the crops by the use of new techniques. (-)					
Farmers get opportunity only few times to participate in the field day. (-)					

Table 2: Final format of	scale to measure attitud	le towards technolo	gical demonstration
			0

SA- Strongly Agree, A- Agree, UD- Undecided, D- Disagree, SD- Strongly Disagree

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### Participatory Assessment of Biorational Module for Pod Borer Management in Chickpea Ecosystem

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#### ABSTRACT

Pod borer (*Helicoverpa armigera*) is a major pest of chickpea crop that causes huge economic loss to the farmers every year. Increasing concern for environmental awareness on use of chemical insecticide has generated interest in environmentally safe alternative for management of this pest. Participatory assessment of biorational module was carried out in *Bundelkhand* region of UP state, India with participation of 300 partner farmers. The participatory trials were conducted during 2010-11 to 2012-13 in 60 ha area. The biorational module that included pheromone trap + Neem Seed Kernel Extract (NSKE) + *Helicoverpa armigera* Nuclear Polyhedrosis Virus (HaNPV) + spinosad 45SC, was found to have lowest percent pod damage and highest yield (8.4% and 1525 kg/ha) as compared to control plots (20.4% and 874 kg/ha). The application of biorational module resulted in higher average gross returns (Rs 39,425 / ha) as compared to control (Rs 22,886/ha). The overall knowledge and technology gap among partner farmer with regard to pod borer management before interventions was observed to be as high as 86 and 85.5 percent, respectively. The participatory trials (300) and related extension activities (15 nos) led to overall gain in knowledge score of partner farmers by 22.19 points against 58 maximum obtainable score on pod borer management with biorational module.

Keyword: Biorational module, HaNPV, Helicoverpa armigera, NSKE, Pod borer, Spinosad

#### **INTRODUCTION**

Chickpea is the most important food legume crop in India. The crop accounted for about 44.5 per cent (11.23 MT) of the total pulse production and occupy about 35.25 per cent (10.56 MHa) total pulse area in the country in 2017-18 (DAC&FW, Ministry of Agriculture and Farmers' Welfare, 2018). It is cultivated as winter crops across India primarily under rainfed conditions. Uttar Pradesh is a major pulse producing states that contributes more than 2 MT of total pulse production in the country. Chickpea production accounts for nearly one fourth of total pulse production (0.58 Mt) in the state. Pod borer, Helicoverpa armigera Hubner is considered to be the most damaging pest of chickpea crop (Anwar and Shafique, 1993). The pest causes 30-40 per cent damage to pods (Rahman, 1990; Hashmi, 1994), that may increase up to 80-90 per cent, in conducive environments (Sachan and Katti, 1994).

For management of pod borer, farmers primarily rely on chemical insecticides for ease in their access and application. Insecticides are cost intensive as well as their indiscriminate use has induced pesticide resistance and environmental pollution (Phokela *et al.*, 1990; Singh and Mandal, 2013). Increasing concern for environmental pollution due to use of chemical insecticide has generated interest in greener and environmentally safe alternative for management of this pest. Development and implementation of eco-friendly management of the chickpea pod borer is of paramount importance in achieving sustainable production (Patil *et al.*, 2007). Efforts have been made towards integrated management approaches for management of this pest.

Regular monitoring of population build up is a vital component for pod borer management. Pheromone traps can be incorporated for forecasting about adult population buildup of pod borer in chickpea (Prabhakar *et al.*, 1998) as well its management (Ahmed and Khalique, 2002).

Plant and animal-based extracts offer environmentally benign and cost-effective option for pod borer management. Neem Seed Kernel Extract (NSKE 5%) is a commonly used plant extract for pod borer management. Application of NSKE (5%) has been reported to be effective in reducing the pod borer population in chickpea (Gupta, 2007; Pachundkar *et al.*, 2013; Hussain *et al.*, 2016). Similarly, enhancing the NPV infection in pod borer could an effective strategy to reduce the larval population without any harm to non targeted organisms. Use of these natural products allows farmers to produce their own pest control measures and also ensures their use on a sustainable basis.

Bundelkhand region of Uttar Pradesh state is an important chickpea producing region of the country (Dubey *et al.*, 2010) and it covers a sizable area in the region. Traditional methods of cultivation, heavy incidence of diseases and insect pests and rainfed semi-arid farming conditions limit the chickpea productivity in the region. Participatory technology assessment can greatly accelerate the process of self-help and learning (Sarkar *et al.*, 2018) and cause greater insights into the farmers' perspective of the technology. With this background, a field-based study on participatory on farm assessment of selected biorational module was carried out for management of pod borer in chickpea ecosystem in *Bundelkhand* region of Uttar Pradesh state of India, with the objective to assess the effectiveness of identified bio rational module.

#### MATERIALS AND METHODS

Participatory trials were laid out in fields of 300 partner farmers in Jalaun district of *Bundelkhand* region of UP state during 2010-11, 2011-12 and 2012-2013. The trials were conducted in an area of 20 ha per year to assess the biorational modules for management of pod borer in chickpea ecosystem. The partner farmers were selected on the basis of the farmer's willingness to participate as well as site uniformity.

**Biorational module assessed for pod borer management:** The biorational module assessed with partner farmers included pheromone trap for monitoring of population build-up, Neem Seed Kernel Extract (NSKE), *Helicoverpa armigera* Nuclear polyhedrosis virus (HaNPV) and spinosad 45SC for managing chickpea pod borer (*Helicoverpa armigera* Hubner). The components were applied in recommended doses i.e., pheromone trap @ 5 traps/ha, NSKE (neemarin) @ 2.5 L/ha; HaNPV @ 250 Larval Equivalent/ha; Spinosad 45SC @ 200 ml/ha, in the experimental fields. The trails were conducted in all the three years with five treatments including an untreated control.

**Pod borer damage assessment:** Assessment of pod borer damage in chickpea crop was carried out in experimentation fields. From each experimental field, 5

different spots were randomly chosen and 5 plants were selected from each spot for assessing the percentage damaged pods by pod borer. The percent pod damage was calculated as per the formula given below,

 $Percent \text{ pod damage} = \frac{\text{Number of damaged pods}}{\text{Total number of pods}} \times 100$ 

**Yield parameters:** Average yield from experimental fields was calculated for each treatment and subsequently the incremental yield of each treatment was calculated against the yield in the control plot.

**Knowledge gap assessment:** Knowledge gap assessment of partner farmers on management of pod borer using biorationals was carried out using a knowledge test developed for study. The score was subjected to following formula to calculate the knowledge gap.

The knowledge gap was assessed before the interventions were made.

Assessment of gain in knowledge: Assessment of gain in knowledge of partner farmers on pod borer management was carried out by administering the knowledge test before and after the project interventions.

Gain in knowledge = Knowledge score before project-Knowledge score after interventions

**Technological adoption gap assessment:** Technological adoption gap was assessed with respect to the adoption of various components of management of pod borer among partner famers, using the following formula-

Total adoption score – Actual adoption score Total adoption score × 100

#### **RESULTS AND DISCUSSIONS**

Knowledge and technological gap among partner farmers on management of pod borer: Perusal of data in Table 1 reflects 100 percent knowledge gap with regard to components like intercropping with mustard /linseed, deep summer ploughing, use of bird perches and use of safer insecticides like spinosad for management of pod borer among partner farmers. In addition, knowledge gap on components like use of HaNPV, pheromone traps and neem-based products for management of pod borer was 96, 78 and 72 per cent, respectively. In similar lines, technology adoption gap was recorded to be 100 percent with regard to components like deep summer ploughing, use of bird perches, neem-based products, HaNPV and safer insecticides for management of pod borer among partner farmers. In contrast, the technological gap in adoption of intercropping with mustard/linseed was recorded to be 27 per cent. However, the practice was adopted as a means for gaining diversified agricultural products and additional farm returns rather than pod borer management by partner farmers. With regard to use of chemicals insecticides for pod borer management adoption gap was 57 per cent.

The findings indicate higher reliance of partner farmers on chemical pesticides for pod borer management compared to environmentally safe options. The overall knowledge and technology gap with regard to management of pod borer was observed to be as high as 86 and 85.5

Table 1: Knowledge and technology gap with regard use of biorational module for management of *Helicoverpa armigera* 

Components	Knowledge gap (%)	Technology gap (%)
Inter culturing with mustard / linseed	100	27
Deep summer ploughing	100	100
Use of pheromone traps	78	100
Use of Neem based products	72	100
Use of HaNPV	96	100
Use of bird perches	100	100
Use of safer insecticides	100	100
Use of chemicals for management	42	57
Overall gap	86	85.5

Table 2: Effect of biorational treatment on pod damage (%)

per cent, respectively. This reflects on poor knowledge and adoption level of recommended environmentally safe practices for management of pod borer among the partner farmers.

Impact of biorational module on extent of pod damage and yield level: The pooled percent pod damage among the treatments varied from 8.4 to 20.8 (Table 2). Lowest percent pod damage (8.4) was recorded from  $T_4$ : Neemarin + HaNPV+ Spinosad. Further this treatment has recorded lowest percent pod damage during consecutive 3 years (7.6, 10.22 and 7.3). The second best treatment was observed to be  $T_2$ : Spinosad alone as it recorded 10.6 percent pod damage. The highest percent pod damage was recorded from unsprayed control ( $T_5$ ) during all the 3 years (20.5, 25.5 and 16.4). Pheromone traps were deployed in all the four treatments. The percent pod damage decrease over control was also highest for T4 (59.62) bio rational module followed by T3 (57.21) and T2 (49.04).

The observations on mean yield indicate that treatment ( $T_4$ ) with Neemarin + HaNPV+ Spinosad recorded highest yield during 3 years (1818 kg/ha, 1415.13 kg/ha and 1343.7 kg/ha). The second highest yield (1431.25 kg/ha) was recorded from ( $T_3$ ): HaNPV + Spinosad, followed by  $T_2$ . Spinosad (1391.58 kg/ha) alone. The unsprayed control ( $T_5$ ) recorded lowest yield (874.18 kg/ha). The highest percent increase in yield over control was recorded from T4 (74.52) followed by T3 (63.72) T2 (59.19) and T1 (27.34).

Highest yield was recorded from the treatment ( $T_4$ ) Neemarin + HaNPV + Spinosad. This treatment comprised of 3 consecutive sprays of above said biorational module along with use of pheromone traps. The possible reason for the highest yield may be that use of Neemarin as a first spray might have reduced pod borer oviposition in chickpea by repelling the adults and concurrently repelling

Treatments	2010-11	2011-12	2012-13	Average	Percent lower	Percent decrease
				8	damage	over control
$\overline{T_1: Neemarin + HaNPV}$	15.85	21.86	13.8	17.17	3.64	17.45
T <sub>2</sub> : Spinosad	10.35	13.63	7.9	10.6	10.18	49.04
T <sub>3</sub> : HaNPV + Spinosad	9.85	-	8.1	8.9	11.42	57.21
$T_4: N + H + Spinosad$	7.6	10.22	7.3	8.4	12.43	59.62
T <sub>5</sub> : Control	20.5	25.52	16.4	20.8		

Treatments	2010-11	2011-12	2012-13	Mean yield	Incremental yield/ha	Percent yield increase over control
T1: Neemarin + HaNPV	850	1261.79	1227.9	1113.2	239.05	27.34
T2: Spinosad	1437	1312.75	1425	1391.6	517.4	59.19
T3: HaNPV + Spinosad	1475	-	1387.5	1431.2	557.07	63.72
T4: N + H + Spinosad	1818	1415.13	1343.7	1525.6	651.43	74.52
T5: Control	715	917.55	990	874.18		

Table 3: Effect of biorational module on yield level

the neonates from feeding while HaNPV controlled early instar larvae and spinosad controlled both early and late instar pod borer larva. Thus, it had recorded lowest percent pod damage and highest yield.

The results are in line with Narayan *et al.* (2015) who also reported that application of spinosad 45 SC caused 59.76 per cent reduction in larval population of pod borer in chickpea. While Gupta (2007); Pachundkar *et al.* (2013); Hussain *et al.* (2016) and Lulie and Raja (2012) observed reduction in pod borer population in chickpea by application of NSKE (5%).

The biorational module resulted in higher average gross returns (Rs 39425/ha) as compared to control (Rs 22886/ha). Correspondingly, cost of production as well as net returns (Rs 14204/ha & Rs 25239/ha) was higher in fields where biorational module was applied as compared to control (Rs 9605/ha & 13859/ha). The benefit cost ratio of use of biorational was higher (1:2.6) as compared to control (1:2.06).

**Knowledge gain by partner farmers on pod borer management:** The data presented in Table 5 indicate that the before and after score of partner farmers was 3.54 and 22.19, respectively against 58 maximum obtainable score related to various components of management of pod borer. The maximum gain was observed with respect to the damage by pod borer (10.46) followed by use of HaNPV (7.52) and use of neem based products (6.91).

 Table 4: Economics of application of biorational module

 for pod borer management

Observations	<b>Biorational module</b>	Control	
Cost of cultivation	14204	9605	
Gross return	39425	22886	
Net returns	25239	13859	
B:C ratio	2.6	2.06	

Table 5: Knowledge gain among chickpea farmers about pod borer management due to field demonstration in Bundelkhand

Components	Before score	After score	Gain in knowledge
Extent of damage by pod borer	2.97	13.43	10.46
Use of Pheromone trap	0.23	6.52	6.29
Use of Neem based products	0.28	6.91	6.63
Use of HaNPV	0.05	7.52	7.47
Use of bird perches	0	6	6
Use safer insecticide (Spinosad)	0	2.0	2.0
Grand total	3.54	25.73	22.19

The interventions related to participatory assessment of bio rational module for management of pod borer in chickpea and extension activities for popularization led to significant gain (22.19 points) in knowledge of the partner farmers.

**Farmers' perception of biorational module:** Partner farmers' perception of components of biorational module was ascertained with respect to aspects like simple to produce and apply effective and labour intensiveness. The numbers of asterisks indicate the extent of perception. Data in table 6 indicate that farmers perceived pheromone traps to be simple to apply to a great extent and they all perceived it to be effective. NSKE and HaNPV were perceived to be labour intensive but effective for management of pod borer. Spinosad on the other hand was found to be very effective in management of pod borer.

Further, farmers' perception revealed that majority of the farmers (84.4%) perceived spinosad to be cost intensive. Problem of carrying water to distant fields for spray was perceived by majority of partner farmers for spray of all the components of biorational module (Table 7). With

## Table 6: Farmers' perception of components of biorational module

	Simple to produce	Simple to apply	Labour intensive	Effective
Pheromone trap	-	***	*	**
NSKE	*	*	***	**
HaNPV	*	*	***	**
Spinosad	-	*	*	***

(Number of asterisks indicates the extent of perception)

 Table 7: Farmers perception on problems faced in application

 of components of biorational module

Feedback	HaNPV	NSKE	Spinosad
Cost Intensive	43(35.2)	0(0.0)	103(84.4)
Problem of carrying water for spray	97(79.5)	54(44.3)	87(71.3)
Labour Intensive in preparation	45(36.9)	89(72.9)	32(26.2)
Problem of collecting the raw material	99(81.1)	32(26.2)	0
Social taboo associated	58(47.5)	52(42.6)	0

respect to production of NSKE, majority of the farmers (72.9%) perceived it to be labour intensive. While 81 percent of the farmers perceived problem of collecting the raw material for preparation of HaNPV. A significant percent of the partner farmers expressed social taboos associated with the production of HaNPV (47.5%) and NSKE (42.6%).

#### CONCLUSION

Participatory trials conducted on biorational module comprising of NSKE, HaNPV and spinosad with pheromone trap, for pod borer management in *Bundelkhand* region of UP state lead to lowest percent pod damage (8.4), highest incremental yield advantage (651.43 kg) and net returns (Rs 25239/ha) in chickpea crop. The knowledge and technology gap with regard to management of pod borer among partner farmers was observed to be as high as 86 and 85.5 per cent, respectively before the initiation of the participatory trials. The systematically planned interventions including capacity enhancement programmes coupled with participatory trials led to significant enhancement (22.19 points) in knowledge score of the partner farmers. Majority of the farmers perceived problem of carrying water to distant fields for application of different components of biorational module.

Systematically planned interventions on promotion of biorational module among chickpea growers of *Jalaun* district of *Bundelkhand* region of UP state led to enhancement knowledge level among the partner farmers. Extrapolation of similar interventions in other chickpea growing areas can augment the knowledge as well as income level of farmers by uptake of biorational module for pod borer management.

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### Critical Analysis of Vegetable Consumption Pattern in Rural and Urban Community of Punjab

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#### ABSTRACT

India is a vast country, endowed with diverse agro-climatic conditions that are conducive to grow large array of horticultural crops. Urbanization, changes in lifestyle, growth in economy as well as sizeable additions to population have increased domestic demand and consumption for vegetable crops. Vegetables consumption is a critical route to long life and good health. Although consumption of vegetables is important not only for vitamins and minerals, but also phyto-nutrients, which are useful chemicals found in vegetables. They are important in preventing and fighting diseases. This research therefore evaluated the vegetable consumption pattern using on simple random sampling method. In total, 100 women were selected for the study. Results of the study indicated that majority of the respondents from rural areas consumed carrot, cauliflowers, peas and radish maximum times in a week in winter season. As far as urban community was concerned, they consumed mushroom and fenugreek more in a week. In summer season, respondents from rural areas consumed bottle gourd and round gourd (*tori*) 4 to 6 times in a week.

Keywords: Community, Consumption pattern, Rural, Urban, Vegetable

#### **INTRODUCTION**

Vegetable consumption is dreadfully low among middle and high-income groups in urban India, according to a survey conducted by the Indian Council for Research on International Economic Relations (ICRIER) in five Indian cities. The survey shows that the younger generation is consuming even less nutritious food than older people, primarily due to lifestyle choices (Joshi *et al.*, 2016).

Food security is the physical, economical and environmental access to balanced diet, which enables the individual to live a healthy and productive life (Paroda, 2003). The food security rests on the most efficient use of natural resources like land, water, energy and plant diversity. Further, food security may be determined at various levels, *viz*, at the level of a family, a community or a country in terms of demand and supply indicators. It is best assured when food is available on a continuous and sustainable basis, preferably from local production, processing, storage and distribution regardless of climatic fluctuations and other variations. Therefore, it would be important to realize an even and a continuous availability of food in sufficient quantity and quality particularly in the developing countries to essentially safeguard the food and nutritional security of the mankind Anika et al. (2017). Optimal nutrition will demand the intake of a wide range of foods, which taken together and in judicious combination (in a well balanced diet) can provide the required essential nutrients. Ensuring good nutrition is not just equivalent to avoidance of hunger. While the latter can be achieved through the intake of a single staple cereal, the former will demand besides cereals, inadequate supply of other foods such as vegetables, pulses, fruits and milk. Therefore, while sustaining food grain production, the production of quality foods has to be significantly raised to ensure nutritionally adequate household diets. The policy makers need to fight at two ends of the spectrum, feeding the millions and ensuring adequate and nutritional food. In other words, need of the hour is not just food security but ensuring nutrition security to the hungry millions. Hence, an attempt was made in this paper to study the consumption of vegetables in rural and urban areas. The specific objective of the study

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was to study the vegetable consumption pattern in rural and urban community.

#### MATERIALS AND METHODS

This study was conducted using simple random sampling and a part of village and town-wise survey of vegetable consumption patterns in Mansa and Fatehgarh Sahib districts of Punjab. Twenty five rural and urban women were selected from each of the districts. In total, 100 women (50 rural and 50 urban women) were selected for the study. Data was collected through the pre-tested and pre-designed interview schedule. Information obtained included demographic and socio-economic characteristics as well as "Seven days dietary recall method" where participants were asked how often they consumed vegetables. Appropriate statistical tools were used.

#### **RESULTS AND DISCUSSION**

Analyzed data in Table 1 have shown that 54.00 per cent of the respondents were in the middle age group i.e. 35-40 years. Almost one third of the respondents were in the high age group category and only 16.00 per cent belonged to old age group. The data pertaining to the level of education of the respondents, it was found that majority of the respondents i.e. 64.00 per cent were matriculate. Only 10.00 percent of respondents were graduated, whereas 26.00 per cent were educated upto primary level. Agriculture was the main occupation of the respondents in the selected districts. Nearly 15.00 per cent of the respondents did their own business whereas; only 14.00 per cent of them were in service. A scrutiny of the data has further shown that 72.00 per cent of the respondents belonged to joint families while the remaining 28.00 per cent hailed from nuclear families. It showed that joint family system is not losing its importance especially in rural settings. It is evident from the data that more than half of the respondents i.e. 58.00 per cent had monthly income from Rs. 25000-30000. Only 6.00 per cent of the respondents had monthly income from Rs. 20000-25000.

Data depicted in Table 2 revealed about winter season vegetables rural people include carrots in their diet 3.4 times on average in a week whereas urban people include carrots in their diet 2.1 times on average in a week. The consumption of carrots is higher among all winter vegetables by rural people as rural people sown carrots in their kitchen gardens whereas the urban people consume more mushroom on average 3.9 times in a week as it is

Tab	ole 1:	Personal	character	istics of	respond	lents (	(n=100)	)
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Characteristics	Frequency	Percentage
Age		
30-35 years	8	16
35-40 years	27	54
above 40 years	15	30
Education		
Primary	13	26
Matric	32	64
Graduation	5	10
Occupation		
Agriculture	35	70
Service	7	14
Business	8	16
Family type		
Nuclear	14	28
Joint	36	72
Family income/month		
20000-25000	3	6
25000-30000	29	58
30000-35000	18	36

easily available in urban areas. These findings are in consonance with those of Kaur and Verma (2018) who studied that urban people consumed more mushroom as compared to rural people. Rural people include cauliflower in their diet 2.6 times on average whereas urban people include cauliflower in their diet 1.76 times on average in a week. Cabbage included one time in diet on average in a week by rural people whereas urban people include cabbage in their diet 1.88 times on average in a week. Urban people included broccoli in their diet 1.45 times on average in a week whereas rural people included broccoli in their diet 0.08 times on average in a week as non-availability of broccoli in rural area. Rural people included spinach in their diet 1.8 times on average in a week whereas urban people include spinach in their diet 2.2 times. Radish, peas and fenugreek are taken 2.9, 2.7 and 1.38 times on average in a week by rural people whereas urban people include radish, peas and fenugreek 3.0,4.8 and 3.88 times in their diet respectively. Similar results are also reported by Debnath et.al. (2019) who found that 25 eggs and about 20 kilo gram fish were consumed by a family in a winter month at Tripura.

Data in Table 2 also shown that rural people consume tinda 2.4 times in a week on average whereas the urban people consume 1.38 times. The consumption of bottle gourd was 4.7 times in a week by rural people and 2.62 times urban people. Data further shows that on an average 1.5 times okra was consumed by rural community whereas, urban community consumed it 2.4 times. About 2 times in a week bitter gourd was consumed by rural people as compared to urban people who consumed it 3.26 times in a week on average. Pumpkin, brinjal, capsicum and tori were consumed 1.08, 1.58, 0.6 and 3.3 times by rural people in a week respectively. In case of urban people, they consumed pumpkin, brinjal, capsicum and ridge gourd (tori) 0.6, 0.74, 2.98 and 4.66 times in a week on average respectively. These findings are also reported by Sharma et al. (2016) who found that 85.00 per cent of respondents of plain region consumed fruits and vegetables rich in

vitamin A, whereas 98.00 per cent of respondents from the same region consumed fruits and vegetables rich in carbohydrates. Only 21.00 per cent consumed vegetables rich in vitamin A, K, fiber and iron. The present study further analyzed that cumber was taken 6.16 times by urban community as compared to rural people as they eat it 0.76 times in a week (Table 3). The consumption of cucumber is higher among all summer vegetables by urban people as they were diet conscious and included salad in their lunch and breakfast daily. These findings are in consonance with those of Sachdeva *et al.* (2013).

#### CONCLUSION

In this paper it was analyzed that rural community consumed more vegetables as compared to urban community. In winter season, majority of the respondents from rural areas consumed carrot, cauliflowers, peas and

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Vegetables	Rural Co	ommunity	Urban (	t-value	
	Mean	SD	Mean	SD	
Carrot	3.38	0.6024	2.02	0.8204	9.45
Cauliflower	2.60	0.5714	1.76	0.6869	6.65
Cabbage	1.06	0.6824	1.88	0.799	5.52
Broccoli	0.08	0.2740	1.48	0.5436	16.26
Mushroom	0.06	0.2399	3.92	1.1925	22.44
Spinach	1.80	0.4949	2.20	0.7284	3.21
Raddish	2.92	1.4405	3.02	0.7951	0.43
Peas	2.76	0.7969	4.80	0.8533	7.99
Fenugreek	1.38	0.6966	3.88	0.773	16.99

Table 2: Descriptive statistic of winter season vegetable consumption pattern of a week in rural and urban community

Table 3: Descriptive statistic of summer season vegetable consumption pattern of a week in rural and urban community

Vegetables	Rural Community		Urban C	Urban Community		
	Mean	SD	Mean	SD		
Okra	1.50	0.505	2.40	0.606	8.07	
Tinda	2.40	0.635	1.38	0.490	8.81	
Bottelgourd	4.70	0.931	2.62	0.830	11.79	
Bittergourd	1.90	0.700	3.26	0.633	10.49	
Pumpkin	1.08	0.634	0.60	0.700	3.59	
Bringal	1.58	0.499	0.74	0.633	7.37	
Capsicum	0.60	0.571	2.98	0.845	16.50	
Tori	3.30	0.580	4.66	0.745	10.18	
Cucumber	0.766	0.766	6.16	0.842	33.06	

radish maximum times in a week. As far as urban community was concerned, they consumed mushroom and fenugreek more in a week. In summer season, respondents from rural areas consumed bottle gourd and round gourd (*tinda*) about 2 to 4 times in a week as compared to urban respondents; they consumed cucumber and ridge gourd (*tori*) 4 to 6 times in a week. To facilitate the change behaviour for improving the consumption of vegetables social marketing strategies should be directed at making highly preferred and frequently consumed vegetables readily available and easily accessible.

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# Farmer Friendly Low Cost Breeding and Seed Rearing Technology of Walking Cat Fish (*Clarias Magur*)

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#### ABSTRACT

The present study was conducted at Department of Aquaculture, College of Fisheries, Assam Agricultural University, Raha, Assam in the year 2019 to assess the success of induced breeding with cost effective breeding method and growth performance of larvae of *Clarias magur* (magur). The observations on breeding trials suggested that a dose of ovaprim @ 1.5 ml/kg female is appropriate with a latency period of 24 hrs in *C. magur* under the prevailing environmental conditions. The experiments were conducted in the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> week of June, at 1.5 ml, 2.0 ml and 1.5 ml Ovaprim dose level recording a latency of 26 hrs, 26 hrs and 24 hrs respectively. The percentage of fertilization at three trials was 76, 78 and 85 per cent, respectively. Hatching rate was ranged between 70 to 84 per cent with 70 per cent in 1<sup>st</sup> trial, 84 per cent in 2<sup>nd</sup> and 80 per cent in 3<sup>rd</sup> trial.

Keywords: Brood stock, Clarias magur (magur), Induced breeding, Larvae and growth

#### **INTRODUCTION**

Pisciculture plays an important role and has been regarded as sunrise sector amongst all the agricultural sectors. The present scenario of changing agriculture in India demands involvements of youths with innovative mind and energy which can boost up the present status of agriculture (Sukanya et al., 2018). Fish is a highly nutritious food and it is particularly valued for providing high quality protein which is better than those of meat and eggs (Bordoloi et al., 2018). The catfish magur is a highly valued fish in Indian subcontinent and is highly revered for its nutritious flesh which is therapeutic in nature. Its fishery is mostly based on capture from natural resources but it can be cultured in ponds in monoculture or poly-culture along with carps. Due to inadequate availability of stocking material, proper feed and successful package of practice for rearing is not available hence the culture of this species is not popular. In nature this fish easily spawns during rainy season (April - July) in shallower regions of the already flooded ponds, swamps, streams, rice fields and other water bodies. However, the feasibility of procuring magur seed in requisite amount from natural resources has been declining continuously due to loss of natural breeding grounds, disappearance of village ponds, indiscriminate fishing of brood stock and increasing use of agrochemicals in rice

fields and other shallow agricultural fields which are the main breeding grounds of this fish. Moreover, harvesting stocking material of magur from nature is very labour intensive, time taking and quantum of availability is also not very sure.

During last few decades extensive efforts have been made to develop the technology of seed production of magur, which ranged from controlled breeding to hatching and larval rearing. In India the earliest effort for its induced breeding was done in 1956 (Ramaswami and Sundararaj, 1957). Since then regular efforts including under All India Co-ordinated Project on 'Air-breathing Fish Culture' (ICAR Final Report, 1987) and also by several other scientists independently by using pituitary extract (Sundararaj and Goswami, 1969; Rao and Janaki Ram, 1991) have continuously been made for its induced breeding and seed production. Despite development of successful techniques at different institutes for seed production of this fish the production of large quantities of magur seed still remains a major constraint.

# MATERIAL AND METHODS

Three induce breeding trials were conducted to study the rate of fertilization and hatching, hatching period, survival rate of fry and fingerlings relating to ambient environmental condition.

The experiments were conducted in the year 2019 at College of Fishery Sciences; Assam Agricultural University, Raha, Assam geographically located at 26.45°N latitude, 90.87°E longitude in the bank of Kalane river. In the present investigation an effort has been made to assess the success of induced breeding with low cost hatchery technology and larval rearing. Efforts have also been made to assess the growth performance of the larvae feed with different diet composition in the same breeding season. Induced breeding was done during the month June. Sexually matured brood fish were selected for induced spawning trials based on external morphological features and secondary sexual characters. Gravid females were segregated on the basis of having round, smooth and bulging belly. Level of softness and bulginess of the belly was used as a dependable indicator of gonadal maturity. Female specimens with softer and more bulging belly were taken as having better ovarian maturity, hence, were selected for induced breeding experiments. In males, the genital papilla is conical and elongated with a pointed reddish tip. The specimens with more elongated papilla were selected as fully mature one. Both mature male and female specimens after selection were kept in plastic tubs for 4-5 hrs for acclimatization. After proper acclimatization the weight of each specimen was recorded and the pairing of similar sized female and male specimens in 1:1 ratio was made. Each pair was kept in tub separately. Male were put in tubs directly from acclimatization chamber while female was put in it after induction. Ovaprim was used for induced breeding and given to only female specimens (a) 1-2 ml kg<sup>-1</sup> body weight intramuscularly at the flank above lateral line and anterior to caudal peduncle by the hypodermic syringe having 24 no. syringe needle.

The incidence of ovulation was checked at 12, 16, 20 and 24 hrs after ovaprim injection by applying slight pressure on the bulging belly of the female fish. Extrusion of a few eggs after 24 hrs from ovaprim injection and slight pressure of hand on abdomen was indicative of ovulation taking place. For preparing the milt for artificial fertilization the male specimens were sacrificed and intact testis removed. The extricated testis was washed in 0.9 per cent NaCl solution to remove blood and other contaminants. After washing, it was cut into pieces and sperm is extracted by using hanker ships and milt suspension is prepared. The eggs were released by gently pressing the abdomen towards the vent, collecting them on a plastic washed and dried tray. On stripping, large amount of greenish brownish ovulated eggs were obtained. The sperm suspension was then added to the striped eggs and mixed well. A small amount of filtered water is added and eggs and sperm were allowed to mix by gently moving the bowel for 1-2 minutes. The eggs in bowel were washed with water 2-3 times and tissue material was removed. Thus the fertilization was completed. The fertilized eggs were transferred to plastic tubs with proper water outlet provisions. Unfertilized or dead (opaque/white) eggs were removed to prevent fungal infection. After every 8 hrs 50 per cent water exchange of the tubs were done. The water temperature was also regularly monitored which ranged between 27-30°C. The duration time for hatching was recorded separately for each group. The egg shells and debris were removed periodically from the tubs. The hatchlings of C. magur were heavily yolk ladden and had large size yolksac.

Observation of growth and survival was done. Cemented tanks of  $2m \times 1m \times 1m$  having 15 to 20 cm water were used for larval rearing. Fifteen days old hatchlings were stocked in above tanks @ 200 /m<sup>2</sup>. The tanks were supplemented with zooplankton daily from outside and were also fed with boiled dried and finely ground into fine powdered hen egg, chicken viscera, vermi and fish meal for 1st 15 days. After 15 days they were fed with ground fishmeal and powdered chicken viscera in ratio of 2:1 four times/day, including once at 7.0 or 8.0 P.M. daily adlibtum. The mixture of fishmeal and chicken viscera was boiled and then cooled daily before feeding to avoid transmission of infections. Above mixture of feed was then lowered in earthen bowels in the tanks for feeding the larvae. After one month only finely ground fish meal after boiling and cooling was given to the larvae with the same feeding schedule. Length and body weight of fry and fingerlings were fortnightly recorded. Water treatment of antibiotic (1 ppm) and was given in a regular interval. The length, weight and number of alive larvae was recorded regularly after an interval of 15 days to assess the growth and survival performance. The water temperature of the tanks holding the larvae were regularly recorded.

#### **RESULTS AND DISCUSSION**

The observation on induced breeding of *C. magur* by ovaprim and the physico-chemical parameters are summarized in Table 1 & 2 respectively. At the doses of

Breeding	Fe	Female		Male		Latency	Fertilization	Hatching	
trials	Avgerage length (cm)	Avgerage weight (g)	Avgerage length (cm)	Avgerage weight (g)	ovaprim (ml/kg)	period (hr.)	rate (%)	rate (%)	
1 <sup>st</sup> trial	30.5	322.5	35.2	383.3	1.5 (female)	26	76	70	_
2 <sup>nd</sup> trial	35.5	370	40.5	395	2.0 (female)	26	78	84	
3 <sup>rd</sup> trial	29.5	280	37	325	1.5 (female)	24	85	80	

Table 1: Latency period, fertilization and hatching percentage in induced breeding trials of C. magur at different timings

 Table 2: Physico-chemical parameters during different

 breeding trials

Parameters	1 <sup>st</sup> trial	2 <sup>nd</sup> trial	3 <sup>rd</sup> trial
Air Temperature (°C)	32	33	31
Water Temperature (°C)	28	29	28
рН	7.9	8.1	8.0
Dissolved oxygen (mg lit <sup>-1</sup> )	6.221	6.023	6.096

ovaprim used @ 1.0 to 2.0 ml kg<sup>-1</sup> fish the latency period in different trials varied from 24-26 hrs. The first experiment conducted in the 1st week of June at 1.5 ml dose level and at 2.0 ml dose level in second trial 2nd week of June the latency period was 26 hrs and in 3rd week of June at 1.5 ml dose level it was 24 hrs. The percentage of fertilization at three trials was 76, 78 and 85 per cent, respectively. Hatching rate was ranged between 70 to 84 per cent with 70 per cent in 1st trial, 84 per cent in 2nd and 80 per cent in 3<sup>rd</sup> trial. The physico-chemical parameters of water (temperature, pH, dissolved oxygen) recorded during different experimental trials on induced breeding did not show any perceptible variation. The water temperature varied between 28 to 29°C, pH between 7.9 to 8.1 and dissolved oxygen between 6.096 to 6.221 (Table 2).

Survival performance of the larvae produced at different trials in the same breeding season has been summarized in Table 3. The results of this study revealed

 Table 3: Survival rate of fry and fingerling of C. magur

 produced at different times of breeding season

Breeding	Percentage of survival of fry and fingerling					
trials	(1 <sup>st</sup> to 15 <sup>th</sup> ) day	(16 <sup>th</sup> to 30 <sup>th</sup> ) day	(31 <sup>st</sup> to 45 <sup>th</sup> ) day			
1 <sup>st</sup> trial	69.8	80.5	85.6			
2 <sup>nd</sup> trial	72.5	77.4	81.2			
3 <sup>rd</sup> trial	70.5	78.7	79.8			

that the mortality of larvae was high in their initial stages and after a certain period instances of mortality decreased. While comparing the survival performance of larvae of different breeding trials it was found that larvae produced in June 1<sup>st</sup> week showed relatively better performance.

Month wise record of average water temperature has been summarized in Table 4 and there is no significant difference in average water temperature of the tanks in the observation period. The growth performance of the larvae produced at different times in the same breeding season has been summarized in Table 5. The difference in length and weight between the larvae produced in different trials was not significant.

 
 Table 4: Water temperature during the rearing period of fry and fingerlings

Month	Range (°C)	Average (°C)
June	25.0 - 32.0	28.5
July	25.0 - 31.5	28.3
August	27.0 - 32.0	29.5

Induced breeding trials by ovaprim indicated that depending upon the reproductive status induced breeding of C. magur can be successfully done during the month of June under prevailing conditions of Nagaon district of Assam. In the present experiment Ovaprim @ 1.5 ml kg-1 body weight has been found appropriate dose for induced breeding of C. magur. At this dose the latency period required for stripping of ovulated eggs was 24 hrs. In June 1st week trial even @ 2.0 ml kg-1 body weight the latency period remained 26 hrs which suggested that even increased dose of ovaprim beyond the most appropriate dose was not able to hasten the processes associated with final oocyte maturation and ovulation in C. magur. However, the observations on fertilization rate and hatching percentage exhibited a pattern contrary to dose requirement of ovaprim and latency period. Best

Days	Group hatch	ned on 1 <sup>st</sup> trial	Group hatch	ed on 2 <sup>nd</sup> trial	Group hatche	ed on 3 <sup>rd</sup> trial
	Avgerage length (cm)	Avgerage weight (g)	Avgerage length (cm)	Avgerage weight (g)	Avgerage length (cm)	Avgerage weight (g)
15	2.03±0.38	0.065±0.035	2.41±0.21	$0.020 \pm 0.008$	1.5±0.36	0.024±0.015
30	6.13±1.20	$2.07 \pm 1.853$	3.35±1.24	$1.400 \pm 0.565$	3.20±0.63	$2.289 \pm 0.239$
45	7.93±1.55	4.50±3.358	4.40±1.38	3.339±0.940	4.19±1.02	4.400±0.511

Table 5: Length - weight of fry and fingerling of C. magur produced by induced breeding in June and July

\*Values are mean  $\pm$  SD, n = 20 – 50.

result of fertilization and hatching rates were obtained in 3<sup>rd</sup> week of June which might have been more influenced by environmental factor like temperature.

Sahu et al. (2000) reported that required latency period ranged between 12 to 15 hrs with ovaprim @ 0.6 to 0.8 ml kg-1 body weight. Earlier Zonneveld et al. (1988) also reported 17 hrs as optimum latency period for stripping of C. magur at carp pituitary dose level of 6 and 9 mg kg<sup>-1</sup> body weight. Successful induced breeding was also reported in C. magur by injecting LHRHa and pimozide consecutively @ 0.05 µg and 5 µg g-1 body weight respectively and observing latency time of 18-21 hrs by Manickam and Joy (1989). Singh et al. (2002) revealed that by using ovaprim (a) 1.8 ml kg<sup>-1</sup> body weight followed by 12 mg carp pituitary (acetone dehydrated)/kg body weight 24 hrs apart had recorded very high percentage of ovulation in C. magur. Ovaprim was used in successful induced breeding of C. magur @ 2.0 to 2.5 ml kg-1 body weight to female and 0.75 to 1.0 ml kg-1 body weight to male by Mahapatra et al. (2000). In this case latency period was recorded to be 16-17 hrs. Our observations and findings of other workers undisputedly revealed that ovaprim is a successful inducing agent for breeding and seed production of C. magur though requirement is very high in comparison to carps. The variability in observations pertaining to dose requirement, latency period, amount/ number of stripped eggs, induction of male specimen etc. seem to be more correlated with prevailing environmental condition, maturity status of individual fish, handling etc. However, as for as the survival rate of larvae is considered it was not significantly different amongst all three groups. As similar rearing conditions i.e. stocking density, rearing tank size, water level etc. and feeding regimen like type of feed, rate of feeding, were applied for all three groups. Borthakur and Sarma (1998) reported better feed conversion ratio in C. magur fed on fish meal. In the present study additional care was taken in feeding fish with fishmeal by boiling as its hygienic quality is not

ensured. The density of *C. magur* though was getting slightly reduced due to mortality regularly yet for maintaining appropriate density restocking was done every fortnightly after sampling which helped in better growth.

In view of our work and report pertaining to breeding and larval rearing of *C. magur* it seems that the objective of large scale seed production and extensive and intensive culture of this valuable fish with some improvisations and continued efforts can be made virtually feasible also at the farmers' level.

#### **CONCLUSION**

The success of induced breeding depends on dose of inducing agent, maturity status of brood stock and also on breeding time. In case of *C. magur* a ovaprim dose of 1.5 ml/kg body weight in female gave good results. The early breeding trials (during June) is appropriate period for induced breeding of *C. magur* for better survival and growth performance owing to prevailing ambient temperature regimen.

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# Economic Viability of *Penaeus vannamei* Shrimp Farming in Purba Medinipur, West Bengal

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#### ABSTRACT

Economic viability of Penaeus vannamei farming is utmost important as this sector has been identified as a powerful tool for rural income & employment generation. The present study was undertaken in Purba Medinipur, the predominant shrimp farming district of the state. Data were collected with the help of structured interview schedule with observation method. Economic viability analysis of the vannamei shrimp producing revealed that all the cases studied generated positive net returns. Shrimp farmers who practiced one crop per year had generated net profit of Rs. 2.31 lakhs; whereas, those who cultured two crops per year had net profit of Rs. 10.03 lakhs on an average. Pay-back period was found very short i.e., 0.26 years and 0.29 years in one crop and two crop per annum, respectively which reflects that the investment in the business of Penaeus vannamei farming is repaid in the shorter time period and is considered the viable choice as investment or other costs are recovered sooner and available again for further farming purpose. Rate of return on investment was found higher (159.11%) among the shrimp farmers engaged in two crops farming per year as compared to those involved in one crop farming (107.3%). In the same way, rate of return on total cost was also higher among the shrimp farmers engaged in two crops farming per year (41.51%) as against the investment in one crop farming per year (19.84%). It would appear that the investment in big-scale on the enterprise was the wiser move. However, for both the groups of shrimp farmers rate of return on investment, total cost, variable cost as well as fixed cost was found to be higher in the Penaeus vannamei farming which implied that the enterprise is profitable in nature.

Keywords: Economic viability, Enterprise, Pay-back period, Penaeus vannamei

#### INTRODUCTION

Crustacean aquaculture has been grown up very rapidly in last few years where its annual production reached about 5 million tons in the year of 2006 (Jaspe et al., 2011). Penaeid shrimps are the preferred crustaceans in aquaculture and vast area are invested for shrimp farming (Karuppasamy and Mathivanan, 2013) because of high demand of it all over the world. Among all the species of shrimp, Penaeus vannamei (Boone, 1931), which represents over 90% of shrimp culture in the western hemisphere, it is the most commonly cultured shrimp in Central and South American Countries, China and Thailand (Frias-Espericueta et al., 2001; Mc Graw et al., 2002; Saoud et al., 2003). India with its 8118 km coast line and with 1.24 million hectares of brackish water area ranks second in shrimp production in the world. Due to continuous outbreak of WSSV in Penaeus monodon culture leads to shattering of shrimp culture in India, a more bio secure

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and environment-friendly approaches were adopted to replace the species with white leg shrimp (*Penaeus vannamei*) commonly known as the Pacific white shrimp like major shrimp producing countries like China, Thailand, Indonesia and Vietnam (Kumaran *et al.*, 2012).

In West Bengal, *Penaeus vannamei* farming have been predominantly cultured in three districts, namely- Purba Medinipur, South 24 Parganas, and North 24 Parganas. The area under *Penaeus vannamei* culture of West Bengal is 4,127 ha and production of *Penaeus vannamei* in the year 2017-18 is 22,191 MT (MPEDA, 2017-18). As per supplied data of District Agriculture Department, Purba Medinipur District, Government of West Bengal and local information, within last few years, the single cropped hectares after hectares paddy land of coastal region of this District have converted to brackish water shrimp ponds for farming to gain high profit (Patra *et al.*, 2016). Declining trends of employment in government and private sectors coupled with less income from agricultural crops has forced the unemployed youth to brackish water farming. *Penaeus vannamei* farming industry has been identified as a powerful tool for rural income & employment generation as it stimulates growth of a number of subsidiary industries besides being a foreign exchange earner. Economic viability of the farming unit engaged in *Penaeus vannamei* farming is important for the growth of the enterprises. Well organized farming system is utmost important for the growth of the industry of *Penaeus vannamei* shrimp and no systematic studies which examine the economic viability of shrimp producing units in West Bengal was carried out as on date.

Farmers adopting high yielding intensive and semiintensive Penaeus vannamei farming (which are subject to degradation of the quality of land and water) are at a higher financial risk. The sustainability of Penaeus vannamei culture systems refers to both the ecological sustainability and the economic sustainability, which is the capacity of the production system to produce a positive income in the long run. Even if a production system scores high in terms of ecological sustainability, it will not be adopted by farmers if it does not provide sufficient income (Sahu et al., 2012). The necessity of procuring a stable return from Penaeus vannamei farming in the long run assumes additional importance in the case of developing countries where the village households invest their scarce resources into shrimp culture and even convert their agricultural lands into shrimp ponds. Thus, an economic assessment of the shrimp culture systems must consider the financial risks associated with them. With this background the research was conducted to study the socio economic profile of the shrimp farmers as well as the economic viability of the shrimp business so that stakeholders interested in the Penaeus vannamei farming development would take concentrated efforts based on the findings of the study. Viability studies may throw light on the economic performance of the farming of Penaeus vannamei which can help potential entrepreneurs in this lucrative business of shrimp through production and marketing system.

#### MATERIALS AND METHODS

The study was undertaken to assess economic viability of *Penaeus vannamei* farming using ex-post facto research design in the purposively selected district i.e., Purba Medinipur of West Bengal state in the year 2019. A total of four blocks, i.e. Chandipur, Contai-I, Deshopran, Contai-III were selected for the study considering the preponderance of shrimp farmers. From each block, two gram panchayats

(GP) were selected with the help of simple random sampling method without replacement technique. Thus total, eight gram panchayats were selected as the representing unit for this study. Twenty five farmers engaged in shrimp farming having experience in minimum of three years were selected from each gram panchayat by simple random sampling method without replacement techniques. Thus total 200 farmers were constituted as sample of the study. Economic viability is the most crucial incentive for Penaeus vannamei farming development. To examine profitability of various domestic shrimp business systems, a simple cost return analysis as per Shang (1990) was employed by adopting a three-step procedure, which included estimation of input costs, estimation of revenues and calculation of profits. Efficiency indices like payback period, the ratio of net profit to total cost, the ratio of variable cost to total initial investment and rate of return on investment and total costs were also estimated. Since the focus was more to detail various production systems, no attempt has been made at this stage to compare them.

# **RESULTS AND DISCUSSION**

Shrimp farmers' profile is studied and findings are presented in Table 1. It was found that most of the farmers were middle age group (53.3%), followed by the old age group (26%). Majority of the shrimp farmers (56%) were found to be having their educational attainment up to middle level, 20.5 per cent were found to be having their educational attainment up to secondary level, 15 per cent up to primary level, 7 per cent up to higher secondary level. Whereas 58.5% of the respondents had low level of the farming experience of up to 5 years, 41.5 per cent of their counterparts had medium level of *vannamei* farming experiences (between 5 to 10 years). While shrimp farming practices was the primary occupation for the majority of the farmers (91.5%), 8.5 per cent of their counterpart had taken it as their secondary occupation.

Whereas an overwhelming majority (83.5%) of the respondents were found to be placed under marginal land holding category with their holding size up to 2 acres of land, 15 per cent were under small land holding category and 15 per cent of their counterparts were under big land holding category. According to the pattern of distribution of the respondents in accordance with their annual family income 41.5 per cent were observed to be belonging to the income range category up to Rs. 10,00,000/- per annum from shrimp culture, 31 per cent were found being placed to the income range category between Rs. 10,00,000/-

S.No.	Variables	Category	Frequency (f)	Percentage (%)
1.	Age	Young (18-35 yr)	41	20.5
		Middle (More than 36-50)	107	53.5
		Old (More than 50)	52	26.0
2.	Educational level	Up to Primary	30	15.0
		Up to middle level	112	56.0
		Up to secondary level	41	20.5
		Up to higher secondary level	14	7.0
		Graduate	3	1.5
3.	Farming experience	Up to 5	117	58.5
		Above 5 to 10	83	41.5
4.	Occupational status	Primary	183	91.5
		Secondary	17	8.5
5.	Land holding	Marginal (Up to 2 acres)	167	83.5
		Small (2 to 5 acres)	30	15.0
		Big (More than 5 acres)	3	1.5
6.	Average yield of vannamei	Low (Up to 2 tones/ acre)	54	27.0
		Medium (Above 2-9 tones/ acre)	119	59.5
		High (Above 9 tones/ acre)	27	13.5
7.	Annual income	Low (Up to 10 lakhs)	83	41.5
		Medium (Above 10-20 lakhs)	62	31.0
		High (Above 20-30 lakhs)	43	21.5
		Very high (Above 30 lakhs)	12	6.0

Table 1: Socio-economic profile of shrimp farmers (N=200)

Rs.20,00,000/-, 31.5 per cent between Rs. 20,00,000-Rs.30,00,000/-. Whereas majority (59.5%) of the respondents were found to be placed under medium yield of *vannamei* category with their yield up to above 2-9 tones/ acre, 27 per cent were under low yield of *vannamei* category and 13.5 per cent of their counterparts were under high yield category (Above 9 tones/ acre).

The study revealed that majority (56%) of the farmers were harvesting two crops per year followed by 44 per cent of their counterparts were practicing one crop per year. Pond construction, equipment (pumps, aerators, land & farm equipments), building (pump house cum workshop, watchman shed), bird & crab fencing constituted the major investment cost for shrimp farming. The total initial investment cost for farmers who were engaged in one crop per year farming was on an average Rs. 2,15,000 as against the Rs. 6,30,000 invested by shrimp farmers who are engaged in two crops per year farming. The ratio of fixed cost to total cost of shrimp farmers was 18.55 per cent and 31.50 per cent for single crop and double crop per year respectively. The ratio of variable cost to total cost of shrimp farmers was 68.50 per cent in case of single crop whereas, it was 81.45 per cent in case of two crops per year. Around Rs. 34,20,000/year revenue was generated by the farmers through selling of *Penaeus vannamei* shrimp in two crop cycle as against Rs.13.96 lakhs/ year though one crop cycle (Table 2).

In Table 3, comparative analysis of profits and efficiency indices of shrimp farming by the farmers in different crop cycle in a year are presented. On the whole, *Penaeus vannamei* farming in Purba Medinipur, West Bengal had been a profitable activity. It may be noted that the shrimp farmers engaged in two crop per year farming had a net profit of Rs. 10,03,000 in comparison to Rs. 2,31,000 from one crop cycle per year. Payback period measures the time required for total cash outflows to equal

Category	One crop per year (n=88)	Two crops per year (n=112)	
Initial Investment (Rs.)			
Infrastructure	26,882.2	66,934.52	
Building	11,429.98	30,272.32	
Equipments	1,25,763.80	3,60,550.60	
Other infrastructure	15,733.97	19,833.33	
Miscellaneous	35,645.25	1,52,979.20	
Total Investment Costs	2,15,455.20	6,30,570.00	
Variable Cost (Rs./year)			
Water treatment cost	550.38	29,116.07	
Chemicals, manure and medicines	60,895.98	1,31,190.5	
Cost of seeds	1,19,363.60	1,50,337.50	
Cost of feed	4,53,017.30	8,94,806.10	
Fuel charges	1,17,101.40	52,886.90	
Electricity charges	11,459.62	71,556.55	
Labour charges	51,456.29	75,877.98	
Annual maintenance and repairing cost	3,264.859	14,627.98	
Miscellaneous	3,200.903	7,720.238	
Harvesting	12,8794.20	2,27,232.14	
Total Variable Cost (Rs./ year)	9,49,104.50	16,55,352.00	
Fixed Cost (Rs./ year)			
Lease amount @ Rs. / year	66,365.10	1,07,886.90	
Depreciation on Investment cost @ 10%	1,81,69.99	63,056.55	
Interest on initial investment @ 11%	31,333.99	69,362.2	
Interest on variable cost @ 11%	10,0272.90	5,21,088.72	
Total Fixed costs (b)	2,16,142.00	7,61,394.40	
Total Cost (a+b) (Rs./ year)	11,65,246.00	24,16,746.00	
Revenue (Rs.)			
Shrimp	13,96,425.00	34,200,50.00	
Total revenue (Rs.)	13,96,425.00	34,20,050.00	

Table 2: Economic viability of different shrimp farming unit of study area

*#* the data represents average data of the samples.

(Figures in parenthesis indicates the percentage of respective costs to total cost)

total cash inflows, that is, the time required to break even and from the table 4.43, it is clearly visualized that payback period of both the group of shrimp farmers were very short i.e., 0.29 years and 0.26 years for shrimp farmers who were are engaged in two crop per year and one crop per year *Penaeus vannamei* farming, respectively. It reflects that the investment in the business of the shrimp farming is low risky and is repaid in the shorter time period thus, is considered viable choice for investment. Rate of return is a profit on an investment or costs over a period of time, expressed as a proportion of the original investment or costs. Rate of return on investment was found higher i.e. 159.11 per cent in two crops farming per year as against the 107.3% from one crop farming per year. Rate of return on total cost was also higher in two crops farming per year (41.51%) as against the one crop farming per year (19.84%). It may be inferred from the result that investment in big-scale on the enterprise through two crop cycle in a year may give the better returns. However, it can be concluded from the Table 3 that shrimp farming as such

Category	One crop	Two crops
	per year (n=88)	per year (n=112)
Total cost*	11,65,246.00	24,16,746.00
Revenue*	13,96,425.00	34,200,50.00
Net profit*	2,31,179.00	10,03,304.00
Pay back period**	0.26	0.29
Rate of Return (%)		
On investment	107.30	159.11
On fixed cost	106.96	131.77
On variable cost	24.36	60.61
On total cost	19.84	41.51

Table 3: Comparison of profitability of different crop cycle of Penaeus vannamei farming

\*in Rs./year \*\* in years

is profitable in nature as it earned good rate of return on investment, total cost, variable cost as well as fixed cost. To sustain economic profits, shrimp farmers minimized input costs by substituting family labour for hired labour. This cost reducing method was highly useful to reduce costs and increase profits. The variable cost and investment ratio as given above indicated that lined systems were subjected to intensive utilization of capital investment. In this regard, Shyama (2008) opined that in general, lower the relative ratio of variable cost to investment less will be the efficiency of capital utilization. Both investment and variable cost complement each other in reaching the efficiency level of output. A very initial cost and very low variable cost lead to less efficient use of capital and consequently low efficiency in shrimp production.

Shrimp farmers incurred various kinds of costs to procure inputs for undertaking farming activities. The expenditures incurred in shrimp farming are categorized into fixed and variable costs. The data on percentage distribution of different items under variable cost among different cycle of shrimp farming are depicted in Figure 1 and Figure 2. The major variable cost in shrimp farming were found for purchasing of feed (47.73% for one crop farming and 54.06% for two crop farming) followed by harvesting cost (13.57% for one crop farming and 13.73% for two crop farming), cost of seeds (12.58% for one



Figure 1: Percentage distribution of different items under variable cost in one crop cycle of Penaeus vannamei per year



crop farming and 9.08% for two crop farming). The other cost were labours, chemicals, manure, medicines, water treatment, electricity, fuel, annual maintenance and repairing and miscellaneous. These costs varied from farmers to farmers because of difference in management skill, distance from input supply center, farm and pond size and marketing channel availed.

Fixed costs included lease amount of land, depreciation on infrastructure and equipment, interest on initial investment, interest on variable cost. The data on percentage distribution of different items under fixed cost under shrimp farming in one crop cycle as well two crops cycle in a year are given in the Figure 3 and Figure 4 respectively. The major fixed costs in shrimp farming were interest on variable cost (46%) as witnessed by shrimp farmers in one crop farming per year and 69 per cent in two crops per year.

#### CONCLUSION

*Penaeus vannamei* culture can give miracles towards socioeconomic development for a large number of rural people. But the only factor that is pulling them back is because of many uncertainty and unpredictability existing there on. The study revealed that for both the groups of shrimp farmers rate of return on investment, total cost, variable cost as well as fixed cost was found to be higher in the *Penaeus vannamei* farming which implied that the enterprise is profitable in nature. The setback in shrimp culture mid 90s and 2008 due to outbreak and the success and failures of other developing countries necessitates update review of modern production technologies and disseminate the results to the farmers through various communication media can make the shrimp aquaculture sustainable with more viable and economic benefits.

In *Penaeus vannamei* farming, an optimum output can not be assured even after taking the risk of huge investment. The export policy promotion, distinct quality measures, application of scientific method, proper quality control mechanism targeted to marketing strategy, and presence of modern technology, sustainable market price, insufficient supply of institutional credit and such other ancillary facilities are the crucial factors, for sustainability and long term viability of the industry. For the sustainability of this industry, it is essential that training programme be conducted for farmers, in order to develop confidence to practice *Penaeus vannamei* culture. Crop insurance facilities should be introduced so that the farmers would not bury them under debt burden if there is a loss. The motto should be to practice an economically and ecologically viable shrimp culture.

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# Studies on Spacing and Fertigation of Parthenocarpic Cucumber (*Cucumis sativus* L.) Under Naturally Ventilated Polyhouse Condition

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#### ABSTRACT

An investigation was conducted on two consecutive years during 2016-17 & 2017-18 to study the response of cultivars, different spacing and time of fertigation on parthenocarpic cucumber (*Cucumis sativus* L.) under naturally ventilated polyhouse condition at Krishi Vigyan Kendra, Raisen (M.P). The whole experiment was arranged with 12 treatments consisting of three cultivars  $V_1$ - Kafka, V2 - Kian and  $V_3$  -Hilton along with two levels of spacing  $S_1$ - 50 × 30 cm,  $S_2$  – 50 x 50 cm and 2 levels of fertigation  $F_1$  -once in a week,  $F_2$ - once in 10<sup>th</sup> days interval (recommended dose of N P K - 8:3.5:9 kg/500m<sup>2</sup>. The experiment was laid out in factorial completely randomized design with three replications. The results showed that all vegetative characters under study were significantly influenced by various cultivars along with levels of spacing and time of fertigation. The effects of cultivars, spacing and time of fertigation were significant for most of vegetative characteristics except fruit weight. The variety Kafka was found to be significantly superior in respect of yield and yield attributing traits having maximum values of 2.78 kg and 14.92 kg yield per vine and per square meter, respectively. The characters like vine length, intermodal distance, leaf area, days to flower bud initiation, fruit set (%), fruit drop (%), no. of fruit per vine, fruit length, fruit width, yield per vine and yield per m<sup>2</sup> were significantly influenced by interaction effect of variety, spacing and time of fertigation. The treatment of  $V_1S_1F_1$  registered significantly highest vegetative and yield attributing characters. However, treatment combination of  $V_3S_2F_2$  registered lowest yield per vine and per square meter (1.43 & 5.73 kg, respectively).

Keywords: Cucumber, Fertigation, Naturally, Polyhouse, Ventilated

# INTRODUCTION

Greenhouse cucumber production is very popular in many areas of the world. The cucumber is a warm season crop with required growing conditions of 80°F and plenty of sunlight. The fruits are mild in flavor, seedless, and have a thin edible skin that requires no peeling. Greenhouse cucumber cultivars are parthenocarpic (produce fruit without pollination). Gynoecious cultivars, i.e., those producing only female flowers or predominately gynoecious cultivars should be grown. India, being a vast country with diverse and extreme agro-climatic conditions, the protected cultivation technology can be utilized for year-round production of high value quality vegetable crops, with high yield. Protected cultivation has higher water and nutrient use efficiencies. Increasing photosynthetic efficiency and reduction in transpiratory losses are added advantages of protected cultivation. Both of these factors are of vital importance for healthy and luxuriant growth

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of crop plants. This technology is highly suitable for farmers in peri-urban areas of the country, especially in central zone of India. But protected cultivation requires careful planning and attention including selection of varieties, suitable production technology like spacing, time of planting, water and nutrient management and plant protection to produce economic yield of good quality.

The cultivars of cucumber require a constant water supply along with fertilizer application to reach high quality yield. The irrigation & fertigation system of cucumbers under naturally ventilated greenhouse through drip system of irrigation and fertilizers are also applied along with irrigation water according to the crop growth and season of cultivation. In view of importance of protected cultivation, the study was initiated to find out suitable cultivar, plant spacing and time of fertigation (fertilizers with irrigation water) in cucumber grown under naturally ventilated polyhouse.

# MATERIAL AND METHODS

The experiment was conducted under naturally ventilated polyhouse at Krishi Vigyan Kendra, Raisen (Madhya Pradesh) India, during kharif, 2016 & 2017. The trial was laid out in Factorial Completely Randomized Design with three replications. The size of the naturally ventilated polyhouse was  $25m \times 20m$  (500 m<sup>2</sup>) covered with aluminates screen and ultra violet stabilized low-density polyethylene sheet having 200 micron thickness. The experiment was comprised of three parthenocarpic cultivars viz. Kafka  $(V_1)$ , Kian  $(V_2)$ , Hilton  $(V_3)$ , with two levels of spacing viz.,50 cm  $\times$  30 cm (S<sub>1</sub>), 50 cm x 50 cm  $(S_2)$  and two level of time of fertigation *viz.*, once in a week ( $F_1$ ), once in a 10<sup>th</sup> days interval ( $F_2$ ). The recommended dose of macro nutrients for fertigation in parthenocarpic cucumber (N P K) was 8:3.5: 9 kg per 500m<sup>2</sup> in the form of ppm (180:80:200), based on soil testing status (Table 1). For green house cultivation of cucumber, the seedlings were raised on soil-less media (Mixture of cocopeat, vermiculite and parlite) in plug trays having cells of 2" in size. 18 days old seedlings at 2-3 true leaf stage were transplanted according to the different treatment combinations. During growing periods all the cultural practices including irrigation and hoeing were carried out as per the standard commercial procedures. Spraying for control of the pests and diseases were applied whenever it appeared necessary throughout the growing season. Plants were vertically trained for utilization of maximum spaces with plastic ropes. The experimental data on vegetative characteristics vine length, intermodal distance, leaf area, days to flower bud initiation, fruit setting percentages, fruit drop percentages, number of fruit per vine, fruit weight, fruit length, fruit width, yield per vine and yield per square meter were recorded from randomly selected five tagged plants of each treatment and further analyzed. All data were subjected to analysis of variance to determine interaction effects.

# **RESULTS AND DISCUSSION**

Interaction effect of cultivars, spacing and time of fertigation significantly influenced the vegetative growth characteristics as vine length, internodal distance and leaf area of parthenocarpic cucumber under naturally ventilated polyhouse condition during *kharif* season (Table 1). The pooled value of data, maximum vine length (3.98 m), leaf area (501.10 cm<sup>2</sup>), minimum intermodal distance (7.84 cm) and minimum days taken (36.946) for flower bud initiation were recorded in treatment of  $V_1S_1F_1$  (Kafka

Table 1: Physical and chemical properties of experimental soil

Nutrients	Unit	Availability	Status
pН	-	7.8	Normal
EC	ms/cm	0.37	Normal
OC	Percentage	1.16	High
AN	kg/ha	283.9	Medium
AP	kg/ha	16.53	Medium
AK	kg/ha	242.5	Medium

+ 50×30 cm + once in a week of Fertigation). This might be due to the combined effect of cultivars, timely and uniformly availability of all the macro-nutrients through fertigation. This finding is supported by Kumar *et al.* (2014) in greenhouse cucumber; Arora *et al.* (2006) in greenhouse grown tomato; Ban *et al.* (2006) in melons. Drip fertigation of cucumber adequately sustain favourable vegetative and reproductive growth as compared to conventional method of fertilizer application. These results are in accordance with the findings of Choudhari and More (2002) in gynoecious cucumber hybrids.

In this investigation, all the yield and yield attributing characteristics as given in Tables 2 & 3 clearly exhibited significant influence by interaction effect of cultivars, spacing and time of fertigation. The pooled data revealed that maximum fruit set (54.19%) with minimum fruit drop (7.97%) was reported in combined treatment V<sub>1</sub>S<sub>1</sub>F<sub>1</sub> (Kafka +  $50 \times 30$  cm + once in a week of Fertigation). These findings are quite analogous with that of Sharma et al. (2011) in cucumber and Sharma (2016) in capsicum under NVPH. The pooled data of maximum number of fruits per vine (25.57) and fruit length (17.73 cm) were observed in same treatment *i.e.* $V_1S_1F_1$  (Kafka + 50×30 cm + once in a week of fertigation). The similar findings of increased number of fruits per vine due to uniformly and proper time for fertigation in whole crop duration was reported by Ughade et al. (2016); Mantur and Patil (2008) and Bahadur and Singh (2005) in tomato. Choudhari and More (2002) reported maximum number of fruits per vine and fruit weight at 1.80 m  $\times$  0.45 m spacing with fertigation experimentation in tropical gynoecious cucumber hybrid namely Phule Prachi. The pooled maximum yield per vine and per square meter 2.78 & 14.92 kg was noticed in  $V_1S_1F_1$  (Kafka + 50×30 cm + once in a week of Fertigation). Whereas, minimum yield per vine and per square meter of 1.43 &5.733 kg was noticed in F<sub>3</sub>S<sub>2</sub>F<sub>2</sub> (Hilton+50x50+once in 10<sup>th</sup> days interval

Treatment	Vine length (m)	Internodal distance (cm)	Leaf area (cm <sup>2</sup> )	Days to flower bud initiation	Fruit set (%)	Fruit drop (%)
V1S1F1	3.98	7.84	501.10	36.946	54.19	7.97
V1S1F2	2.99	8.89	431.65	38.656	49.45	9.71
V1S2F1	3.45	9.15	450.37	38.316	52.81	8.86
V1S2F2	2.98	9.27	399.65	39.34	51.88	8.75
V2S1F1	3.63	8.35	419.92	38.346	53.51	8.85
V2S1F2	2.98	9.1	389.55	39.08	48.22	9.32
V2S2F1	3.75	8.95	433.32	38.416	48.34	9.13
V2S2F2	2.98	9.52	397.10	39.226	47.45	9.48
V3S1F1	3.38	8.62	500.63	37.933	52.06	8.76
V3S1F2	2.98	9.123	444.89	38.346	48.70	10.00
V3S2F1	3.43	8.85	398.12	37.973	49.75	9.26
V3S2F2	2.76	9.62	384.29	39.776	47.06	7.64
SE(m±)	0.209	0.440	32.444	0.676	2.171	0.157
CD at 5%	0.249	0.524	38.671	0.806	2.588	0.459

Table 2: Interaction effect of cultivars, spacing and time of fertigation on vegetative behavior characteristics of parthenocarpic cucumber under zero energy polyhouse condition during *kharif* season

Table 3: Interaction effect of cultivars, spacing and time of fertigation on yield characteristics of parthenocarpic cucumber under naturally ventilated polyhouse condition during *kharif* season

Treatment	Number of fruits per vine	Average fruit weight (g)	Fruit length (cm)	Fruit width (cm)	yield per vine (kg)	Yield per square meter (kg)
V1S1F1	25.57	100	17.73	3.286	2.78	14.92
V1S1F2	20.56	98.04	15.35	2.683	1.80	10.76
V1S2F1	15.39	126.89	17.11	3.063	2.12	8.506
V1S2F2	16.79	115.00	16.76	2.896	1.91	7.666
V2S1F1	24.40	96.63	15.8	3.25	2.00	11.96
V2S1F2	22.13	95.11	16.91	2.83	1.70	12.18
V2S2F1	23.57	98.88	14.99	3.17	2.30	9.32
V2S2F2	20.31	93.63	14.54	2.70	1.89	7.573
V3S1F1	23.98	91.76	17.43	3.23	2.11	12.64
V3S1F2	22.92	91.93	17.09	2.93	2.07	12.4
V3S2F1	23.62	95.1	17.29	3.17	2.26	9.04
V3S2F2	19.77	95.11	15.28	2.59	1.43	5.733
SE(m±)	1.138	11.371	0.261	0.345	0.057	0.921
CD at 5%	3.324	NS	0.763	0.411	0.166	2.690

of fertigation). It is concluded that the main factors responsible for the increase in fruit yield per unit area at narrow spacing were due to greater crop biomass. These results indicated that maximum yields are function of greater number of plants per unit area. The increase in yield attributes under fertigation in cucumber may be attributed to better water utilization and higher uptake of nutrients. Fruit width of cucumber was found to be significantly influenced by interaction effect of cultivars, spacing and time of fertigation. The pooled maximum fruit width (3.286 cm) were observed in  $V_1S_1F_1$  (Kafka + 50×30 cm + once in a week of Fertigation) treatment.

Takale et al. (2014) and Pandey et al. (2005) reported the significant differences for fruit width on capsicum & cucumber grown under protected structure, respectively. Maximum fruit diameter was recorded by Choudhari and More (2002) in cucumber through fertigation. The enhanced supply of nutrients through increased fertigation level in the root vicinity of plant maintain optimum nutrient concentration in the root zone throughout the crop growth period, which increases the uptake of moisture and nutrients resulted in increasing all the growth attributes of cucumber which increases the photosynthetic rate and absorbed APAR resulted in more translocation of photosynthates towards reproductive organ (sink) which ultimately increases the yield attributes of cucumber. Janapriya et al. (2010) also reported that significantly higher yield and yield attributes under increased fertigation level. Similar results are also reported by Sharma et al. (2009); Dai et al. (2011).

# CONCLUSION

Based on the above findings, it could be concluded that cucumber should be grown at a spacing of  $50 \times 30$  cm along with the once in a week of fertigation practice using parthenocarpic cucumber cultivar 'Kafka' during *kharif* season for sustaining higher fruit yield under naturally ventilated polyhouse in central zone of India.

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# **Problems Faced by The Fast Food Street Vendors**

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#### ABSTRACT

The present investigation was carried out to study the problems faced by fast food street vendors of Jorhat district of Assam. The study was undertaken to identify the problems faced by the Fast Food Street Vendors. The registered fast food street vendors of Jorhat city were purposively selected as the locale of the present study. A total of 111 respondents were randomly selected for the present study which was 50 percent of the total population. An interview schedule was constructed for collection of data. Appropriate statistical methods were used such as ranking and intensity index. The respondents faced a number of problems in different areas and of different intensity. Among financial problem, the problems related to repayment of loans from financer and realising the credit from customers were ranked first and second and were of moderate intensity. Among the familial problem, the problems relating to construction of the sanitary system for the family and medical check up of the family members were ranked first and second and were of severity intensity. Problems pertaining to hygiene, it was found that use of apron and use of head covers were ranked first and second. Both these problems were of severe intensity. Among the social problem, it was found that the problem regarding sudden strike in the locality was ranked first and of severe intensity, followed by problem regarding competition with other vendors was ranked as second and were of moderate intensity. Among administrative problem it was found that the problems pertaining to local administrative tax, location tax were ranked first and second and of mild intensity. A training programme to inform the fast food vendors regarding health and hygiene is the need of the hour. Local administration may be approached to sponsor such a training programme to prepare a training kit containing apron, head cover and gloves. Moreover, the local administration may be requested to make it mandatory to use this hygienic kit by all fast food vendors and become a proud pioneer to show case a step towards popularising the healthy fast food centres in Jorhat city thereby attracting the unemployed educated youth to start fast food centres as a good start up. Government can also provide minimum facilities in appropriate places for the street food vendors, since major economic return from this sector are more in a developing country like India.

Keywords: Administrative problem, Family problems, Fast food street vendors, Financial problems, Social problems

#### **INTRODUCTION**

Fast Food Street vendors are mainly visible section of the informal market. Fast Food Street vending as an occupation has been in continuation in India since times immemorial. In the major cities of Assam, the large numbers of urban poor live on by working in the informal sector; this is because of poverty and lack of profitable employment in the rural areas of Assam driving large numbers of people from minor towns to the capital city for work and livelihood. These people in general possess low skills and lack the level of education necessary for the better paid jobs in the organised sector. Besides, permanent scheduled jobs in the organized sector are very low in Assam; hence, even those having the requisite skills are unable to locate proper employment. For these people, hawking/ street vending is one of the resources of earning a livelihood, as it requires smaller financial inputs and the skills involved are very low and also no entry level obstacles in this job.

Fast Food Street vending is an important economic activity and fast food street vendors are broadly defined as self-employed workers in the urban informal sector who offer their labour for selling goods and services on the street in the absence of any permanent built-up structure National Policy on Urban Street Vendors (NPUSV, 2006).

Fast Food Street vendors have been grouped into three categories. First, vendors are those who carry out their vending on a regular basis in a specific space. Second,

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vendors are those who carry out vending not on a regular basis and without a specific location, for example, vendors who sell goods in weekly markets(bazaars). The third type of the vendors is those who are the mobile street vendors. Thus, the street vendors are stationary by way of occupying space on the pavements or other public places or may even be mobile in the sense that they move from one place to another carrying their wares on push carts or in cycles or baskets on their heads, or may sell their wares in moving bus, etc.

Fast Food Street vendors are the "one who bought the goods at wholesale and sell it in the street, roadsides, bus stands and at the other places of decent crowd for their daily livelihood. They have the option of selling the goods by making a small shop at the convenient place or by carrying the goods to different places with or without getting any license for the sale of goods". Fast Food Street vendors are contributing broadly to the informal as well as the overall urban economy in conditions of employment and cheap accessibility of goods and provides for the human society. Their daily earned money between Rs.30 to Rs.120. However Fast Food Street vendors have no contact to strict finance, and they mainly rely on their own savings, and get money from friends and relatives. But Fast Food Street vendors have not accessed the strict Micro Financial Institutions (MFIs) that have come on board to fill the gap left by formal financial institutions. Since most MFIs use banks as collateral, effective group can provide collateral required by financial institutions. It also provides a good meeting for extending business development provided to fast food street vendors. At the same time, working conditions of the vendors are very tough.

Due to rapid urbanization, majority of the people started to migrate or planning to migrate from rural to urban areas for earning their livelihood, getting a greater variety of education and recreational facilities, etc. Urban areas consisting of different places for providing variety of services which rural areas cannot. India which is a developing country, stands second in global context in terms of population and rapid urbanization (Panwar, 2015) which induces migration for all kinds of people as the development require all kinds of skilled and unskilled workforce for generating economy for developing urban infrastructure.

Now a days street foods are enjoying increasing patronage due to rapid urbanization which is forcing many

city dwellers to eat their major daily meals out of home, so street food vending is becoming a common feature for most of the cities and towns in the developing countries like India. The management practices of fast food street vendors are mostly outside the regulation and protection of the government. The economic importance of the activities is not up to the mark mainly due to the informal nature of this profession and also lack of official data on volume of trade involves in the cities and towns.

The present researcher has shown his interest to do a systematic research through collection of base line data on identifying the problems faced by street food vendors. This will give a strong platform to some planners in future to plan a need based interventional programme to be implemented for the direct benefit to the fast food street vendors and indirect benefit to the general people in large and youth in specific. On this backdrop, the researcher has undertaken a study on the problems faced by the fast food street vendors

# MATERIALS AND METHODS

The study was conducted in Jorhat district of Assam. The highly populated commercial areas of Jorhat subdivision were selected for the present study using random sampling method. Out of 222 registered fast food vendors, the densely populated fast food street vendor's localities were selected for the present study. A total of 16 densely populated fast food localities were identified;7 respondents from 15 and 6 respondents from one locality were randomly selected for the present study comprising of 111 respondents to get 50% of the total registered fast food street vendors. In the present study, problems refer to the difficulties, barriers or hindrances that were faced by the street fast food vendors while running their business.

An interview schedule was designed to collect information regarding the problems faced by the fast food street vendors. The problem statements were framed by reviewing different journals, books, research reports and by interviewing with the respondents. The statements were put into four point continuum of 'mild', 'moderate', 'severe', and 'no problem' with scores 1,2,3 and 0, respectively.

The collected data were coded, tabulated and analyzed in accordance with the objectives of the study by using appropriated statistical techniques. The statistical tests and techniques used in the study were as follows**Ranking:** Ranking of the problems faced by the respondents was done on the basis of mean score obtained by the respondents for different problems and their level of intensity

*Intensity index:* To find out the severity of the problems, intensity index (Barthakur, 1980) was used in the following way.

Intensity index (II) = Number of level of intensity

The mean scores between:

0-0.8 (II) = Not a problem 0.8-1.6 (II) = Mild 1.6-2.4 (II) = Moderate 2.4-3.2 (II) = Severe 3.2-4.0 (II) = Acute

# **RESULTS AND DISCUSSION**

An attempt has been made to identify the problems and their intensity faced by the fast food street vendors. Ranking of the problems was done to prioritise the problems faced by the majority of the respondents. The problems were ranked on the basis of mean score obtained by each problem in different problem areas.

Table 1 reveals that out of six financial problems faced by the fast food street vendors, not a single problem was of severe intensity. The problems related to repayment of loans from financer, realising the credit from customers and buying the raw materials were ranked as first, second and third, respectively and all these problems were of moderate nature. The problems relating to payment of bills and taxes, buying of packing materials for delivery and meeting the unexpected demands of the society were of mild intensity and ranked lower. This finding indicates that since majority of the fast food street vendors were from weaker section of the society and they were economically and financially unstable so they faced problems in repaying of the loans to the financer. However, while interviewing, most of the respondents expressed that they failed to recover their credits because they were mostly cheated by the customers and also sometime they were afraid of losing their customers if they asked for payment of credits.

Table 2 reveals that among the various family problems faced by the fast food street vendors, only two problems were of severe intensity. The problems relating to the facilitating sanitary system and medical check-up of the family were ranked first and second, respectively. Both these problems were of severe intensity. The problems relating to shopping for the family needs, repaying of the house, monthly food product for the family, buying of 2wheelers, buying medicines for the family, obtaining ornaments for the female members of the family and paying of the school fees of the children were ranked as third, fourth, fifth, sixth, seventh and eighth, respectively and these problems were of moderate intensity. The other problems were of mild intensity and ranked at lower level. The severe problems might be due to the fact that probably the respondents reside in a rented house having common sanitary facilities for many families. Since majority of the fast food street vendors were financially not strong hence, they could not afford to have rented house having adequate facilities. They had come out to the urban areas for earning their livelihood with a meagre amount. Most of the respondents expressed their opinion that they were not able to send sufficient amount of money to the members residing in their home town for decent survival as they stay away from them with very low annual income. So, they were not able to manage their family properly including medical and other family expenses.

Table 1: Ranking and intensity of the financial problem faced by the fast food street vendors

S.No.	Problems	Mean	Intensity of the	Rank
		score	problem	
1.	Problem relating repayment of loans to financer	1.73	Moderate	Ι
2.	Problem relating to realising the credit from customers	1.71	Moderate	II
3.	Problem relating to buying of the raw materials	1.68	Moderate	III
4.	Problem relating to payment of bills and taxes	1.55	Mild	IV
5.	Problem relating to buying of packing materials for delivery	1.44	Mild	V
6.	Meeting the unexpected demands of the society	1.43	Mild	VII

S.No.	Problems	Mean score	Intensity of the problem	Rank
1.	Problems relating to facilitating of sanitary system for the family	2.46	Severe	Ι
2.	Problems relating to medical check-up of the family	2.41	Severe	II
3.	Problems in shopping for the family needs	2.38	Moderate	III
4.	Problems relating to repairing of the house	2.07	Moderate	IV
5.	Problems regarding vaccination for the family	2.05	Moderate	V
6.	Problems regarding monthly food product for the family	1.88	Moderate	VI
7.	Problems in buying 2-wheeler	1.83	Moderate	VII
8.	Problems relating to medicines for the sick person in the family	1.80	Moderate	VIII
9.	Problems in obtaining ornaments for the female members of the family	1.78	Moderate	IX
10.	Problems in paying school fees of children	1.69	Moderate	Х
11.	Problems in obtaining land for construction of house	1.57	Mild	XI
12.	Problems in paying Tution fees for their children	1.53	Mild	XII
13.	Problems in going picnic for the family	1.51	Mild	XIII
14.	Problems in paying rent	1.49	Mild	XIV
15.	Problems in buying stationery product for their children	1.37	Mild	XV
16.	Problems in paying fees for extracurricular activities of the children	1.32	Mild	XVI
17.	Problems in obtaining the weekly food product for the family	1.32	Mild	XVII
18.	Problems in paying electricity bill	1.24	Mild	XVIII
19.	Problems in paying water supply bill	1.19	Mild	XIX
20.	Problems in obtaining daily food product for the family	1.13	Mild	XX
21.	Problems in Outing other place with the family	1.09	Mild	XXI
22.	Problems in buying 4-wheeler	0.94	Mild	XXII

Table 2: Ranking and intensity of the family problem faced by the fast food street vendors

Table 3 reveals that among the various problems related to hygiene faced by the fast food street vendors, the problems related to use of water for washing, disposal of garbage and source of drinking water were ranked first, second and third, respectively. All these problems were of moderate intensity. The other problems relating to the hygiene faced by the fast food street vendors were of moderate intensity and ranked at lower levels. The problems ranked in the higher level were mainly because of non-availability of such facilities in the fast-developing Jorhat city to run a business like fast food street vending. Moreover, the researcher expressed his point of view that it might be due to the lack of awareness programme on health and hygiene initiated by the local authority or social organisation/ institutions especially for fast food vendors. Most of the respondents were registered as mobile fast food street vendors, so the problems regarding getting a suitable place for vending was felt by them and were of mild intensity ranked at lower level.

Table 4 reveals that among the various social problems faced by the fast food street vendors, only one problem was of severe intensity. The problem regarding sudden strike in the locality was ranked first and of severe intensity. Problem regarding competition with other vendors was ranked as second and of moderate intensity. The problems regarding to handling of the customers during peak hours, asking donation by the local people, and shortage of food products were of mild intensity and ranked as third, fourth and fifth, respectively. The other problems which were about asking of food items without payments and difficulty created by local people were regarded as not a problem and ranked at lower. Majority of the respondents expressed that they cannot do their business properly and increase their earning.

S.No.	Problems	Mean score	Intensity of the problem	Rank
1.	Problems relating to use of water for washing	2.17	Moderate	Ι
2.	Problems relating to use of disposal of garbage	2.05	Moderate	II
3.	Problems relating to drinking water source	1.83	Moderate	III
4.	Problems in having quality containers and utensil used for delivering of the product	1.80	Moderate	IV
5.	Problems in having quality container and utensil used for serving	1.79	Moderate	V
6.	Problems in having quality container and utensil used for cooking	1.78	Moderate	VI
7.	Problems in getting a suitable place for the business	1.09	Mild	VII

#### Table 3: Ranking and intensity of problem related to hygienic faced by the fast food street vendors

#### Table 4: Ranking and intensity of the social problem faced by the fast food street vendors

S.No.	Problems	Mean score	Intensity of the problem	Rank
1.	Problems in having sudden strike in the locality	2.59	Severe	Ι
2.	Competition with other vendors	1.93	Moderate	II
3.	Difficulty in handling the customer in Peak hours	1.42	Mild	III
4.	Asking donation by local people	1.14	Mild	IV
5.	Shortage of products	1.07	Mild	V
6.	Problems in asking food items without payments	.69	Not a problem	VI
7.	Difficulty Created by local youth	.40	Not a problem	VII

#### Table 5: Ranking and intensity of the administrative problem faced by the fast food street vendors

S.No.	Problems	Mean	Intensity of the	Rank	
		score	problem		
1.	Problems relating to local administrative tax	1.04	Mild	Ι	
2.	Problems relating to location tax	1.03	Mild	II	
3.	Problems relating to electricity bill	.65	Not a problem	III	
4.	Problems relating to water supply bill	.61	Not a problem	IV	
5.	Problems relating to security tax	60	Not a problem	V	
6.	Problems relating to Rents	.18	Not a problem	VI	
7.	Problems relating to police tax	.08	Not a problem	VII	
8.	Problems relating to Broker tax	.01	Not a problem	VIII	

Table 5 reveals that among the various administrative problems faced by the fast food street vendors, only two problems were of mild intensity. The problems relating to local administrative tax, and location tax were ranked as first and second, respectively. Both these problems were of mild intensity. The other problem was regarded as not a problem and was ranked at the lower level. The mild problems which were ranked at the higher level were mainly due to the introduction of new rules and regulation by the concern administrative authority.

# CONCLUSION

The major problems faced by the fast food vendors are related to repayment of loans availed from financer, realising the credit from customers and buying the raw materials, which are of moderate natures. The problem relating to the construction of the sanitary system for the family and medical check-up of the family were of severity intensity. The problems relating to using of head cover and using of apron were also of severe intensity. Sudden strike in the locality was of severe intensity, followed by the problems relating to local administrative tax, location tax were of mild intensity.

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# Information Seeking Behaviour of Post Graduate Students of Punjab Agricultural University, Ludhiana

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## ABSTRACT

The present study was undertaken with the objectives to study the information seeking behaviour of post graduate students of Punjab Agricultural University, Ludhiana. A total of 120 students (40 students from Ph.D. and 80 students from M.Sc.) were selected from all colleges using probability proportional to number method. Data were collected from the respondent by using distributed questionnaire approach. The findings of the study revealed that majority of the respondents (76%) from Masters' respondents were in the age group of 20-25 years and majority of respondents (72%) from Ph.D. respondents were in the age group of 23-27 years. All the Masters as well as Ph.D. students (100%) had used text books and internet browsing as a source/method of information. Majority of the respondents (95%) sought information for course work and research purpose. Majority from Masters' respondents (67%) and Ph.D. respondents (75%) occasionally delegate work of information collection to others, and expressed lack of time (49% and 48% respectively) main reason behind this. Majority of Masters' respondents (68%) Ph. D respondents (70%) preferred the both print and electronic sources and spending 1 to 4 hours per day for information seeking.

Keywords: Information seeking behavior, Students, Purpose

## **INTRODUCTION**

It is quite realistic that information plays a fundamental role in each individual's life. There may not be any single field of research or activity, where information is not needed. We get the information from variety of sources throughout the day. Radio, newspapers, television, internet, mobiles, books, etc. are the major media which provides various types of information. This is the information explosion age, where information is generated, and distributed with high speed (Ahmed, 2013).

Information seeking behaviour can be defined as an individual's manner of gathering and sourcing information for personal use, knowledge updating and development. The importance of information seeking behavior is not overlooked. Information is considered as an essential input to agricultural education, research and development and extension activities (Sreeram and Gupta, 2018). During the last decades, considerable resources have been invested in hardware, software, connections, training and support actions under the scope of improving the quality of teaching and learning. (Pandey *et al.*, 2019). Keeping all these

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important observations, the present study was undertaken with an objective to finding out the information seeking behavior of post graduate students. Information seeking behavior is a vast field in the field of information science and science, whose research around it has a qualitative aspect. Two things are very important as far the information and human being is concerned. Firstly, different methods or sources to which people have access or the do use for gathering information. Other is the information seeking behavior which includes purpose of information seeking, time spent information gathering, preferred format of information sources etc.

#### MATERIAL AND METHODS

The study was conducted in Punjab Agricultural University, Ludhiana. A list of post graduate students admitted in the different colleges of PAU Ludhiana during in the year 2015-16 was obtained from Registrar Office of the university. From this list a total of 120 students 40 students from Ph.D. programme (20 Males+20 Females) and 80 students from M.Sc. programme (40 Males+40 Females) were selected from all constituent colleges using probability proportional to number method. A structured questionnaire was prepared and finalized. It was consisted of four different parts. First part consisted of questions related with socio-personal characteristic like age, current OCPA, current degree, family type, family background, Family Size, total annual income etc. Second part dealt with the different methods/sources of information sought by post graduate students. Third consisting of question related with Information seeking behavior of the students.

Questionnaire so prepared was pre tested among 20 non-sampled students from non-sampled area. The obtained response was analyzed and questionnaire was modified according the results of pre testing. The data was analyzed by applying appropriate statistical tools like mean, frequency, percentage, range method, t-test, z-test and standard deviation.

# **RESULTS AND DISCUSSION**

The Table 1 represents the socio-personal characteristics of the respondents. The age of the respondents varied from 20-34 years among Masters' respondents and from 23-35 among Ph.D. students. Majority of respondents (76%) from Masters' respondents were in the age group of 20-25 years and majority of respondents (72%) from Ph.D. respondents were in the age group of 23-27 years. Most of the masters' respondents (i.e. 54%) were having 7 to 8 OCPA and most of Ph.D. respondents (i.e. 50%) were also having 7 to 8 OCPA. 63 per cent of the students doing Master of Science in different field (51 students), followed by M.Tech. (19%), M.B.A (14%) and M.C.A (4%). Among Master's students 39% of the respondents belong to COBS, followed 27 per cent of the respondent belong to COA, 25% of the respondent belong to COAE. In Ph.D. case 45 per cent of the respondents belong to COA, followed 28 per cent of the respondent belong to COBS, 15 per cent of the respondent belong to COHS, and respectively only 12 per cent of the students were belong to COAE. From Masters respondents, 59 per cent of the respondents were belonging to Urban family whereas 41 per cent of the respondents were belonging to Rural" family and from Ph.D. students 55 per cent of the respondents were belong to Urban family whereas 45 per cent of the respondents were belonging to Rural family. Masters student's families 70 per cent of the respondents were having income between (1 to 6 lakhs), and from Ph.D. student's families 40 per cent of the respondents were having income between 1 to 6 lakhs.

Data given in the Table 2 provides information about sources/ method of information used by the respondents. It is clear from the table that all the Masters as well as Ph.D. students (100%) had used text books and internet browsing as a source/method of information. Other

S.No	Socio-personal characteristics	Category		Respondents f(%)	
		Masters (n=80)	Ph.D. (n=40)	Masters	Ph.D.
1	Age (years)	(20-25)	(23-27)	61(76%)	29(72%)
		(25-30)	(27-31)	16(20%)	8(20)
		(30-34)	(31-35)	3(4%)	3(8%)
2	Current OCPA	(6 -7)	(6 - 7)	21(26%)	10(25%)
		(7 - 8)	(7 - 8)	43(54%)	20(50%)
		(above 8)	(above 8)	16(20%)	10(25%)
3	Family background	Urban		47(59%)	22(55%)
		Rural		33(41%)	18(45%)
4	Family type	Nuclear		56(70%)	27(67%)
		Joint		24(30%)	13(33%)
5	Family Size.	Up to 5me	mbers	56(70%)	30(75%)
		More than	5 members	24(30%)	10(25%)
6	Total annual income of	(1-6 Lakh)		56(70%)	16(40%)
	the family (approx. /annum)	(6-10 Lakh	)	21(26%)	19(47%)
		(10-15 Lal	xh)	3(4%)	5(13%)

Table 1: Distribution of respondents according to socio-personal characteristics (n= 120)

Source/Method ofInformation	Masters (n=80) f (%)	Ph.D. (n=40) f (%)	Total	Z Value
Written/print Sources				
Lecture Notes	75(94%)	39(98%)	114(95%)	0.979
Text Books	80(100%)	40(100%)	120(100%)	N/A
Library	66(83%)	38(95%)	104(86%)	1.843
Newspapers	64(80%)	26(65%)	90(75%)	1.789
Print Journals	58(73%)	28(70%)	86(71%)	0.345
Handout	54(68%)	26(65%)	80(66%)	0.329
Articles	65(81%)	31(78%)	96(80%)	0.387
Reference Materials	65(81%)	31(78%)	96(80%)	0.387
Book reviews	51(64%)	29(73%)	80(66%)	0.988
Bibliography	54(68%)	26(65%)	80(66%)	0.329
Personal correspondents	42(53%)	24(60%)	66(55%)	0.727
Reference/citation	43(54%)	23(58%)	66(55%)	0.415
Published catalogue and flyers	40(50%)	16(40%)	56(46%)	1.035
Spoken Sources				
Conferences	58(73%)	28(70%)	86(71%)	0.345
Seminars	74(93%)	38(95%)	112(93%)	0.424
Workshops	60(75%)	30(75%)	90(75%)	0.000
Training	63(79%)	27(68%)	90(75%)	1.318
Consultation with experts	56(70%)	30(75%)	86(71%)	0.573
Meeting with expert's/ resource person/teachers	72(90%)	36(90%)	108(90%)	0.000
Electronic Sources				
E-books	56(70%)	24(60%)	80(66%)	1.095
E-journals	62(78%)	32(80%)	94(78%)	0.252
TV	41(51%)	19(48%)	60(50%)	0.310
Electronic data base like CD / software/online data base/ CeRA /ICSSR/open access e-resource/dictionary/ encyclopaedia/nationaldigital library.	72(90%)	38(95%)	110(91%)	0.934
Radio	22(28%)	12(30%)	34(28%)	0.228
Internet browsing	80(100%)	40(100%)	120(100%)	N/A
Online forums or news group	43(54%)	19(48%)	62(51%)	0.620
Web page of book store or publication	36(45%)	20(50%)	56(46%)	0.518
Online chatting	47(59%)	23(58%)	70(58%)	0.105
E-mail	72(90%)	36(90%)	108(90%)	0.000
Video conferencing	39(49%)	19(48%)	58(48%)	0.103
Audio conferencing	34(43%)	22(55%)	56(46%)	1.242
Mobile calls	66(83%)	34(85%)	100(83%)	0.279

# Table 2: Distribution of respondents according to the sources/methods of information seeking

Source/Method ofInformation	Masters (n=80)	Ph.D. (n=40)	Total	Z
	f (%)	f (%)		Value
Search Engine				
Google	68(85%)	36(90%)	104(86%)	0.760
Yahoo	35(44%)	21(53%)	56(46%)	0.931
MSN	11(14%)	7(18%)	18(15%)	0.573
Bing	14(18%)	6(15%)	20(16%)	0.412
rediff	8(10%)	4(10%)	12(10%)	0.000
Social Media				
Facebook	66(83%)	32(80%)	98(81%)	0.403
WhatsApp	75(94%)	39(98%)	114(95%)	0.979
Telegram	26(33%)	14(35%)	40(33%)	0.219
Instagram	51(64%)	25(63%)	76(63%)	0.107
YouTube	74(93%)	38(95%)	112(93%)	0.424

Table 2 contd...

important sources/methods used by Masters students were lecture notes (94%), WhatsApp (94%), seminars (93%), YouTube (93%), meeting with experts/resource persons/ teachers (90%), electronic data base like CD / software/ online data base /CeRA /ICSSR/open access e-resource /dictionary/ encyclopedia/national digital library (90%) and email (90%). A similar trend was visible among Ph.D. students who had used lecture notes (98%), WhatsApp (98%), library (95%), seminars (95%), electronic data base (95%), YouTube (95%), meeting with experts/resource persons/teachers (90%), search engines like google (90%) and email (90%). The least used source/method of information seeking was search engines of Bing, MSN and rediff to which Masters students used 18 percent, 14 percent and 10 percent respectively. Similarly, Ph.D. students also used search engines least as only 18 percent uses MSN, 15 percent used Bing and 10 percent used rediff. So it is clear that google was the most preferred search

engines by Masters (85%) and Ph.D. (90%) students. WhatsApp was a most use social media by Masters (94%) and Ph.D. (98%) students as far the source/method of information was concerned if be combine both the Masters and Ph.D. students the combined data also revealed the similar trend where text books and internet browsing was the source/method used by all the students (100%) for information seeking and rediff search engine was the least preferred method (10%) among all the students. Z test was applied to see any variation among Masters and Ph.D. students as for the source/methods of information seeking was concerned. Test revealed that there was no significance difference among them. Results are in line with Bhanu (2014); Majid and Ali (2002).

Students collect information for varied purposes. The data in Table 3 clearly indicate that majority of the respondents (95%) sought information for course work

Table 3: Distribution of	respondents a	ccording to purpo	se of seeking information
	<b>1</b>		0

Purpose	Masters (n=80)	Ph.D. (n=40)	Total	Z value
Course work	77(96%)	37(93%)	114(95%)	0.711
To keep yourself up to date	75(94%)	37(93%)	112(93%)	0.212
Research purpose	77(96%)	37(93%)	114(95%)	0.711
For career development	75(94%)	35(88%)	110(91%)	1.142
General Reading	66(83%)	36(90%)	102(85%)	1.022
Preparation for Seminar / conferences	74(93%)	36(90%)	110(91%)	0.571
Solving the problem	74(93%)	36(90%)	110(91%)	0.571
To write on article	58(73%)	32(80%)	90(75%)	0.839

and research purpose followed by 94 per cent of the respondents for keeping them upto date and career development (91%). However, writing of articles was the least preferred purpose (75%) among respondents. In case of Masters' students, the purpose of seeking information was primarily for the course work and research purpose by the majority of the respondents (96%) followed by career development (94%) and lowest percentage of the respondents (i.e. 73%) reported that purpose of seeking information was to write an article.

In similar trend for Ph.D. students, majority (93%) of the respondents expressed that the purpose of seeking information was course work, to keep themselves up to date and research purpose, followed by 90 per cent respondents who sought information for general reading, preparation for seminar / conferences and solving the problem and among least percentage of the respondents (i.e. 80%) the purpose of seeking information was to write an article. Z test was applied to see any variation among Masters and Ph.D. students as for the purpose of seeking information was concerned and there was no significance difference found. Results are in line with Tahir *et al.* (2008) and contrary to Adio and Arinola (2012).

Data in Table 4 pertains to start/initiation of information seeking by the respondents. It shows that in case of Masters' students, browsing the internet obtained the highest mean score (2.85) for starting/initiation of information seeking followed by Inquiring from fellow students (2.39), inquiring from teachers, searching the electronic database (mean score 2.34), whereas seeking assistance from library staff obtained lowest mean score (2.01). Among Ph.D. respondents, browsing the internet obtained the highest mean score i.e. 2.85 whereas using the shelf guide to locate books obtained lowest mean score (1.98) as far the starting/initiation of information seeking is concerned. T test was applied to check the difference among Masters and Ph.D. students and no significant difference was found in this case also.

Many times students do delegate the work of information collection to other due to one or other reason. Table 5 indicates that majority from Masters' respondents (67%) occasionally delegate work of information collection to others, 10 per cent delegate frequently and 8 per cent of them moderately delegate work of information collection to others. Among Ph.D. respondents also, large number of respondents (i.e. 75%) occasionally delegate work of information collection to others, whereas only 5 per cent of the student's frequently delegate work of information collection to others. So in total majority of the respondents (70%) delegate work of information collection occasionally and only eight percent of them frequently delegate work of information to others.

There were varied reasons behind delegation of information collection from others. Table 6 represents the

Table 5: Distribution of respondents according to thedelegation of work of information collection to others

Delegation	Masters	Ph.D.	Total
-	(n=80)	(n=40)	
	f (%)	f (%)	
No delegation	12(15%)	4(10%)	16(13%)
Occasionally	54(67%)	30(75%)	84(70%)
Delegate moderately	6(8%)	4(10%)	10(8%)
Delegate frequently	8(10%)	2(5%)	10(8%)

Table 4: Distribution of res	pondents according to s	start/initiation of in	of formation seeking
	P		

Initiation of information seeking	Masters(n=80)	Ph.D. (n=40)	Total	t Value
	Mean	Mean	Mean	
Using the Shelf Guide to Locate Books	2.04	1.98	2.02	0.615
Browsing the Internet	2.85	2.85	2.85	0.000
Searching the Electronic Database	2.34	2.43	2.37	0.797
Searching the CD-ROM Database	1.48	1.45	1.47	0.289
Inquiring from teachers	2.34	2.43	2.37	0.893
Inquiring from fellow Students	2.39	2.38	2.39	0.105
Seeking Assistance from Library staff	2.01	2.03	2.02	0.182
Inquire from friends	2.24	2.27	2.25	0.260
Asking from experts	2.21	2.23	2.22	0.185

Reason	Masters	Ph.D.	Total
	(n=80)	(n=40)	
	f (%)	f (%)	
Lack of time	39(49%)	19(48%)	58(48%)
Task is tedious	15(19%)	5(12%)	20(17%)
Unfamiliarity with	26(32%)	16(40%)	42(35%)
the sources			

Table 6: Distribution of respondents according to the reason for delegation of information collection to others

various such reasons. It can be observed from table that maximum number of Masters' respondents gave reason for delegation of information collection to others as lack of time (49%), followed by unfamiliarity with the sources (32%). The lowest rank was obtained for task is tedious (19%). Similar response was given by Ph.D. students with some variation in percentage. The highest ranked reason for delegation of information collection to others was lack of time (48%), followed by unfamiliarity with the sources (40%) and the task was tedious (12%).

Data placed in Table 7 indicates the learning of respondents about information gathering from different sources. It is evident from table that highest percentage of the Masters students (94%) learnt themself with trial and error method about information gathering from different sources, followed by friends and fellows (91%) and teachers (81%). Whereas lowest percentage of the respondents (40%) learnt from training provided by library staff. In this way majority of the Ph.D. students (93%) learned by self (trial and error method) and friends/fellow about gathering information from different sources, whereas 35 per cent of the respondents learnt it from someone at terminal.

Table 8 clearly indicates that respondents had spent as high as 10 hrs a day for information seeking. It was found that majority of respondents (94%) from Masters have spent 1 to 4 hours per day for information seeking, whereas only 2 percent of respondents had spent 7 to 10 hours per day. But in case of Ph.D., maximum of respondents (i.e. 50%) had spent 1 to 4 hours per day, whereas only 8 percent of students spent 7 to 10 hours per day for information seeking. Analysis of the data clearly indicated that Masters and Ph. D respondents significantly vary among categories of 1-4 hr. and 4-7 hr. at 5 per cent level of significance. Results are in contradiction with Tenopir *et al.* (2009).

Learning method/source	Masters (n=80)	Ph.D. (n=40)	Total	Z Value
	f (%)	f (%)		
Self (trial and error method)	75(94%)	37(93%)	112(93%)	0.212
Online instructions	68(85%)	32(80%)	100(83%)	0.693
Friends/fellows	73(91%)	37(93%)	110(91%)	0.374
Training provided by library staff	32(40%)	20(50%)	52(43%)	1.042
Workshop/short course	39(49%)	17(43%)	56(46%)	0.621
Someone at terminal	38(48%)	14(35%)	52(43%)	1.354
By reading books/articles etc.	47(59%)	21(53%)	68(56%)	0.626
From Teachers	65(81%)	34(85%)	99(82%)	0.542

Table 7: Distribution of respondents according to learning of information gathering from different sources

#### Table 8: Distribution of respondents according to average time spent on information seeking

Average time you spent	me you spent Masters (n=80) Ph.D. (n=40)		. (n=40)	Z Value	
on information seeking (hours/day)	f (%)	Ranking	f (%)	Ranking	
(1-4)	75(94%)	1	20(50%)	1	5.611*
(4-7)	3(4%)	2	17(42%)	2	5.265*
(7-10)	2(2%)	3	3(8%)	3	1.581

\*significant at 5 % level of significance

# CONCLUSION

Study of information seeking behavior is very important process to meet the information requirements of students. With the spread of ICT behavior of students has been changed drastically as for the information seeking is concerned. Although methods of information seeking have been changed but still the traditional methods or sources cannot be completely ruled out. As it is clear from the present study traditional methods like text books, lecture notes, meeting with experts, teachers, etc. are still most popular among students. On the other hand modern techniques like internet browsing are also much popular methods. Thus it can be concluded that traditional methods are equally important as modern methods/sources as far as information seeing behavior is concerned. Thus a blend of both i.e. traditional sources and ICT will be more effective for maximum utilization of resources.

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# Development of A Scale to Measure the Job Satisfaction of Extension Personnel: A Methodological Approach

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#### ABSTRACT

Job satisfaction of the employees in any organization is an important indicator of the health of the organization. The present study is taken up with the objective to develop and standardize a scale to measure the job satisfaction of extension personnel. Job satisfaction in the present study is operationally defined as the positive orientation of an individual towards the work role which he is presently occupying. A tentative list of 41 items was drafted keeping in view the applicability of items suited to the area of study. The method of summated rating suggested by Likert was followed in the construction of job satisfaction scale. Items which were statistically significant were retained in the final scale. The final job satisfaction scale consists of 21 items and is found to be reliable and valid; hence it can be used to measure the job satisfaction of extension personnel.

Keywords: Extension personnel, Job satisfaction, Summated rating method

## INTRODUCTION

Job satisfaction of the employees in any organization is an important indicator of the health of that organization. The concept of job satisfaction has been developed in many ways by many different researchers and practitioners. Lawler (1973) defined job satisfaction as a person's affective reaction to his total work role. Kallerberg (1977) pointed that job satisfaction refers to an overall affective orientation on the part of individual toward work roles which they are presently occupying. Though there are several definitions, one of the most widely used definitions in organizational research is that of Locke (1976), who defines job satisfaction as a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences.

Ensle (2000) reported that job satisfaction in extension is dependent on many factors. Results of the research conducted by Koustelios (2001) also indicated that many personal characteristics affect job satisfaction in many different and complex ways. Lu *et al.* (2005) reported that job satisfaction is related to a number of organizational, professional and personal variables. The job satisfaction in the organization greatly facilitates the task of administrators because it creates favourable conditions for the overall progress of the organization (Mishra, 2005). Wright *et al.*  (2007) reported that a worker's satisfaction does influence his job behaviour and job satisfaction is associated with high employee performance. The study conducted by Faizuniah *et al.* (2011) showed that low levels of reward, responsibility and structure leads to low level of job satisfaction.

For any meaningful development in the agricultural sector, agricultural extension can play a pivotal role. Extension does not only involve delivering information to farmers, but should also attempt to make farmers creative, self-confident and competent enough to overcome their own problems and dilemmas (Sulaiman and Hall, 2003). Hence, extension personnel that are saddled with this responsibility need to be satisfied with their job in order to perform their duties effectively and efficiently. Though there are a number of methods for measuring the job satisfaction, extension personnel's job satisfaction unfortunately have not drawn sufficient research attention which again is due to non-availability of pertinent items in the scale to correctly measure the perception of the extension personnel towards their job satisfaction. Hence, the present study is taken up with the following objective of developing and standardizing a scale to measure the job satisfaction of extension personnel

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# MATERIALS AND METHODS

Job satisfaction in the present study is operationally defined as the positive orientation of an individual towards the work role which he/she is presently occupying. It can be measured in different dimensions such as pay, promotion, benefits, rewards, satisfaction with supervisor, co-workers and clienteles, operating conditions and the nature of work. The method of summated rating suggested by Likert (1932) and Edwards (1969) were followed in the construction of job satisfaction scale. Though there are several techniques for scale construction, summated rating method is relatively simple and saves time. Moreover, it provides an opportunity to select the items based on their discriminating power. The methodologies followed for the development of the scale are discussed hereunder.

**Defining the Construct:** A construct is a concept with added meaning, deliberately and consciously invented or adopted for scientific purpose which can be able to measure in magnitude (Kerlinger, 1973). It is a concept with a measurement dimension. In the present study, the construct was job satisfaction of extension personnel.

Identification and Operationalization of the Dimensions under the Construct: Major dimensions identified under this construct were pay, promotion, benefits, rewards, relation with supervisor, co-workers and clienteles, operating/ working conditions and the nature of work.

**Collection and Formulation of Items:** Items are the statements representing each dimension of construct under the study. A tentative list of 41 items/statements reflecting the job satisfaction of extension personnel was prepared based on extensive review of literature, consultation with the experts from agricultural extension discipline and also based on the field experience of the researcher.

**Scrutiny of Items:** The items so identified were carefully examined and edited in the light of 16 criteria suggested by Edward (1969) and Thurstone and Chave (1929). After discarding repeated, restructured and ambiguous statements, 30 items were kept in the schedule for administration.

*Item Analysis:* Item analysis was carried out on the items selected in the first stage to delineate them based on the extent to which they differentiate the job satisfaction of extension personnel as satisfied or dissatisfied. A schedule

consisting of 30 items was prepared and used for personally interviewing the perception of extension personnel regarding their job satisfaction on a five point continuum ranging from strongly disagree to strongly agree from non-sample respondents during pilot study. A scoring pattern of 1 to 5 was adopted for the continuums starting from strongly disagree to strongly agree. A reverse scoring pattern was adopted for negative statements. For item analysis, the respondents were arranged in ascending order based on their total scores. Twenty five per cent of the subjects with the highest total score and 25 per cent with the lowest total scores were selected. These two groups were considered as the criterion groups in terms of which item analysis was done. Items or statements were selected on the basis of higher 't' value over a cut-off point of 1.75. Only those statements with significant t values (t e" 1.75) were retained and incorporated in the final scale. Based on t value, 21 items were found to be significant. Thus, items which were statistically significant were retained in the final scale to measure the job satisfaction of extension personnel.

$$t = \frac{\overline{x}_h - \overline{x}_l}{\sqrt{\frac{s_h^2}{n_h} + \frac{s_l^2}{n_l}}}$$

 $\overline{\mathbf{x}}_{h}^{} = \text{Mean score of given statement in high group}$   $\overline{\mathbf{x}}_{l}^{} = \text{Mean score of given statement in low group}$   $\mathbf{s}_{h}^{2} = \text{The variance of the distribution of responses in high group}$   $\mathbf{s}_{l}^{2} = \text{The variance of the distribution of responses in low group}$   $\mathbf{s}_{l}^{2} = \text{number of subjects in high group}$   $\mathbf{n}_{h} = \text{number of subjects in low group}$  Reliability Test: Reliability is the ability to give consistent

**Reliability Test:** Reliability is the ability to give consistent and accurate measurement in repeated testing with the same instrument. The split-half method or internal consistency was employed to test the reliability of the presently developed scale. It helps to assess the homogeneity of items in the scale. In this method items were divided in to two equal halves and found the inter correlation between the two groups. Coefficient of internal consistency (Spearman's rho) of this scale is 0.844. In order to avoid or nullify the problems associated with the grouping, Cornbach *alpha* coefficient has been used. Cornbach *alpha* coefficient of this rating scale is 0.860.

#### List of Statements for the Job Satisfaction Scale of Extension Personnel

S.No.	Items	't' value
I)	Satisfaction with Pay, Promotion, Benefits Rewards	
1.	I am satisfied with my present salary	2.05
2.	I think scope for my salary increases are not satisfying*	1.23
3.	The chances for promotion in my job is not convincing*	2.65
4.	There is a fair rule to judge the chances of being promoted	2.05
5.	I am satisfied with the benefits I receive	0.00
6.	I think the benefits which I receive are not as good as other organizations offer*	2.13
7.	I am satisfied with my present position, when I compare it to similar positions elsewhere	5.07
8.	I am not satisfied with the amount of time and energy devoted to my present position and the recognition I receive from it*	4.31
9.	My extra efforts in job are not properly recognised*	0.53
10.	I am satisfied with the rewards given for good performance in my job	3.68
II)	Satisfaction with Supervisor, Co-workers, Clienteles	
11.	I like my supervisor since he/she allow me to express my views in decision-making	3.25
12.	I am satisfied with the help and guidance from my supervisor	2.61
13.	Many a times target fixed by the supervisor create pressure on me*	0.56
14.	I am not satisfied with the time taken by the authorities in decision making*	0.96
15.	I don't think the clientele I serve accept me as a professional expert*	6.59
16.	I like my co-workers as they are co-operative	3.68
17.	I feel happy with the co-operation from different stakeholders (fertilizer and seed supply agencies, village and block level staff, university staff, villagers etc.)	0.75
18.	I think am not able to provide the services according to the farmers' needs*	3.40
19.	I am satisfied with the support I receive from the farmers/villagers for performing my job better	3.47
20.	I think the number of clerical assistants available to facilitate my job are dissatisfying*	2.97
III)	Satisfaction with the Operating conditions, Nature of work	
21.	I like my job as it provide me the opportunity to participate in professional get together	2.61
22.	I think rules and procedures in my work place make doing a good job difficult*	0.33
23.	I am satisfied that I have been given enough authority to do my job	0.89
24.	I think frequent transfer is a barrier for good performance*	0.00
25.	My work is delayed due to lack of availability of resources in time*	2.31
26.	I feel my duty is affected by too much clerical/paper work*	1.88
27.	I enjoy freedom for writing and publishing articles	2.67
28.	I am not satisfied with the training given to me for up scaling my knowledge and skill*	3.28
29.	I like my job since it provide me an opportunity for further learning	1.90
30.	I am proud of my job as it provide me an opportunity to serve the farming community	4.12

\* Indicates negative statement

**Validity Test:** Validity refers to whether an instrument is measuring what it intended to measure. Validity of the scale was measured with juries' opinion method. Content validity of the measuring instrument was established through a panel of experts from SAUs, Central Universities and ICAR institutions through Google Form with necessary instructions to critically evaluate each item/statement for its relevancy to measure the job satisfaction of extension personnel and give their response on a five point continuum viz., Most Relevant (MR), Relevant (R), Somewhat Relevant (SR), Less Relevant (LR) and Not Relevant (NR) with the score of 5,4,3,2 and 1 respectively. Total of 21 statements were selected for final scale to measure the job satisfaction of extension personnel.

S.No.	Items	't' value
1.	I am satisfied with my present salary	2.05
2.	The chances for promotion in my job is not convincing*	2.65
3.	There is a fair rule to judge the chances of being promoted	2.05
4.	I think the benefits which I receive are not as good as other organizations offer*	2.13
5.	I am satisfied with my present position, when I compare it to similar positions elsewhere	5.07
6.	I am not satisfied with the amount of time and energy devoted to my present position and the recognition I receive from it*	4.31
7.	I am satisfied with the rewards given for good performance in my job	3.68
8.	I like my supervisor since he/she allow me to express my views in decision-making	3.25
9.	I am satisfied with the help and guidance from my supervisor	2.61
10.	I don't think the clientele I serve accept me as a professional expert*	6.59
11.	I like my co-workers since they are co-operative	3.68
12.	I think am not able to provide the services according to the farmers' needs*	3.40
13.	I am satisfied with the support I receive from the farmers/ villagers for performing my job better	3.47
14.	I feel the number of clerical assistants available to facilitate my job are dissatisfying*	2.97
15.	I like my job as it provide me the opportunity to participate in professional get together	2.61
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17.	I feel my duty is affected by too much clerical/paper work*	1.88
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20.	I like my job since it provide me an opportunity for further learning	1.90
21.	I am proud of my job as it provide me an opportunity to serve the farming community	4.12

\* Indicates negative statement

#### CONCLUSION

The job satisfaction scale developed is found to be reliable and valid; hence it can be used to measure the job satisfaction of extension personnel. It can be concluded that the scale developed is useful in explicitly measuring the job satisfaction of agricultural extension personnel which will help the policy makers in designing innovative extension systems to improve the work efficiency of extension personnel and thereby improving the welfare of farming communities.

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# Correlates of the Attitudes of Tribal Dairy Farmers towards Dairy Entrepreneurship in Balrampur District of Northern Hill Region, Chhattisgarh

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#### ABSTRACT

Dairy helps to improve the status of rural masses, particularly vulnerable sections, consisting of small and marginal farmers, landless laborers, and low-income women. The study was conducted during 2018-19 to know the Attitudes of tribal dairy farmers towards dairy entrepreneurship in the Balrampur district of northern hill region, Chhattisgarh. The results of the study found that the majority of respondents had neutral (74%) Attitude of tribal dairy farmers toward dairy entrepreneurship. The study further revealed that among Seventeen independent variables viz. Age, Gender, Caste, Family Size, Family Type, Experience in Dairy Farming, Education, Social participation, Mass media Exposure, Social contact, landholding, Economic motivation, Income Status, livestock possession, Total milk production, milk consumption and milk sale, where six variables show the positive significant relationship at 1 per cent level and two variables 5 per cent level of probability respectively. The regression analysis showed that all 17 Background variables combined had a significant change in attitude to the 35.80 per cent range. Path analysis shows that the Income status had the highest total effect on the Attitudes of tribal dairy farmers towards dairy entrepreneurship, where the total milk production and the milk sale had the second and third total effect respectively.

Keywords: Attitudes, Dairy entrepreneurship, Path analysis socio-economics, Tribal dairy farmers

# INTRODUCTION

Dairy farming plays an important role in the rural economy of India. India has vast and diverse livestock resources. More than two-thirds of Indian farmers belong to the marginal and small categories and are severely constrained by crop cultivation in increasing income. The ubiquitous aspect of any Indian village is the presence in every household of 1-2 milk animals or a few small stocks such as goat or poultry, which serves mainly as a source of additional income. Dairying helps improve the status of particularly weaker sections of rural masses, composed of small and marginal farmers and landless labourers, and low-income women. In India, a large majority of milk producers have one or two milk animals and account for about 70 per cent of milk production. (Thankachan and Joseph, 2019). Dairying, as a subsidiary source of income, is a real relief to most of society's weakest groups. Often, one or two milk animals allow farmers to generate sufficient additional income to break the vicious agricultural debt situation (Thankachan and Joseph, 2019). Dairy farming is usually performed as a subsidiary occupation by farmers to meet domestic needs as well as to supplement their agricultural income. But in today's era, when most rural people have small landholdings, livestock production is expected to be pro-poor and vibrant in reducing poverty (Birthal and Taneja, 2006). During 2011-2012, the livestock sector contributed 3.92 per cent of national GDP (NDDB, 2014). North Indian State is one of the leading milk producers in the country. Around 17.31 million people in the state live in rural areas constituting 62.50 per cent of its total population. The livestock sector has contributed 8.4 per cent to the Net State Domestic Product at constant (2004-05) prices in 2010-11 (GADVASU, 2014). The livestock sector offers farmers and households in the state on a large scale of part-time and full-time employment prospects. In the newly created State of Chhattisgarh in

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India, livestock is an almost integral and inseparable component of the agriculture system. The rural poor have lived in difficult conditions and livestock tend to be an active partner in their endeavours.

Entrepreneurship is a new dimension of agriculture. The entrepreneurs are key persons of any country for promoting economic growth and technological change (Goswami et al., 2019). The development of entrepreneurship is directly related to the socio-economic development of society (Chaurasiya et al., 2015). Dairy farming has undergone considerable change in recent decades and stockmanship quality has become an increasingly important factor in good animal husbandry. The nature of the relationship between humans and animals and the motivation for a farmer's work are both major factors in animal productivity (Hemsworth and Coleman, 2010). Animal welfare assessment on-farm is usually a tradeoff between good scientific practice and both practical and economic limitations that need to be met to obtain scientifically useful information. In an earlier study, in a semi-structured interview situation, we examined the attitudes of farmers by examining qualitatively how they discuss the topic of improving animal welfare (Kauppinen et al., 2010). The development of effective tools for use in vocational guidance interventions and career consulting services is one of the tangible ways in which current entrepreneurship research can contribute to this goal (Almeida et al., 2014; Santos et al., 2013). Essentially, it is assumed that individuals who are higher in their attitude toward the enterprise would be more likely to engage in entrepreneurial activities and thus have a higher attitude toward them. Moreover, earlier evidence indicated that theoretically and empirically an attitude to an enterprise is associated (Santos et al., 2013; Spagnoli et al., 2016). Given the critical significance of dairy farming in the tribal region, it is important to improve tribal dairy farmers' attitude toward the dairy Entrepreneurship, and this is one of how rural tribal people are more capable of dairy farming. Therefore, the present study was conducted with specific objects to analyse the Attitude of tribal Dairy Farmers toward Dairy Entrepreneurship and also to establish a relation between the independent variables and Attitude of tribal Dairy Farmers toward Dairy Entrepreneurship.

#### MATERIALS AND METHODS

The study was conducted during the year 2018-19 in Balrampur District of northern hill Region, Chhattisgarh.

The methodology suggested by Ray and Mondal (2011), was followed with the necessary modifications as per the context and objective of the present study to be investigated. Research design is the framework of methods and techniques selected by a researcher. It is the set of methods and procedures used in the collection and analysis of variable measurements defined in problem research. The present study was followed ex-post facto Research Design in Balrampur District of northern Hill region, Chhattisgarh state for study on Attitudes of tribal Dairy Farmers towards Dairy Entrepreneurship.

The Balrampur district where this study was conducted is located in the northern part of the state of Chhattisgarh in central India. It was created out of the former district of Surguja and came into being on January 17, 2012. The district shares its borders with the Uttar Pradesh, Jharkhand, and Madhya Pradesh states and is spread over a total land area of approximately 60.16 lakh hectares. A significant part of the district is dominated by the hilly and thickly forested terrains of the Satpuda ranges. Paddy and maize are the primary crops grown by farmers, while groundnut, wheat, and gram are also grown in some irrigated parts of the Balrampur district forming part of the Chhattisgarh Northern Hills agro-climatic region. A hot summer and well-distributed rainfall (125 cm average) during the monsoon time of the year are the characteristics of the district's climate. The district has a total population of 7,30,491 individuals with a sex ratio of 973 females per 1,000 males. It is a tribal-dominated district with almost 63 per cent of the population of the Scheduled Tribes, while the Scheduled Castes make up only 4.5 per cent of the total population of the region. Pahadi Korwas, Gonds, Khairwars, Kanwars and Pandos are the main tribal groups living in the district. The culture and traditions that people follow are greatly influenced by tribal beliefs and practices. Karma and Chherta are the major tribal festivals celebrated with Hindu festivals like Diwali, Holi, and Sankranti celebrated by a large majority of the population. Tatapani, Dipadih, Bacchraj Kunwar are the main tourist attractions. Agriculture is the primary occupation of a large majority of the working population while animal rearing is the most common secondary occupation (Balrampur District Govt. of Chhattisgarh website, 2020).

The state of Chhattisgarh consists of 27 districts, out of which the district of Balrampur was selected purposively based on the investigator's knowledge of the culture of the people and Command in Regional Language
which was helped to develop a report from the respondents for the present study. Out of total six blocks in Balrampur district namely, Balrampur, Ramchandrapur, Wadrafnagar, Raipur, Shankargarh, and Kusmi (Samri) where only two blocks namely Ramchanderpur and Balrampur was selected purposively. From Ramchanderpur block 2 villages and Balrampur block 2 villages were selected based on the maximum availability of dairy farmers in the villages. In this way, the villages, Keoli, Gamhariya, from Ramchaderpur block and Manikpur, Kotarki from Balrampur block were selected for the study. A list of farm families who are engaged in Dairy farming was prepared. From the list of each selected village, 30 farm families were selected randomly. In this way, a total of 120 farm families (30 \* 4 = 120), were selected as respondents.

The collection of data had been taken through a personal interview with the help of a pre-tested structured schedule. In the present study, eighteen independent variables viz. Age, Gender, Caste, Family Size, Family Type, Experience in Dairy Farming, Education, Social participation, Mass media Exposure, Social contact, landholding, Economic motivation, Income Status, livestock possession, Total milk production, milk consumption, and milk sale where Attitudes of tribal Dairy Farmers towards Dairy Entrepreneurship as a dependent variable have been taken.

Allport (1935) defined attitude as a mental state of readiness, organized through experience, exerting a directive and dynamic influence upon the individual's response to all the objects and situations with which it is related. To measure the attitudes of the livestock owners towards dairy farming, the scale of Gupta and Sohal (1976), named "attitude towards dairy farming" scale was used. The scale consisted of thirteen statements. The scoring for the positive statements was strongly agree-5, agree-4, undecided-3, disagree-2, and strongly disagree -1. For the negative statements, the reverse order of scoring was followed. The Attitudes of tribal Dairy Farmers towards dairy entrepreneurship data was calculated and compared the relationship between the dependent and independent variables through the using of statistic tool viz. frequency, percentage, simple correlation, regression, and path analysis with the help of SPSS version 16.0 software as well as the help of OPSTATE Website. The information was collected by directly asking the respondent and then categorized by used classification as the mean and standard deviation in the following categories: Based on the mean and standard deviation of the total score, the respondents were categorized as Unfavourable, Neutral, and favourable.

Category	Attitude of dairy farmers
Unfavorable	< (Mean – S.D.)
Neutral	(Mean – S.D.) To (Mean + S.D.)
Favorable	> (Mean + S.D.)

#### **RESULT AND DISCUSSION**

Attitude is the composite measure of thirteen components. The data in this regard have been presented from Table 1 that the majority (74%) of the respondents had a Neutral Attitude, 18 percent of the respondents scored Unfavorbale Attitude and the remaining 8 percent of the respondents had a favourable Attitudes. The mean score of the total distribution is 53.88 and the standard deviation of the distribution is 9.30. From the results, it is clear that most of the dairy farmers had Neutral Attitudes of tribal dairy farmers towards dairy entrepreneurship. This might be due to the major components of the dairy farmers towards dairy entrepreneurship.

Table 1: Attitudes of tribal dairy farmers towards dairy entrepreneurship (N=120)

Category	Frequency	%tage	Mean	S. D.
Unfavorable < 41.58	22	18	53.88	9.30
Neutral 41.58 - 66.18	89	74		
Favorable > 66.18	9	8		

The zero-order correlation coefficient established the relationship between the Attitudes of tribal dairy farmers towards dairy entrepreneurship and different attributes such as Socio - Personal, Socio-Economic, and Socio-Communicational characteristics.

It was found from Table 2 that among Seventeen background variables only Six variables viz. Landholding, Mass media exposure, Income status, Herd Size, Total milk production, Milk consumption, and milk sale showed positive and significant relationships at a 1% level of probability, whereas Education and Milk consumption showed a positive and significant relationship at 1% level of probability. Age, gender, cast, family size, family type, experience in dairy farming, Social participation extension

Variables	'r' Value	'P' Value
Age (X <sub>1</sub> )	0.075	0.413
Gender $(X_2)$	0.122	0.185
Cast (X <sub>3</sub> )	-0.037	0.691
Family size $(X_4)$	0.116	0.206
Family type $(X_5)$	-0.079	0.392
Landholding $(X_{\phi})$	.337**	0.000
Experience in dairying $(X_{\gamma})$	0.096	0.298
Education $(X_8)$	.213*	0.019
Social participation (X <sub>9</sub> )	0.01	0.913
Mass media exposure (X <sub>10</sub> )	.351**	0.000
Extension contact $(X_1)$	-0.032	0.725
Economic motivation $(X_{12})$	0.069	0.455
Income status (X <sub>13</sub> )	.487**	0.000
Herd size $(X_{14})$	.269**	0.003
Total milk production $(X_{15})$	.385**	0.000
Milk consumption $(X_{16})$	.211*	0.021
Milk sale (X <sub>17</sub> )	.385**	0.000

Table 2: Correlation between selected background Variables (X) and Attitudes of tribal dairy farmers towards dairy entrepreneurship (Y) (N = 120)

\*\*Correlation is significant at the 0.01 level (2-tailed).

\*Correlation is significant at the 0.05 level (2-tailed).

contact, and economic motivation did not establish any significant relationship with attitudes. Hence, the null hypothesis was accepted to the characteristics and concluded that these characteristics were not correlated with the Attitudes of tribal dairy farmers towards dairy entrepreneurship.

To know the important varieties with their prediction ability in explaining the dependent variable of respondents, multiple regression analysis was carried. The regression coefficient (b) values and 't' values are presented.

Table 3 Presented that the selected traits had a 35.80 percent explanation of variation in the Attitude of respondents toward dairy farming was the result of the influence of al 17 variables put together. This variation was observed to be statistically significant at 0.05 level of probability. Therefore, the null hypothesis was rejected by accepting the empirical hypothesis and concluded that all the 17 independent variables put together have influenced significant variation in Attitude toward dairy farming to the extent of 35.80 percent. However, the large proportion (64.20%) of unexplained variation in the dependent

Table 3: Regression analysis between background Variables (X) and Attitudes of tribal dairy farmers towards dairy entrepreneurship (Y) (N = 120)

Variable	'b' Value	't' Value	P-value
Age (X <sub>1</sub> )	0.089	0.592	0.555
Gender $(X_2)$	5.441	1.713	0.09
$Cast(X_3)$	-0.259	-0.265	0.792
Family size $(X_4)$	0.056	0.232	0.817
Family type $(X_5)$	-1.338	-0.648	0.519
Landholding $(X_6)$	0.186	0.175	0.861
Experience in dairying $(X_7)$	-0.061	-0.408	0.684
Education (X <sub>8</sub> )	0.211	0.229	0.819
Social participation $(X_9)$	-0.24	-0.496	0.621
Mass media exposure $(X_{10})$	1.201*	2.084	0.04
Extension contact $(X_1)$	-0.761	-1.209	0.229
Economic motivation $(X_{12})$	0.27	0.776	0.44
Income status $(X_{13})$	0.001**	2.496	0.014
Herd size $(X_{14})$	-0.034	-0.346	0.73
Total milk production $(X_{15})$	0.152	0.035	0.972
Milk consumption $(X_{16})$	0.72	0.165	0.869
Milk sale (X <sub>17</sub> )	0.135	0.031	0.975

\*\*Correlation is significant at the 0.01 level (2-tailed) \*Correlation is significant at the 0.05 level (2-tailed).  $R^2 = 35.80$ 

variables may be attributed to the factors other than the selected independent variables. These findings indicated that mass media exposure and Income status was showing positively significant at a 0.05% confidence level.

Path analysis is a technique that aims at determining the direct and indirect effects among the number of variables and thereby helps to a quantitative interpretation of the interrelationships within a known or an assumed casual system that exists in some specific population. The result extracted from path analysis shows that the independent variable affected (direct and indirect effect) on entrepreneurship

It has been found from the Table 4 that the variable Milk sale  $(X_{17})$  has the highest total indirect effect on the Attitude of tribal Dairy Farmers toward Dairy Entrepreneurship (Y) reaming Landholding  $(X_0)$  and Herd size  $(X_{14})$  has been second and third position respectively. Income status  $(X_{13})$   $(X_{15})$  had the highest direct effect remaining Mass media exposure $(X_{10})$  and Gender  $(X_2)$  has been the Second and third passion direct effect respectively. Income status  $(X_{13})$  had the highest total effect on Attitude

Variable	<b>Total Indirect effect</b>	<b>Total Direct effect</b>	Total effect
Age (X <sub>1</sub> )	-0.027	0.102	0.075
Gender $(X_2)$	-0.030	0.152 (Third)	0.122
$Cast(X_3)$	-0.013	-0.024	-0.037
Family size $(X_4)$	0.095	0.021	0.116
Family type $(X_5)$	-0.025	-0.054	-0.079
Land holding $(X_6)$	0.315 (Second)	0.022	0.337
Experience in dairying( $X_7$ )	0.166	-0.070	0.096
Education $(X_8)$	0.184	0.029	0.213
Social participation(X <sub>9</sub> )	0.055	-0.045	0.010
Mass media exposure( $X_{10}$ )	0.088	0.263 (Second)	0.351
Extension $contact(X_{11})$	0.073	-0.105	-0.032
Economic motivation( $X_{12}$ )	-0.003	0.072	0.069
Income status $(X_{13})$	0.097	0.390 (Fist)	0.487 (Fist)
Herd size $(X_{14})$	0.311 (Third)	-0.042	0.269
Total milk production $(X_{15})$	0.295	0.090	0.385 (Second)
Milk consumption( $X_{16}$ )	0.188	0.023	0.211
Milk sale (X <sub>17</sub> )	0.389 (Fist)	-0.004	0.385 (Third)

Table 4: Path Analysis between the background Variables (X) and Attitudes of tribal dairy farmers towards dairy entrepreneurship (Y) (N=120)

of tribal Dairy Farmers toward Dairy Entrepreneurship where total milk production  $(X_{15})$  and Milk sale  $(X_{17})$  has been the second and third position in total effect respectively. The potential explanation for this assumption may be that respondents with greater holding will be likely to seek to take specific scientific modifications. As Attitudes of tribal dairy farmers towards dairy entrepreneurship results, farmers with the highest total of milk production are likely to have a strong desire to know about and be more open to a new practice, thus improving the knowhow, income status, and landholding which directly and indirectly imitate their attitude. Since the dairy is a highly remunerative enterprise, tribal dairy farmers expect the Total milk production to exponentially increase and compete vigorously to undertake efforts.

# CONCLUSION

The study was concluded that the majority of the respondents fall under a Neutral Attitude toward dairy farmers toward Entrepreneurship. Among Seventeen Background variables, six variables viz. Landholding, annual income, total milk production, milk sale, mass media exposure, herd size were having at one percent level of a positive significant relationship, and Education and milk consumption was having at five percent level of Significant with their Attitude of dairy farmers toward the Entrepreneurship. Regression analysis had shown all the 17 background variables put together have influenced significant variation in the Attitude of dairy farmers toward the Entrepreneurship to the extent of 35.80 per cent. Path analysis shows that the Background variable affected (direct and indirect effect) on Attitude of dairy farmers toward the Entrepreneurship where Income status had the highest total effect on attitude remaining Total milk production and Milk sale has been the second and third passion in total effect respectively. The above fact shows that most farmers have Neutral Attitudes of tribal dairy farmers towards dairy entrepreneurship is a clear indication of the opportunity to push them towards a high level of entrepreneurship. Attitudes of tribal dairy farmers towards dairy entrepreneurship have a positive impact on dairy production, as it allows tribal dairy farmers to learn and adapt to the changing situations. The logical reason may lie in the fact that dairy farmers can become more involved in their dairy Entrepreneurship and employ the latest innovation. Therefore, necessary to raise the commercial viability and profitability attitudes among dairy farmers. Dissemination the awareness knowledge and encourages the tribal framers is urgently needed and essential for the development of dairy entrepreneurship in the study area.

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# Role of Women in Small Ruminant Disease Control within Kenema District, Eastern Sierra Leone

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#### ABSTRACT

The rearing of ruminants play an important role in the provision of protein needs in the daily diet of rural farmers and provides financial support for many rural women in Sierra Leone. The main aim of this study was to find out the role played by women in the control and prevention of diseases among small ruminants in the Kenema District and to identify the types of small ruminants reared in the district by women, to ascertain the number of females that shepherd these small ruminants. Multistage sampling technique was used to select 8 chiefdoms from Kenema District and 100 respondents were randomly selected from each of the chiefdoms. Both primary and secondary sources of data were used. A semi-structured questionnaire was used to collect data from the female farmers who served as respondents for this study. In addition to this, information was obtained from other small ruminant farmers and expert opinion was sort in order to enrich this study. Major findings reveal that most (60%) of the women in the study area reared goats and 48.15 percent of the small ruminants were owned by only women. Majority (78.22%) of the women had a herd size of 1 to 10. Majority of the women (83.17%) in the study area had spent between 1 to 5 years in raising small ruminants and 37.62 percent of the small ruminants were killed by diseases. Only 5.9 percent of the women reported that they treat the small ruminants themselves. According to the study, worm was a major threat that affected small ruminants as it was reported by more than one-tenth (13.9%) of the respondents.

Keywords: Disease prevention, Livestock, Prevention, Small ruminant, Women

## **INTRODUCTION**

The role played by women generally in agricultural activities in Sub-Saharan African and the world cannot be overemphasized. According to FAO (2011a), women make up the majority of poor livestock keepers, representing two-thirds of the estimated 600 million poor livestock keepers in the world (FAO, 2011a). In South Asia, many species of livestock are reared by women (including buffalo, cattle, yaks, small ruminants and poultry) and have access to some of their products, even when the husband is the formal owner (Miller, 2011).

Women play a significant role in the domestic and national socio-economic development of many countries in sub-Sahara Africa. In livestock production, it has been indicated by Flinton (2010) that women play a pivotal role at least equal to that of men. However, their input has been overly underrated. This may be as a result of male dominance. Women, therefore, need to value their work and have strong confidence in themselves. Although women are responsible for taking care of most livestock, they do so amidst severe constraints due to the high illiteracy rate, immobility and low status among them. They are as well deprived of many other facilities which are accessible by men. There is a tendency for women to be more illiterate especially in rural communities than their male counterparts. This makes it difficult for them to gain the confidence to ask questions. When they seek help from veterinarians or experts, they are often neglected (Miller, 2011).

As many livestock disease control programmes in Africa depend on para-professionals and livestock producers to carry out animal health care services. It is expedient that they understand the different roles household

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members play in delivering animal health care (Curry *et al.*, 1996).

In Sierra Leone, small ruminants are a very important part of the food chain and for the most part, they provide a good percentage of the total protein intake for residents in the country. The health of such an important class of animal is of prime concern. Naturally, like all other living things, they from time to time may have health challenges and how these health challenges are resolved, who resolve them, and what mechanisms are put in place to mitigate these health problems are of great concern. The Food and Agricultural Organization (FAO), in partnership with the Livestock and Veterinary Services Division of the Ministry of Agriculture, Forestry and Food Security (MAFFS) conducted a five-day complete vaccination of small ruminants and other farm animals against major disease threats in Kenema district and five other districts in the country. In an attempt to prevent small ruminant diseases, FAO carried out a blanket vaccination exercise in 12 Agribusiness Centres (ABC) in 2017. Many communities in Bo, Moyamba, Kono, Kenema, Kailahun and Koinadugu Districts benefited from this exercise. In each ABC and nearby community, at least two thousand animals were vaccinated.

According to the Sierra Leone Housing and Population Census (2015), Agricultural households in Kenema district amounted to 71,698 and out of this number, 55,368 were headed by men and the remaining 16,330 households were headed by women. It now becomes important if not imperative to investigate the huge breadwinner female population in Kenema district to ascertain what percentage of these women are actively participating in small ruminant rearing and their roles in disease prevention and control. Since women play a major role, they are more likely to show interest in small ruminant rearing than cattle for the simple fact that they are normally less difficult to handle. According to FAO (2012b), rural women tend to have an affinity and preference for indigenous breeds rather than improved breeds because they are easier to take care of.

This trend has in recent years seen some amount of changes as animal husbandry is now turning their attention to raising these animals for sale in local markets or even beyond. Despite this move, improvement or the use of improved animal husbandry practices including health care are still at a very low scale. There exist high potentials that valuable benefits can be obtained from even modest improvement programs within a short time.

## MATERIALS AND METHODS

Kenema district is located in the Eastern Province of Sierra Leone and the largest city in the district. Many ethnic groups live in the district but the Mendes make up the largest. Kenema is a major market town for many agricultural activities especially the timber industry in Sierra Leone. The area's production of cocoa, coffee, palm oil and kernels, furniture, and wood carvings is largely transported by road to Freetown for sale and export. The annual rainfall is estimated at 2,001 to 3,000 mm which is favourable for agricultural activities.

Even though Kenema has huge potentials for agriculture, it is said to be one of the most food-insecure districts in the country. The State of Food Security and Nutrition in Sierra Leone (2010) report stated that 33.8 per cent of the households in the district are food insecure. The district exceeded the 40 per cent critical threshold of chronic malnutrition set by WHO. The situation was further worsened by the Ebola outbreak in March 2014 eroding livelihoods, especially as Kenema is a cash-crop production area. Labourers were affected by restrictions and quarantines with production and trading being significantly impacted.

The main aim of this study was to find out the role played by women in the control and prevention of diseases among small ruminants in the Kenema District, to identify the types of small ruminants reared in the district by women, and to ascertain the number of females that shepherd these small ruminants. To achieve these objectives, a multistage sampling technique was used. Purposive sampling technique was used to select the district for this study and 8 chiefdoms were randomly selected. Random sampling technique was used to select a total of 101 women who are involved in the rearing of small ruminants in the study area. Both qualitative and quantitative methods were used and a combination of both primary and secondary sources of data to enrich this study. A semistructured interview schedule was used to elicit information from the respondents. In addition to this, other small ruminant farmers and expert opinion were sought to get additional information to enrich this study.

#### **RESULT AND DISCUSSIONS**

Result from Table 1 shows that majority (60.40%) of the women reared goats, nearly one-fourth (24.75%) of the women reared goats and sheep and only 14.85 per cent of the women reared sheep. The research revealed that

Ruminant	Frequency	Percentage
Goat	61	60.40
Sheep	15	14.85
Goat and Sheep	25	24.75
Total	101	100.00
Ownership of Small Rumina	nts reared	
Women only	36	35.64
Women and Husbands	49	48.51
Female and Children	16	15.84
Total	101	100.00

Table 1: Types and ownership of small ruminants reared

Source: Field Survey (2018)

more women are involved in the rearing of goats than any of the other small ruminants. This is largely due to the fact that raising goats is much easier than sheep. In almost all the chiefdoms visited, sheep are much more expensive than goats. The findings of this research are similar to that obtained by Chawatama *et al.* (2005) in which chicken and cattle were mostly reared by women, having a mean score of 33.8 for chicken and 15.8 for cattle as compared to men who had mean scores of 26.3 for chicken and 14.0 for cattle in the three districts of Chikomba, Kadoma, and Matobo in Zimbabwe.

Furthermore, it is observed that nearly half (48.51%) of the small ruminants were owned by both women and their husbands, 35.64 per cent of the small ruminants were owned by only women, while only 15.84 per cent of the small ruminants were jointly owned by women and their children. In many African societies, it is extremely difficult for women to single-handedly own properties except single-headed households. This may be responsible for the high number of joint ownership of small ruminants in the study area. Results obtained are similar to those obtained by Chawatama *et al.* (2005) who reported that majority of women (60%) said they did not own large animal

Table 2: Table Showing Herd Size of ruminant

Herd Size	Frequency	Percentage	
1 to 10	63	62.38	
11 to 20	22	21.78	
21 to 30	10	9.90	
31 to 40	6	5.94	
Total	101	100.00	

Source: Field Survey (2018)

species like cattle because they lacked the capital to purchase them.

Results from Table 2 revealed that majority (62.38%) of the women had a herd size of 1 to 10, slightly more than one-fifth (21.78%) of the women had a herd size of 11 to 20, nearly one-tenth (9.90%) of the women had a herd size of 21 to 30 whereas, only 5 per cent of the women had a herd size of 31 to 40. From the result, it is clear that the size of the herd raised by the women is relatively smaller when compared to what is raised by women in other African countries like Nigeria, Kenya, Tanzania, Ethiopia etc. The research revealed that the number of women that have small ruminant herd size is by far greater than those with a large number of ruminants. This may be as a result of the workload that women carry in most homes. This does not permit them to raise a higher number of ruminants.

Τ	able	3:	Years of	эf	raising	small	ruminant	s

Years	Frequency	Percentage
1 to 5	84	83.17
6 to 10	15	14.85
11 to 15	2	1.98
Total	101	100.00

Source: Field Survey (2018)

From Table 3, it is observed that most of the women (83.17%) have spent between 1to 5 years in raising small ruminants, 14. 85 per cent have spent between 6 to 10 years in rearing small ruminants, whereas, only 1.98 percent of the women have spent between 11 to 15 years in rearing small ruminants. It can be concluded that the number of women that have spent more years in small ruminant rearing is very small compared to those that have spent just a few years or less. The findings are different from those obtained by Zahoor *et al.* (2013) who found out that majority of the women had 6 to 10 years' experience in raising livestock. Ayoade *et al.* (2009) reported that majority (61.11%) of the women had 11-20 years' experience in livestock production.

From Figure 1, it is revealed that half of the respondents (50.00%) reported that diseases are the major causes of death among small ruminants in the study area. This was followed by thieves (15.80%), predators (10.00%), accident (9.20%), predators and plastic (7.90%), plastic (5.30%) and poison accounts for the least (1.30%), respectively. From the findings, it is evident that raising



Figure 1: Causes of Mortality Rate among Small Ruminants

small ruminants has its own challenges as there are so many threats that hinder the smooth raising of these animals in the communities.

The good news is that despite all these threats women in the six chiefdoms have put in place modalities to mitigate these threats. Even though majority of the women reported mortality rate, 25.00 percent reported that no death has struck their flock which is indicative of the fact that a lot of energy is being put into preventing these ruminants from preventable diseases.

 Table 4: Table showing the form of veterinary facility women

 avail for their herds

Causes	Frequency	Percentage
Does not provide vet service	18	17.80
Vet officer	73	72.30
Private	3	3.00
Self-treatment	6	5.90
Type of facility/traditional medication	n 1	1.00
Total	101	100.00

Source: Field Survey (2018)

From Table 4, it was found that majority (72.30%) of the women seek the services of veterinary officers for their small ruminants, close to one-fifth (17.80%) of the women reported that they do not seek the services of veterinary officers for their small ruminants, 5.90 per cent of the women reported that they treat the small ruminants for themselves, 3.00 per cent of the women reported that they seek the help of private veterinary services for their small ruminants and only 1.0 per cent of the women reported other services for their small ruminants. Majority of the women seek veterinary services for their ruminants which is an indication that these women play a very important role in the control of diseases among small ruminants in the study area. For even the small numbers that do not seek veterinary services, however, have the capacity to raise money for the service. They, however, resort to seeking traditional medication for their herds.

Diseases	Frequency	Percentage	
PPR	35	34.65	
Mange	21	20.79	
Worms	6	5.94	
Orf Virus	3	2.97	
Orf Virus and Mange	1	1.00	
Worms, Orf Virus and Mange	35	34.65	
Total	101	100.00	

Table 5: Types of diseases that affect ruminants

*Source:* Field Survey (2018)

From Table 5, it was observed that more than onethird (34.65%) of the women reported that the disease that affect their small ruminants are PPR and Worm, Orf virus and Mange combined and had equal proportion. This was followed by Mange (20.79%), Worms (5.94%), Orf virus (2.97%) and Orf virus and mange accounted for the least number of 1 per cent. From the result, it can be concluded that the diseases that affect the ruminants, for the most part, are PPR, Orf Virus, Mange, Worms etc.

Those rearing these ruminants have for the most part taken their ruminants for veterinary attention. Those who according to the data collected have to cover long distances or do not have money for veterinary service played role in providing local medication for the ruminants. The results obtained are different from those obtained by Ali *et al.* (2011) who found out that there were 53 types of diseases that affected animals between 2006 and 2010. The most common diseases as reported by them were worm infestation (51.5%), pneumonia and pneumonitis (7.9%). Islam *et al.* (2015) reported that the common diseases found in cattle in Bangladesh were worm infestation (34.2%) and pneumonia (8.7%).

#### CONCLUSION

The findings of this research clearly show that women play an important role in animal diseases control and prevention. Women play critical roles such as feeding, taking the ruminants for veterinary services and cleaning of their sheds. Although some of the ruminants are jointly owned by husbands and wives, wives are the primary caretakers for most of the time even though the husbands and kids give a helping hand at some critical stages. Given the increase in female-headed households and a high number of them living in rural communities, they must be involved in all development efforts. It is, therefore, recommended that training facilities should be provided for these women and organizations should partner with them to enhance their skills so that they can function better. This will increase incomes, livelihoods and increase their role in animal disease prevention and control.

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# Communication Behaviour of Maize Growers in Hilly District Reasi of J&K

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#### ABSTRACT

In India where farmers live in less accessible and isolated villages, dissemination of information is very difficult. In this situation different communication sources could be a potential information source to cater the needs of maize growers of hilly areas to a great extent. Keeping in mind the importance of communication behaviour of the farmers in the transfer of maize production technology, a study was conducted in Reasi District of Jammu and Kashmir. A sample of 20 per cent (150) farmers was selected randomly from selected villages. Majority of respondents were using Extension Personnel of KVK, Extension Personnel of State Departments of Agriculture, progressive farmers, television, radio and relatives and friends as the main sources of information on maize production technologies in a decreasing order of use. It was found that majority of maize growers had medium communication behaviour towards different maize production information sources.

Keywords: Communication behaviour, Information, Maize growers, Maize production, Respondents

### INTRODUCTION

Present Indian extension system is under numerous pressures, where the extension workers have to cater not only the vast number of farmers but also to perform multifarious activities. Under these circumstances, it is not practically possible to serve all the farmers, all the time for all the problems when ratio of extension worker and farmer, the sender and receiver, is more than 1:1000. Therefore, the potential of mass media can be exploited to serve the rural population in this direction. Effective communication from different sources and channels are the essence of extension, which provides knowledge and information for rural people to modify their behaviour in the ways that provide sustainable benefits to them and to the society (Gunawardana et al., 2005). Saravanam and Devi (2008) reported that information and communication technologies can work as a single window system for the improved agricultural information and technology delivery to the farmers by using phone, internet, radio, and television. The personal sources still dominate the agricultural information system in the technologically and

developmentally backward districts (Nain et al., 2015).

Maize is an important crop in hilly and submountainous regions of Jammu and Kashmir, where it forms staple diet of the people. It is widely grown crop in J&K and thrives well in the sandy loam to loamy soils. The crop requires adequate manuring even on the soils which may be considered naturally fertile. Maize crop is a soil exhaustive crop. In Jammu & Kashmir, it is grown in May-June and in some higher hilly areas it is also grown in April. The coarse soils on the hilly slopes are equally conducive for its cultivation. Maize occupies the major area among the cereals crops in J&K. Maize is a potential source of income for the rural people of hilly areas of J&K. Although farmers are adopting the new methods in maize production but still the maize production and productivity is low in Reasi Distt. The low maize production in hilly areas is mainly due to low level of maize production information sources for the maize growers Therefore, the present study was conducted to observe the communication behaviour of maize growers in hilly areas of J&K.

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# MATERIALS AND METHODS

The present study was conducted in hilly district Reasi of Jammu and Kashmir which was selected purposively. Out of 12 C.D. Blocks only 4 C.D. Blocks namely Reasi, Thuroo, Painthal and Pouni were selected randomly. A sample of 20 per cent Gram Panchayats from each selected block was selected randomly. A sample of 20 per cent villages was selected randomly from selected Gram Panchayats. A sample of 20 per cent maize growers (150) was selected randomly from the selected villages. Communication behaviour has been operationalised as maize production information input, maize production information processing and maize production information output behaviour of the respondents in the study. An index was developed to study the communication behaviour of respondents.

Maize production information input was studied in terms of sources of maize production information, maize production information processing was studied in terms of evaluation, storage and transformation of maize production information and maize production information output was studied in terms of dissemination of maize production information.

#### **RESULTS AND DISCUSSION**

The Table 1 shows that the farmers often get the information from extension personnel of KVK (56.66) from State Department of Agriculture (52.00%),

progressive farmers (48.00%), T.V. (46.66%), Radio (44.66%), relatives and friends (40.00%), neighbourers (39.33), salesmen of agricultural inputs (28.66%), local leaders (26.66%) and extension publications (23.33%), respectively.

The farmers also got the information occasionally from neighbourers (44.66%), progressive farmers (41.33%), extension publications (40.00%), local leaders (35.33%), salesmen of agricultural inputs (34.66%), T.V. (34.00%), extension personnel of KVK (33.33%), relatives and friends (32.66%), radio (42.66%), extension personnel of state Department of Agriculture (21.33%), respectively.

The farmers who never got the information from radio (44.00%), local leaders (38.00%), extension publications (36.66%), salesmen of agricultural inputs (36.66%), neighbourers (32.66%), relatives and friends (27.33%), extension personnel of state department of agriculture (26.66%), T.V. (19.33%), progressive farmers (10.66%) and extension personnel of KVK (10.00%), respectively.

The results are in accordance with the results of Lal (2002), Kavaskar and Santa (2008); Meena and Singh (2011); Yadav *et al.* (2011); Dhaka *et al.* (2012); Lal and De (2012) and Sahu *et al.* (2014).

*Maize Production Information Evaluation:* It is clear from the Table 2 that respondents had evaluated the maize production information often by discussing with elder

Table 1: Distribution of respondents on their frequency of using different sources of maize production information

S.No.	Sources of maize production information	Frequenc maiz	Rank		
		Often	Occasionally	Never	
1	Extension personnel of KVK	85(56.66)	50(33.33)	15(10.00)	Ι
2	Extension personnel of State Department of Agri.	78(52.00)	32 (21.33)	40 (26.66)	II
3	Salesmen of agricultural inputs	43 (28.66)	52(34.66)	55 (36.66)	VIII
4	Local leaders	40(26.66)	53(35.33)	57 (38.00)	IX
5	Progressive farmers	72(48.00)	62 (41.33)	16(10.66)	III
6	T.V.	70 (46.66)	51(34.00)	29(19.33)	IV
7	Radio	67(44.66)	17(11.33)	66(44.00)	V
8	Extension Publications	35 (23.33)	60(40.00)	55 (36.66)	Х
9	Neighbourers	44 (29.33)	67 (44.66)	49 (32.66)	VII
10	Relatives and friends	60 (40.00)	49(32.66)	41 (27.33)	VI

Figures in parentheses indicate percentages.

S.No.	Statements		Frequency		Rank
		Often	Occasionally	Never	
Maize	production Information Evaluation				
1	Discuss with elder family members	103 (68.66)	30(20.00)	17 (11.33)	Ι
2	Discuss with neighbourers	65(43.33)	31(20.66)	54 (36.00)	III
3	Discuss with progressive farmers	90(60.00)	20(13.33)	40(27.33)	II
4	Discuss with local leaders / key communicators	58(38.66)	41(27.33)	51 (34.00)	IV
5	Discuss in light of past experiences	56(37.33)	30(20.00)	64 (42.66)	VI
6	Thinking about technical feasibility	46 (30.66)	32(21.33)	72 (48.00)	VII
7	Discuss with SHGs/ farm association/farmers clubs	57(38.00)	33 (22.00)	60(40.00)	V
Maize	production Information storage				
1	By memorization	52 (34.66)	52(34.66)	46(30.66)	Ι
2	Writing in general notebook	34 (26.66)	43(28.66)	73(48.66)	II
3	Preparing subjectwise files	15 (10.00)	10(6.66)	125 (83.33)	IV
4	By preserving the printed matter	16 (10.66)	7 (4.33)	127 (84.66)	III
Maize	production Information transformation				
1	Rearrange the important information as per farmers needs	82(54.66)	35(23.33)	33(22.00)	Ι
2	Rearrange the information in local dialect	15(10.00)	16(10.66)	119 (79.33)	II

Table 2: Distribution of respondents on the basis of maize production information evaluation, maize production information storage and maize production information transformation (N=150)

Figure in parentheses indicate percentages

family members (68.66%),progressive farmers (60.00%), neighbourers (43.33%), local leaders/key communicators (38.66%), by discussing with SHGs / farm association/ farmers clubs (40.00%), on the basis of their past experiences (37.33%) and thinking about technical feasibility (30.66%).

The respondents had evaluated the maize production information occasionally by local leaders (27.33%), by discussing with SHGs / farm association (22.00%), thinking about technical feasibility (21.33%), neighbourers (20.66%), discussing with elder family members (20.00%), on the basis of their past experiences (20.00%) and progressive farmers (13.33%), The percentages of respondents who never evaluated the maize production information by these methods were 48.00, 42.66, 40.00, 36.00, 34.00, 27.33 and 11.33 per cent, respectively.

*Maize production Information Storage:* The Table 2 further shows that the respondents often stored the maize production information by memorization (34.66%), writing in general notebooks (26.66%), by preserving the printed matter (10.66%) and preparing subject wise files (10.00%), respectively. The percentages of respondents who use the

information storage occasionally by these methods were 34.66, 28.66, 6.66 and 4.33 per cent, respectively. The percentage of respondents who never used the maize production information storage by these methods were 84.66, 83.33, 48.66 and 30.66 per cent respectively.

*Maize production Information transformation:* It is clear from the table that the respondents often transformed the information by rearranging the important information as per their needs (54.66%) and rearranging the information in local dialect (10.00%). The percentages of respondents, who occasionally transformed the information were 23.33 and 10.66 per cent respectively. The percentages of respondents who never transformed information by these methods were 79.33 and 22.00 per cent, respectively. The findings are in accordance with the findings of Kadian and Kumar (2003) and Lal and De (2012).

The maize growers after getting the information and processing it disseminate to other farmers. It is clear from the Table 3 that the farmers disseminated the maize production information often to their family members (80.00%), neighbourers (69.33%), those who cultivate in their land (66.00%), friends (64.00%), relatives (63.33%),

S.No.	Statements	Often	Occasionally	Never	Rank
1	To my family members	120 (80.00)	21(14.00)	9 (6.00)	Ι
2	To my relatives	95 (63.33)	43 (28.66)	12(8.00)	V
3	To my neighbourers	104(69.33)	14 (9.33)	32(21.33)	II
4	To my friends	96 (64.00)	34 (22.66)	20 (13.33)	IV
5	To the person who contacted me	82 (54.66)	56(37.33)	12 (8.00)	VII
6	To all the persons known to me	89(59.33)	41 (27.33)	20(13.33)	VI
7	To the farmers of neighbouring villages	71 (47.33)	20 (14.00)	59(39.33)	VIII
8	To those who are cultivating in my land	99 (66.00)	20(13.33)	31 (21.33)	III

Table 3: Distribution of respondents on the basis of maize production information output behavior

Figures in parentheses indicate percentages

Table 4: Distribution of respondents according to their	r
communication behaviour towards maize production farm	ı
information (N=150)	

Level of communication behaviour	Frequency of respondents
$\overline{\text{Low (Below $\overline{X}$ -SD)}}$	21 (14.00)
Medium (in between $\overline{X} \pm SD$ )	78 (52.00)
High (more than $\overline{X}$ +SD)	51 (34.00)

Figures in parentheses indicate the percentages

the persons who were known to him (59.33%), and other persons who contacted him (54.66%) and to the farmers of neighbouring villages (47.33%), respectively. The percentages of farmers who disseminated the maize production information occasionally to others were 37.33, 28.66, 27.33, 22.66, 14.00, 14.00, 13.33 and 9.33 per cent respectively. The percentage of farmers who never disseminated the maize production information to others were 39.33, 21.33, 21.33, 13.33, 13.33, 8.00, 8.00 and 6.00 per cent, respectively. The findings are in line with Yadav *et al.* (2011) and Dhaka *et al.* (2012).

It is clear from the Table 4 that 14.00 per cent respondents had low communication behaviour towards maize production information; 52.00 per cent respondents had medium communication behaviour towards maize production information and 34.00 per cent respondents had high communication behaviour towards maize production information. The finding is in line with Lal and De (2012); Jahagirdar and Balasubramanya (2010); Phukan *et al.* (2013) and Raman (2014).

## CONCLUSION

It can be concluded that communication behaviour of the maize growers was greatly influenced by the Extension

Personnel of KVK, Extension Personnel of State Department of Agriculture, Progressive Farmers, T.V. and radio and they were considered as the effective communication media for dissemination of maize production information. After receiving the maize production information, the farmers mainly disseminated the maize production information to the family members, neighbourers, those who used to cultivate his land, friends and relatives. Majority of the respondents were having medium communication behaviour towards the maize production information sources.

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# Yields, Yield Gaps and Economic Efficiency of Mustard Cultivation in South-Western and Central Punjab, India

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#### ABSTRACT

The present study was conducted to assess the yield gaps in mustard cultivation that affect its economic efficiency in south-western and central Punjab, India. A total of 81 demonstrations (50 in south-western and 31 in central Punjab) were conducted during rabi-2018-19 to investigate the performance of GSC-7 variety, compared with PBR-91. In south-western Punjab, mean grain yield of GSC-7 was higher by ~14 per cent and average net returns were higher by ~53 per cent, compared with PBR-91. Average gross and net returns for GSC-7 were higher by ~23 per cent and ~52 per cent higher as compared to PBR-91. Average B-C ratio for GSC-7 was ~29 per cent higher in south-western Punjab and ~45 per cent in south-western Punjab, compared with PBR-91. Average grain yield of GSC-7 was ~40 per cent higher and of PBR-91 was higher by ~30 per cent in central Punjab, compared with south-western Punjab. The production efficiency of GSC-7 in central Punjab was higher by 4.0 kg ha<sup>-1</sup> d<sup>-1</sup> (~42%), compared with south-western Punjab. Although, mustard yield in south-western and central Punjab were higher, compared with the district and state averages, yet yield gaps of 7.7 and 1.9 q ha<sup>-1</sup>, respectively existed against yield potential for south-western and central Punjab.

Keywords: Economic efficiency, Mustard, Production efficient, South-western Punjab, Yield gaps

#### INTRODUCTION

The rapeseed and mustard are the most important edible oilseed crops of the globe next to soybean and oil palm. In terms of area, production and economic value, oilseeds are second only to food grains (Agriculture Statistics, 2011). India is the largest producer of oilseeds in the world country accounts for 12-15 per cent of global oilseeds area (FAO, 2011), and occupies prime position in the country's economy. India is the 3rd largest producer of rapeseed-mustard in the world after China and Canada. In India, oilseeds are grown in 26 states and union territories with a total production of 5.08 m tones (MT). In India oilseeds are grown in vide range of soils and agro-climatic conditions and its production is still mainly for domestic consumption. Rapeseed-mustard is mainly grown in rainfed conditions and on poor quality soils. The contribution of rapeseed-mustard cultivation to the livelihood security of the small and marginal tribal farmers is substantial. Since, these crops are cultivated mainly in the rain-fed and resource

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scarce regions of the country, therefore, it there yields area always low. Due to the gap between national availability and actual consumption of edible oils, India has to import edible oils. The various extension agencies are continuously making efforts to create awareness among farmers to adopt recommended technologies to enhance production.

Mustard has been considered as potential crop in areas having assured irrigation facilities and favourable soil and climate conditions. There are still a vast yield gaps existing between potential yield and the yield obtained under real farming situation. This may be due to partial adoption of recommended package of practices by the mustard growers. According to Ahmed *et al.* (2017) yield differences at the farmers' fields having the similar soil type, access to irrigation water and even alike varieties are mainly due to the management practices followed by farmers. Singh *et al.* (2017) reported that the reason for low yield could be due to compounded effects of poor crop management practices attributed to the inadequacies of knowledge and the management skills of the farmer. Pingali and Heisey (1999) described that the existence of technical inefficiencies could fully off-set the potential gains of highly superior technologies.

Research managers and development administrators always intend to ensure that the real potential of any crop variety may be realized at the farmers' field (Jha et al., 2011). Therefore, it was important to study the existing yield gaps under different agro-climatic conditions, soils types and irrigation water quality (Singh et al., 2018). Until now, systematic efforts were lacking to realize highest yield of mustard at farmers' field. The constraints in achieving higher yield levels at farmers' field are acknowledged and the frontline demonstrations are designed to overcome the problems in a scientific way (Saravanakumar, 2018). With the introduction of improved latest technologies, it is possible to bridge the yield gap and increase the existing production level up. Keeping this in view, demonstrations were organized in participatory mode with the objective to analyze constraints, yield, yield gaps and economic efficiency of mustard cultivation.

# METHODS AND MATERIALS

**Description of study areas:** The study area in southwestern Punjab (south-western alluvial plain agro-eco-sub region) is characterized by hot, typic arid with hot and dry summers and cold winters, with mean annual temperature ranges between 24°C and 27°C, mean annual precipitation ranges between 300-450 mm, covering 15-24 per cent of potential evapo-transpiration (Singh *et al.*, 2018). The climate of the central Punjab is sub-tropical and is characterized by hot summer with mean maximum temperature of 41°±4°C in June and cool winter with mean minimum temperature of 4°±2°C in December. The average annual rainfall in the study area varied from 600-1200 mm, of which ~75-80 per cent is received in monsoon months during summer season extending from July to September and rest during the winter season.

*Soil analysis:* Surface (0-15 cm) soil samples were collected in the month of October-2018. Soil samples were air dried, ground in wooden pastel and mortar and stored in polythene bags for analysis. Before analysis, soil samples were passed thorough 2.0 mm stainless steel sieve. Soil samples were analyzed for pH (1:2; soil: water) and electrical conductivity (E.C., 1:2; soil: water) (Jackson, 1967). Soil organic carbon was determined by wet digestion method (Walkley and Black, 1934). Available-P in soil

samples was determined by extracting soils with sodium bicarbonate (0.5M, NaHCO<sub>3</sub>, pH=8.5) (Olsen *et al.*, 1954). Available-K in soil samples was determined by extracting with neutral normal ammonium acetate (1N,  $CH_3COONH_4$ ; pH=7.0) by flame photometric estimation (Pratt, 1982).

#### Details of demonstrations

Field preparation and package of practices: The mustard variety GSC-7 was sown between the second fortnight of October and first week of November-2018. Mustard was sown after pre-sowing irrigation. The field preparation includes two operations each of cultivators and disc harrows, followed by planking to pre a fine seed bed. The crop was sown at 3.75 kg seed ha-1 in line 45 cm apart and the plant-to-plant spacing of 10 cm. For mustard crop sown of medium fertile soils, fertilizer-N @ 100 kg N ha<sup>-1</sup> as urea (46% N) was applied in two equal splits; first 1/2 at sowing and remaining half at first irrigation. In soils low in organic C (SOC  $\leq 4.0$  g C kg<sup>-1</sup>), fertilizer-N dose was increased by 25 per cent than the general recommended dose. At sowing, 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> was dressed in the seed zone with seed-cum-fertilizer drill. In Zn deficient soils, farmers also applied 25 kg ZnSO<sub>4</sub>.7H<sub>2</sub>O at field preparation. Weed management was done manually, first hoeing after about 3 weeks after sowing and another about one month thereafter. In the south-western Punjab, farmers applied average 5 irrigations, while in central Punjab farmers applied only 4 irrigations to crop. The crop was harvested manually in the month of April. The grain and straw yield was recorded at each location.

**Crop production efficiency and economics and estimation of economic indices:** The production efficiency was calculated as a ratio of grain yield (kg ha<sup>-1</sup>) and crop duration (days, d). Average crop duration of 154 and 150 days respectively, was considered for estimating the production efficiency of GSC-7 and PBR-91 using Eq. 1)

Production efficiency (kg ha<sup>-1</sup> d<sup>-1</sup>) =  $\frac{\text{Grain yield}}{\text{Crop duration}} \quad ... (1)$ 

Mean cost of cash inputs was estimated as sum of expenditure incurred for the purchase of inputs and labor (men hours). Mean gross returns were estimated as a product of grain yield and selling price of produce using Eq. 2. Mean net returns were estimated as the difference in mean gross returns and mean cost of cash inputs. MGR (Rs.  $ha^{-1}$ ) = Grain yield x Selling price ... (2)

The economic efficiency was determined from a ratio of mean gross returns and average crop duration (d) (Eq. 3).

Economic efficiency (Rs.ha<sup>-1</sup>) d<sup>-1</sup>) =  $\frac{\text{Mean gross returns}}{\text{Crop duration}} ..(3)$ 

#### Statistical analysis

The statistical analysis of crop grain and straw yield, mean cost of cash inputs, mean gross and net returns was carried out by analysis of variance in randomized block design, RBD (Cochran and Cox, 1950). Mean separation for different treatments was performed using Duncan's Multiple Range Test (DMRT) test at p<0.05. Statistical analysis was performed with SPSS for Windows 16.0 (SPSS Inc., Chicago, USA).

#### **RESULTS AND DISCUSSION**

**Basic soil properties:** The pH of surface (0-15 cm) soil layer varied between 8.16 and 8.91 in south-western Punjab, while 7.71 and 7.82 in central Punjab (Table 1). In the southwestern Punjab, pH of soils in cluster-I was significantly lower compared with soils under other two clusters. The electrical conductivity (E.C.) was significantly higher in soils of cluster-II and cluster-III in south-western Punjab. Such differences in soil pH and E.C. in soils under two clusters could be ascribed to the fact that these clusters falls in Jhunir and Bhikhi blocks of south-western district (Mansa) of Punjab. Majority of under-ground irrigation water used for crops in these areas is of poor quality with moderate to high salinity and alkalinity. Soil organic C was significantly lower in cluster-II and cluster-III, compared with cluster-I. The lower SOC concentration in soils under these two clusters was related to relatively light textured soils, compared with cluster-I soils. Available-P was significantly lower in cluster-II and was significantly higher in soils under cluster-III. On the other hand, available-K was significantly lower in cluster-III, and higher in soils under cluster-I. In the central Punjab, however soils under cluster-I and cluster-II did not differed significantly for pH, E.C., SOC and available-P. However, available-K was significantly higher in soils under cluster-II, compared with cluster-I. A non-significant difference in soil pH and E.C. in soils of central Punjab was related to good quality underground water in the area. Soil organic C was ~64.7 per cent higher in soils of central Punjab, compared with soils in south-western Punjab. The E.C. of surface soils was ~31 per cent higher in south-western, compared with central Punjab.

Yield and economics of gobhi sarson: In the southwestern Punjab, mean grain yield of mustard variety GSC-7 varied between 12.7 and 17.9 q ha<sup>-1</sup>, significantly highest in cluster-I and lowest in cluster-II. Grain yield of mustard did not differed significantly in cluster-II and cluster-III (Table 2). In contrast, mean grain yield of PBR-91 in southwestern Punjab varied between 12.3 and 13.6 q ha<sup>-1</sup>, which was significantly lower in cluster-II and cluster-III, compared with cluster-I. These differences could be ascribed to the fact that soils in cluster-I were in general had high fertility. Soils of cluster-I had significantly higher SOC, available-P and available-K concentration, and significantly lower soil pH and E.C., compared with soils under cluster-II and cluster-III. Mean grain yield (average of three clusters) of GSC-7 was 1.8 q ha-1 (~14%) higher compared with PBR-91. Mean straw yield varied between 22.8 and 32.1 q ha  $^{\scriptscriptstyle 1}$  for GSC-7 and 23.1 and 24.3 q ha  $^{\scriptscriptstyle 1}$ for PBR-91, followed the similar trend to that of grain

Table 1: Basic soil properties o	study sites in south-western and	l central Punjab, India
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Cluster	pH <sub>1:2</sub>	E.C. <sub>1:2</sub> (dS m <sup>-1</sup> )	SOC(g kg <sup>-1</sup> )	Av-P (mg kg <sup>-1</sup> )	Av-K (mg kg <sup>-1</sup> )
South-weste	rn Punjab				
Ι	$8.16a^{\dagger}\pm0.05$	0.48a±0.01	4.50b±0.01	30.0b±0.7	312c±13.3
II	8.78b±0.11	0.59b±0.01	2.79a±0.02	21.9a±1.3	265b±16.6
III	8.91c±0.12	$0.58b \pm 0.02$	3.00a±0.03	38.6c±1.6	228a±8.4
Central Pun	jab				
Ι	7.82a±0.13	0.19a±0.02	5.71a±0.02	20.8a±1.4	117a±11.4
II	7.71a±0.18	0.23a±0.04	5.62a±0.03	21.6a±2.2	133b±18.3

<sup>†</sup>Mean values of soil properties for a cluster for a region followed by different letter differ significantly at p < 0.05 by Duncan's Multiple Range Text (DMRT)

and central Punjab, India			8.000					
Crop/Economic parameters		GS	C-7			PBR	-91	
	Cluster-I	Cluster-II	Cluster-III	Average	Cluster-I	Cluster-II	Cluster-III	Average
South-western Punjab								
Mean grain yield (q ha <sup>-1</sup> )	$17.9b{\pm}0.3$	12.7a±0.3	13.3a±0.4	$14.6\pm0.3$	$13.6b{\pm}0.3$	$12.3a{\pm}0.2$	12.5a±0.2	$12.8\pm0.3$
Mean straw yield (qha <sup>-1</sup> )	32.1b±0.6	22.8a±0.5	23.8a±0.8	$26.2\pm0.6$	24.3b±0.7	23.1a±0.3	23.4a±0.9	$23.7\pm0.8$
Mean cost of cash inputs (Rs. ha <sup>-1</sup> )	$18860a\pm137$	19968b±278	19588b±280	$19472\pm 231$	19860a±224	19795a±314	20120b±302	19925a+307
Mean gross returns (Rs. ha <sup>-1</sup> )	64084b±1197	45071a±1072	46610a±1439	$51921\pm1236$	43970b±878	39420a±1232	40140a±1293	41177b±1039
Mean net returns (Rs. $ha^{-1}$ )	45224b±1228	25103a±1266	27022a±1334	32450±1276	24110b44±1069	19625a±1107	20020a±1393	21252b±867
B-C ratio	3.40b	2.26a	2.38a	2.67	2.21b	1.9a9	2.00a	2.07
Central Punjab								
Mean grain yield (q ha-1)	$20.7a{\pm}0.4$	20.1a±0.5		$20.4\pm0.4$	16.6a±0.4	16.8a±0.5		$16.6\pm0.4$
Mean straw yield (q ha <sup>-1</sup> )	$38.7a\pm0.8$	39.1a±0.7		$39.5\pm0.8$	29.7a±0.8	30.1a±0.7		29.9±0.6
Mean cost of cash inputs (Rs. ha <sup>-1</sup> )	19940a±256	20100a±320		$20020\pm302$	23750b±322	22890a±345		$23320\pm322$
Mean gross returns (Rs. ha <sup>-1</sup> )	66080b±1098	64352a±998		65216±1021	52384a±1021	53600a±1232		$52992\pm1135$
Mean net returns (Rs. $ha^{-1}$ )	46140b±1321	44252a±1298		45196±1302	28634a±1324	$30710b\pm 1281$		29672±1324
B-C ratio	3.31b	3.20a		3.30	2.21	2.34		2.27
†Mean values of soil properties for a	cluster for a region	followed by diffe	rrent letter differ s	ignificantly at $p < 0$	<i>).05</i> by Duncan's M	ultiple Range Tex	tt (DMRT)	

yield in south-western Punjab. Although, average cost of cash inputs was only slightly higher by Rs. 453 ha<sup>-1</sup> for PBR-91, the average gross returns were higher by Rs. 10744 ha<sup>-1</sup> (~26%) for GSC-7. Average net returns for GSC-7 cultivation in south-western Punjab were higher by ~53%, compared with PBR-91. The B-C ratio was significantly higher for GSC-7 variety in cluster-I, compared with other clusters, which did not differed significantly. Average B-C ratio for GSC-7 was ~29% higher, compared with PBR-91 in south-western Punjab.

Mean grain yield of GSC-7 in central Punjab varied between 20.1 and 20.7 g ha<sup>-1</sup>, compared with 16.6 and 16.8 q ha-1 for PBR-91 (Table 2). The mean grain and straw yield in cluster-I and cluster-II did not differed significantly. These non-significant differences in grain and straw yield of mustard variety GSC-7 and PBR-91 among two clusters could be ascribed to the fact that the surface soil properties of both clusters did not differed significantly, except for available-K. In the central Punjab, means cost of cash inputs, mean gross returns and mean net returns of both varieties did not differed significantly. However, average gross and net returns for GSC-7 were higher by  $\sim$ 23 per cent and  $\sim$ 52 per cent higher as compared to PBR-91. Average B-C ratio was ~45 per cent higher for GSC-7, compared with PBR-91 in south-western Punjab. The comparison revealed that average grain yield of GSC-7 was ~40 per cent higher in central Punjab, compared with south-western Punjab. Similarly, the average grain yield of PBR-91 was higher by ~30 per cent in central Punjab, compared with south-western Punjab. The average B-C ratio was ~24 per cent higher in central Punjab, compared with south-western Punjab.

**Production and economic efficiency of mustard cultivation:** In south-western Punjab, the production efficiency of mustard variety GSC-7 was higher by 3.0-3.3 kg ha<sup>-1</sup> d<sup>-1</sup> in cluster-I, compared with cluster-II and cluster-III (Figure 1). The production efficiency of PBR-91 was higher by 0.7-0.8 kg ha<sup>-1</sup> d<sup>-1</sup> in cluster-I, compared with cluster-II and cluster-III. However, in central Punjab production efficiency of GSC-7 and PBR-91 were higher in cluster-II by 1.0 and 0.3 kg ha<sup>-1</sup> d<sup>-1</sup>, respectively. Average production efficiency of GSC-7 in central Punjab was higher by 4.0 kg ha<sup>-1</sup> d<sup>-1</sup> (~42%), compared with southwestern Punjab. Similarly, the production efficiency of PBR-91 in central Punjab was higher by 2.6 kg ha<sup>-1</sup> d<sup>-1</sup> (~31%), compared with south-western Punjab. The economic efficiency of mustard cultivation in south-



Figure 1: Production efficiency of technological intervention in gobhi sarson in south-western and central Punjab.



Figure 2: Economic efficiency of technological intervention in gobhi sarson in south-western and central Punjab.

western and central Punjab followed a similar trend to that of the respective mean and gross net returns (Table 2 and Figure 2). On an average, the economic efficiency of GSC-7 cultivation in central Punjab was ~26 per cent higher compared with south-western Punjab. The economic efficiency of PBR-91 in central Punjab was ~29 per cent higher than the central Punjab.

**Yield gap analysis:** Yield gap analysis was done estimate the yield gain potential in mustard cultivation in southwestern and central Punjab (Table 3). Our results showed that yield gas estimated from yield potential was 7.7 q ha<sup>-1</sup> in the south-western Punjab, compared with 1.9 q ha<sup>-1</sup> in central Punjab. It indicates that much higher potential of yield maximization in south-western, compared with

Yield (q ha <sup>-1</sup> )	South-western Punjab	Central Puniab	
Farmers' yield (GSC-7) ♦	14.6	20.4	
KVKs' demo average yield <b>A</b>	21.1	22.2	
Yield potential	22.3	22.3	
State average yield	12.6	12.6	
District average yield	10.6	13.8	
Yield gap from			
Yield potential	7.7	1.9	
KVKs' demo average	6.5	1.8	
State average	-2.0	-7.8	
District average	-4.0	-6.6	

Table 3. Comparative assessment of yield gap in minimized with technological intervention through improved gobhisarson variety (GSC-7) in south-western and central Punjab.

• Values indicate average grain yield (n=50 for south-western Punjab and n=31 for central Punjab)

▲Two year average yield of gobhi sarson yield as a demonstration in technology park at KVK, Mansa (for south-western Punjab) and KVK, Samrala, Ludhiana (for central Punjab) during *rabi*-2018-19

Table 4: Constraints leading to yield gap in mustard production

Constraints	Frequency	Percentage
Cultivation on marginal soils	46	56.79
Poor quality irrigation water	45	55.56
Insect pest attack	52	64.20
In appropriate fertilizer management practices	55	67.90
Delayed sowing	51	62.96
Low plant population	53	65.43

central Punjab. Similarly, a yield of 6.5 and 1.8 q ha<sup>-1</sup> was estimated by comparing GSC-7 yield obtained in demonstrations at farmers' fields and average yield obtained at KVKs' instructional farm. However, the demonstration yields in south-western and central Punjab were higher, compared with the district and state averages. The percent increase in grain yield of GSC-7 estimated from district average in south-western Punjab varied between 20.3 and 68.7 per cent (Figure 3). It was significantly lower in cluster-II and cluster-III, compared with cluster-I. In central Punjab, the percent increase in yield over district's average was significantly higher in



Figure 3: Per cent yield increase with technological intervention over district average in south-western and central **Punjab**. *Line bars indicate standard error from mean*. Mean values of soil properties for a cluster for a region followed by different letter differ significantly at p < 0.05 by Duncan's Multiple Range Text (DMRT).

cluster-II, compared with cluster-I. On an average, the percent increase in yield was ~46 per cent higher in central, compared with south-western Punjab.

**Constraints leading to yield gap in the recommended mustard production technology:** The constraints leading to yield gap revealed that more than fifty percent (56.79) were cultivating mustard on marginal soils and under poor quality irrigation conditions (55.56%). Low economic yield of other crops due to poor quality underground irrigation water has been reported earlier (Singh and Sharma, 2016; Singh *et al.*, 2018). The insect pest attack viz; attack of aphid and bihar hairy caterpillar; was another major constraint faced by most of the farmers (64.20%). Similarly, farmers were un-aware (67.90%) about the fertilizer management practices in oilseed crops. Delayed sowing (62.96%) and low plant population (65.43) were the other constraints faced by farmers that were leading to yield gap in oilseed crops.

#### CONCLUSION

From the study, it can be concluded that by birding yield gap the yield and production level of oilseeds can be enhanced. Various factors viz; agronomic, biological and soil & water related factors cause exploitable yield gaps in oilseeds. The study of constraints faced by farmers reveals that farmers grow mustard crop on marginal soils under poor quality irrigation conditions. Further, delayed sowing and poor plant population also causes yield gaps. These yield gaps can be effectively improved through proper demonstrations of the technology. The front line demonstrations can help in improving the efficiency reduces production costs and increases sustainability.

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# Strengths, Weaknesses, Opportunities and Threats (SWOT) of Integrated Fish Farming System (IFFS) as Perceived by the Farmers in Manipur

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#### ABSTRACT

The present study was conducted with an objective to analyses the i.e. Strengths, Weakness, Opportunities, and Threats (SWOT) of Integrated Fish Farming Systems (IFFS) as perceived by the farmers of Manipur. The study was conducted in five valley-districts of Manipur covering a random sample 300 farmers practicing IFFS. Strength of IFFS in term of farmers can generate more income from IFFS as compared to other monocultures is being ranked 1<sup>st</sup>. Lack of Insurance against losses due to natural calamity is perceived as greatest weakness by the farmers. Creation of an offseason occupation for farmers is being ranked 1<sup>st</sup> as far as Opportunities of IFFS perceived by the farmers. Natural calamity like frequent flood due to improper drainage system is perceived as the highest threat to the farmers. The study concluded that more emphasis should be given to develop capacities of the fish farmers to improve efficiency and effectiveness of IFFS, to improve the weather forecast and drainage system to tackle the natural flood.

Keywords: Farmers' perceptions, Garrett's ranking technique, Integrated fish farming, Opportunities, Strengths, Threats, Weaknesses

#### **INTRODUCTION**

Agriculture is facing various challenges with the growing population alongside the decreasing resources of arable land and water resources. (Fedoroff et al., 2010; Satterthwaite, 2010). So innovative and sustainable agriculture must tackle the present and future need of improving the agricultural system, which gives emphasis on both agricultural production and resource use efficiency of the arable land and water being environment friendly without compromising the nature and accepted by the society (Fedoroff et al., 2010; Giovannucci et al., 2012). Integrated Fish Farming System (IFFS) can be considered as the model of farming based on no waste. It focuses on diversified agricultural options with the main emphasis given on water and fish. This system of integrated fish farming enhances the both water and land productivity (Passioura, 2006).

It's now generally believed that the productivity of water in agriculture is an important means to deal with moderating water deficiencies and diminishing ecological issues. In any part of the country, the type and level of integration depend on the prevalent environmental conditions, social norms, cultural values, and religious factors (Ayinla, 2003). Integrated fish farming commonly combines livestock production with fish farming. As the waste product from the animal is used as the fertilizer for the photosynthetic organisms inside the fish pond. Integrated fish farming system is a methodology of diversification with judicious uses of assets.

The integrated fish farming system can be arranged into three significant frameworks with twelve significant models. Most of the models favored in India are principally like, integration of pond-dyke, fish-paddyduck/poultry-vegetable and fish-dairy animals/pig-duck/ poultry-vegetable. Besides economic thought, it also performs the multiple recycling of carbon, energy, and nutrients supplement from biomass of livestock-poultry/ piggery/fishery, etc., and limits ecological stacking with contaminations. In these structures, minimal land/wetlands are for the most part brought into use, where lake fills in

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as a point of convergence for immediate or backhanded connections between different segments. This framework including poultry integrates with fishpond and croplands. Keeping these in view, an integrated cultivation framework implemented at farmer's field needs to be assessed for additional changes. Water efficiency is always kept as an important aspect in the case of an integrated fish-based farming system.

The North-East Region of India, containing the States of Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland, Sikkim, and Tripura, is having rich biodiversity and fishery assets. More than 90 percent of the inhabitants (40 million of the locales) are fish eaters. Upper east India is extraordinarily wealthy in freshwater aquaculture that represents 236 species. From the State of Manipur alone, 167 types of freshwater species, 31 families and 84 genera are recorded. The fish fauna of Loktak Lake in Manipur contains 64 species. The significant portion of population follow fisheries that guarantees practical vocation inspite of facing social, financial, environmental or climatic bottlenecks. Further, the fishing population are the most hindered, chaotic, and are viewed as the least privileged.

On this backdrop, present study was conducted to prioritize strengths, weaknesses, Opportunities, and threats of IFFS from the perspectives of practicing farmers in the state of Manipur.

#### MATERIALS AND METHODS

The present study was conducted in five selected districts of Manipur where fish farming is mostly followed by the farmers. They are Imphal West, Imphal East, Bishnupur, Thoubal and Kakching districts. From each district, a random sample of 60 farmers following IFFS was chosen as respondents of present study; thus, a total of 300 farmers were covered.

Strengths and weaknesses are considered as the internal factors affecting the farmers which have some measure of control whereas opportunities and threats are considered as the external factors which are beyond control. The study was conducted for the analysis of the overall strategic position of the IFFS and its environment for the farmers. Based on literature review, discussions focus group discussions (FGDs) with the experts including line department personnel and farmers following IFFS, strengths, weaknesses, opportunities, and threats of IFFS were explored and 10 agreed upon items under each are finally listed. Thereafter, an interview schedule was developed and responses were taken from selected 300 farmers. For each of the 10 items under each strengths, weaknesses, opportunities and threats, each farmer was asked to rank. The Garret's ranking technique was followed. As it provides the most significant factor which influences the practicing IFFS, the ranking for all factors and the outcome of such ranking have been converted into score value with the help of the following formula:

$$100 (R_{ij} - 0.5)$$

Percent position = \_\_\_\_\_

Where,  $R_{ij} = Rank$  given for the i<sup>th</sup> variable by j<sup>th</sup> respondents

 $N_i$  = Number of variables ranked by  $j^{th}$  respondents

With the help of Garrett's Table, the percent position estimated is converted into scores. Then for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having highest percentage is considered to be the most important factor.

#### **RESULTS AND DISCUSSION**

Different types of integrated fish farming system practiced by the farmers were explored through field survey covering a sample of 300 farmers in five districts of Manipur (Table 1). It is evident that fish + vegetable crops integration is predominant and being adopted by 42 per cent of the farmers. About 21 per cent farmers have practiced fish + vegetable crops + oilseeds crops integration while about 10 per cent farmers preferred ricefish integrated farming. More than 26 per cent farmers have integrated livestock like dairy, piggery and poultry as one of the components of IFFS.

Different integrated fish farming systems are mainly the combination of fish-livestock farming, fish-agriculture, fish-horticulture system, etc. (Pandey and Srivastava, 2018). Shivani and Kumar (2018) reported six different types of integrated fish farming systems viz. crop + fish + poultry, crop + fish + duck, crop + fish + goat, crop + fish + duck + goat, crop + fish + cattle and crop fish + mushroom. However, present study revealed dominance of fish-agriculture and fish-horticulture system as compared

Category	Component	Freq.	Percen-
		uency	tage
Type 1	Fish and Vegetable	126	42.00
Type 2	Fish and Paddy crop	31	10.33
Type 3	Fish, Vegetable and Oilseed crop	64	21.33
Type 4	Fish, Vegetable and Dairy	10	3.33
Type 5	Fish, Vegetable and Piggery	5	1.67
Type 6	Fish, Paddy crop and Piggery	5	1.67
Type 7	Fish, Paddy crop and Piggery	10	3.33
Type 8	Fish and Dairy	9	3.00
Type 9	Fish, Dairy and Poultry	4	1.33
Type 10	Fish and Piggery	21	7.00
Type 11	Fish, Piggery and Poultry	4	1.33
Type 12	Fish and Poultry	11	3.67

 Table 1: Distribution of different types of IFFS practiced by

 the farmers in Manipur

to fish-livestock system. In this context the SWOT analyses of existing IFFS as perceived by the farmers would be precursor for future policy advocacy and scaling up the IFFS in Manipur and other states having similar agro-eco system.

SWOT analysis is a strategic planning method used for evaluation of strengths, weaknesses, opportunities, and threats involved in any system of either before or after its implementation for making further improvement in the practicing system or activity. Through the analysis of SWOT, one can identify the problems that are likely to come up and look for ways and means of converting threats into opportunities and setting off the weaknesses with the strengths. In order to know the experience of the farmers practicing IFFS, efforts were made to study the SWOT of IFFS from the perspectives of the farmers. Ten items each under strengths, weaknesses, opportunities, and threats were identified and asked the farmers to rank them accordingly followed by final analyses using Garrett's ranking technique.

Table 2 reveals the strengths perceived by the farmers with respect to IFFS. The strengths perceived by the farmers in decreasing order are viable returns from IFFS compared to other monocultures (estimated percent position 16.55%), high quantity of products as compared with the monocultures (14.56%), regular fund generation from short term harvests (13.87%), suitable water and fertile soils under IFFS (13.79%), less encroachment of

wild animals in the field (13.41%), family labour can be employed in small farms for majority of operations viz., spraying, manuring, trails and drainage maintenance, irrigations, etc. (10.14%), suitable condition for IFFS (7.18%), easy maintenance in terms of trails and drain maintenance, manuring, etc. (5.38%), easy availability of inputs such as seedlings, pesticides, weedicides, etc. in the domestic market (2.96%), and lastly, hilly slopes, swampy and low lying land not suitable for other crops can be effectively utilized for IFFS (2.15%).

Table 3 represents the weaknesses perceived by the farmers related to IFFS. The weakness in term of lack of insurance against losses due to natural calamity was ranked 1<sup>st</sup> with highest estimated percent position (15.2%) followed by inadequate financial assistance from govt. (14.5%), lack of new technology for practicing IFFS (12.21%), high initial investments for IFFS (12.14%), lack of farm infrastructure (10.33), high cost of cultivation in IFFS (10.04%), Involvement of middle man (8.52%), increasing pests and disease problems in IFFS (7.22%), inadequate transport system (6.1%) and low yields of certain component of IFFS as compared to its monoculture (3.70%).

Table 4 represents the Opportunities perceived by the farmers in their practices of IFFS. The most favourable opportunity is found to be in term of providing an offseason occupation for farmers (16.14%), followed by providing an opportunity of crop insurance with fund generation round the year from different farm products (13.98%), full utilization of the farm waste (12.82%), less feed requirement for fish in IFFS (11.02%), lots of potential and area for IFFS (10.19%), off-season employment to the farmers and farm labors (9.89%), require less no. of workers in the cultivation of IFFS (8.18%), availability of markets (7.02%), congenial climate for IFFS cultivation in terms of relative humidity, rainfall, temperature, etc. (5.68%) and lastly, requires very little extra input by way of additional costs, particularly in management and labor (5.09%).

Threats perceived by the farmers with respect to the IFFS are given in Table 5. The greatest threat to IFFS as perceived by the practicing farmers is the natural calamity of frequent flood due to improper drainage system in the state (16.47%) followed by pollution of water body and mortality of the fishes (13.80%), inadequate training and

Tab.	le 2: Strengths of IFFS as perceived by the farmers in Manipur														
s.	Strength					Garı	rett Ra	nking (	N = 300						
No.		-	H	H	IV	>	ΛI	ΝII	VIII	IX	x	Garrett score	ď	R	
-	Viable returns from IFFS compared to other monocultures	176	0	13	48	~	3	0	0	0	53	21344	16.55		
0	Hilly slopes, swampy and low-lying land not suitable for other crops can be effectively utilized for IFFS	22	0	113	101	0	0	0	0	64	0	2778	2.15	10	
3	Suitable water and fertile soils for IFFS	8	0	59	0	0	0	24	29	177	С	17781	13.79	4	
4	Regular fund generation from short term harvests under IFFS	44	0	9	0	0	0	3	0	ŝ	244	17882	13.87	3	
ĿΩ	Suitable condition for IFFS	3	0	0	0	0	50	200	20	27	0	9262	7.18	$\sim$	
9	Easy maintenance in terms of trails and drain maintenance, manuring, etc.	38	10	70	122	33	0	0	0	0	0	6944	5.38	8	
_	Family labour can be employed in small farms for majority of operations viz., spraying, manuring, trails and drainage maintenance, irrigations, etc.	0	220	12	3	46	17	0	0	0	0	13070	10.14	9	
8	Easy availability of inputs such as seedlings, pesticides, weedicides, etc. in the domestic market	~	53	0	26	176	38	0	0	0	0	3815	2.96	6	
6	Less encroachment of wild animals in the field	0	0	0	0	0	45	23	203	29	0	17293	13.41	Ŋ	
10	High quantity of products as compared with the monocultures	0	17	0	0	38	147	50	48	0	0	18771	14.56	0	
= d*	Percentage, *R=Rank														
Tab.	le 3: Weakness of IFFS as perceived by the farmers in Manipur														
s.	Weakness					Garı	rett Ra	nking (	N=300	(					
No.		I	II	III	IV	Λ	Ν	ΝII	VIII	XI	X	Garrett score	Р	R	
1	High initial investments for IFFS	31	0	0	0	0	0	201	0	68	0	18144	12.14	4	
0	Lack of farm infrastructure	0	0	0	0	0	62	20	0	218	0	15430	10.33	5	
3	Low yields of certain component of IFFS as compared to its monoculture	0	0	0	64	0	174	48	0	14	0	5532	3.70	10	
4	High cost of cultivation in IFFS	269	0	0	0	0	0	31	0	0	0	15000	10.04	9	
ъ	Increasing pests and disease problems in IFFS	0	283	0	0	0	0	0	17	0	0	10789	7.22	8	
9	Lack of new technology for practicing IFFS	0	0	0	193	14	44	0	32	0	17	18242	12.21	3	
∽	Lack of insurance against losses due to natural calamity	0	17	0	26	26	18	0	213	0	0	22704	15.2	1	
×	Involvement of middle man	0	0	0	17	231	7	0	38	0	12	12734	8.52	∟	
6	Inadequate financial assistance from govt.	0	0	12	0	17	0	0	0	0	271	21718	14.5	0	
10	Inadequate transport system	0	0	288	0	12	0	0	0	0	0	9107	6.1	6	

Inadequate transport system

10 Inadequate transport\*P =Percentage, \*R=Rank

Tai	ble 4: Opportunity of IFFS as perceived by the farmers in Manipur													
s.	Opportunity					Garr	ett Ra	nking (	N=300	(				
Ž		Ι	П	III	IV	Λ	VI	lIV	ΛIII	XI	X	Garrett score	Ъ	R
	Congenial climate for IFFS cultivation in terms of relative humidity, rainfall, temperature, etc.	0	0	0	0	0	259	0	0	41	0	8488	5.68	6
0	Availability of markets	0	0	0	0	53	41	0	0	187	19	10485	7.02	×
З	Lots of potential and area for IFFS	0	0	0	0	223	0	0	0	53	24	15218	10.19	Ŋ
4	Require less no. of workers in cultivation of IFFS	0	0	0	0	24	0	29	12	19	216	12220	8.18	۲
ιΩ	Full utilization of the farm waste		0	224	13	0	0	0	63	0	0	19151	12.82	3
9	Off-season occupation for farmers	0	0	63	0	0		0	225	0	12	24108	16.14	-
$\sim$	Require very little extra input by way of additional costs, particularly in management and labour	0	43	13	244	0	0	0	0	0	0	7597	5.09	10
8	Opportunity for an off-season employment to the farmers and farm labours	20	205	0	29	0	0	46	0	0	0	14772	9.89	9
6	Opportunities of crop insurance, as it generates fund round the year from	248	33	0	0	0	0	19	0	0	0	20893	13.98	0
	different farm products													
10	Less feed requirement for fish in IFFS	32	19	0	14	0	0	206	0	0	29	16468	11.02	4
Tal *P	=Percentage, *R=Rank 51e 5: Threats of IFFS as perceived by the farmers in Manipur													
Ś	Threats					Garr	ett Ra	nking	N=300					
Ž	·	I	Ξ	H	IV	Λ	VI	ΝII	VIII	IX	x	Garrett score	Ч	8
-	Frequent strikes cause problem in marketing and cultivation	0	0	0	300	0	0	0	0	0	0	7783	5.21	10
0	Inadequate training and extension facilities by state, central and private sectors on IFFS	0	33	12	0	255	0	0	0	0	0	18826	12.60	З
З	Lack of skilled technicians who can guide farmers and improve the net returns in IFFS cultivation	0	206	61	0	33	0	0	0	0	0	17849	11.95	4
4	Natural calamity like frequent flood due to improper drainage system in the state	0	61	227	0	12	0	0	0	0	0	24600	16.47	7
ъ	Pollution of water body and mortality of the fishes	29	0	0	0	0	0	0	12	239	20	20625	13.80	0
9	Lack of proper marketing due to middle man involvement	0	0	0	0	0	0	0	235	32	33	10122	6.76	8
∽	Loss of fish due to piscivore birds attack	0	0	0	0	0	0	13	53	0	234	8293	5.55	6
×	Production decrease due to non-utilization of chemical fertilizer	33	0	0	0	0	255	12	0	0	0	14130	9.46	9
6	Risk of spreading diseases are high	73	0	0	0	0	12	215	0	0	0	14486	9.69	ŝ
10	Certain part of the fields is lost for fish culture by the construction of	168	0	0	0	0	33	09	0	29	12	12686	8.49	∟

Certain part of the fields is lost for fish culture by the construction of trenches, ring bund and refuges for fish

<sup>\*</sup>P =Percentage, \*R=Rank

extension facilities by state, central and private sectors on IFFS (12.60%), lack of skilled technicians who can guide farmers and improve the net returns in IFFS cultivation (11.95%), risk of spreading diseases are high (9.69%), production decrease due to non-utilization of chemical fertilizer (9.46%), certain part of the fields is lost for fish culture by the construction of trenches, ring bund and refuges for fish (8.49%), lack of proper marketing due to middle man involvement (6.76%), loss of fish due to piscivore birds attack (5.55%) and lastly, frequent strikes causing problem in marketing and cultivation.

Practicing of integrated aquaculture led to the development of ecosystem in the village and helped to improve the co-existing bio-system (Mohapatra and Barik, 2018). Similar to the findings of present study, past studies also reported that majority of the fish farmers had low institutional participation, lack of technical training, poverty, lack of marketing facilities and lack of technical training as the main constraints faced by the farmers (Gupta and Dev, 2014). Nhan et al. (2007) found the weakness of starting integrated agriculture-aquaculture was the inappropriateness of technology, insufficient land holding or poor access to extension services, limited farm managements, etc. Gupta et al. (2019) and Shoko (2019) concluded that practicing integrated farming has been more profitable than non-integrated farming systems which is in conformity to the finding of present study.

# CONCLUSION

Fish culture in blend with horticulture or livestock is an exceptional and rewarding endeavour in Manipur. Present study has mentioned several strengths of practicing IFFS, most importantly, it can generate more income as compared to other monoculture and provides an offseason occupation for farmers. However, frequent natural calamity used to hamper due to improper drainage system in the state and also there is lack of insurance for the losses for the farmers when natural calamity occurs. More training and awareness programs of IFFS need to be undertaken by the state government and the concerned department so that the fish farmers can generate more income from their limited resources of land and water following profitable IFFS models. The state government and the concerned department should look after the improvement of drainage system in the state. The concerned department should provide the weather report in advance to the farmers so that they can take up some necessary steps to prevent loss due to natural calamity like the flood. Practice of integrated fish farming could play a significant role in both food and nutritional security and providing livelihood to millions of people in rural areas.

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# Performance of Chick pea (*Cicer arietinum*) as Influenced by Cluster Frontline Demonstrations in Northern zone of Telangana

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#### ABSTRACT

Krishi Vigyan Kendra, Adilabad conducted cluster frontline demonstration on chick pea during *rabi* seasons of 2018-19 at Pendalwada and 2019-20 at Sunkidi villages of Adilabad district, Telangana State. The demonstrated technology represented the practices of improved variety (NBeG-3), optimum seed rate (65 kg ha<sup>-1</sup>), seed treatment with *Trichoderma viride* (a) 10g kg<sup>-1</sup> seed, NPK fertilizers (13:00:45) (a) 10 glit<sup>-1</sup>H<sub>2</sub>O and plant protection measures with installation of pheromone traps (a) 4 number per acre, spraying of neem oil 10000 ppm (a) 2 ml lit<sup>-1</sup>H<sub>2</sub>O and chlorpyrifos 50 EC (a) 2 ml lit<sup>-1</sup>H<sub>2</sub>O. The results revealed that the increase in the yield with demonstration was 16.44 per cent and 9.59 per cent over farmers practice in 2018-19 and 2019-20, respectively. Similarly, the highest benefit cost ratio was recorded with demonstration as 3.63 and 3.11 as compared to 3.04 and 2.74 under farmers practice during both the years of trial.

Keywords: Cluster frontline demonstration, Chick pea, Economics, Variety NBeG-3 and yield

#### **INTRODUCTION**

Pulses are an important crop in Indian farming system, both ecologically and in terms of human nutrition. Pulses are vital food crops for human consumption as well as animal feed. Being leguminous in nature, they are considered to be important components of cropping systems because of their viability to fix atmospheric nitrogen and also add substantial amounts of organic matter to the soil and produce reasonable yields with low inputs under harsh climatic and soil conditions (Rakhode et al., 2011). Pulses are mainly cultivated in Asian countries and particularly in the Indian Sub-continent. In India, pulses are grown under different agro-climatic conditions. India is the largest producer and importer as well as consumer of pulses, accounting for 25 per cent of global production from 35 per cent global area under pulses. Pulse production in India is 24.51 million tonnes during 2017-18, which is highest in the country (Directorate of Economics and Statistics 2017-18). India is the largest producer of chickpea (Cicer arietinum) occupies an area of 10.17 m ha with the production of 9.93 mt which is about 63 per cent of the total pulses production in India (Kumar et al., 2019). It is important to note that chick pea continues to be the largest

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consumed pulse in home as well as industrial purpose comprising of about 50 per cent of total pulse production in India (Parmar et al., 2017). The average productivity of pulses in India is 735 kg ha-1 since 2014-15 has not witnessed any significant improvement. There has been however, an impressive growth in area, production and productivity of chickpea in India during the past decade. It is interesting to note that the growth rate of chickpea production was 5.89 per cent during last one decade which is much higher than other crops (Singh et al., 2017). Chick pea accounts to 64.10 per cent and 62.4 per cent share in the total export of India's export basket of pulses during 2016-17 and 2017-18, respectively (Directorate of Economics and Statistics, 2017-18). In Adilabad district, chick pea occupies an area of about 18000 ha in rabi season with an average productivity of 20 q ha<sup>-1</sup>. The variety demonstrated in trial is NBeG-3 which is developed by ANGRAU, Hyderabad. This variety is a bold seeded with 105-110 days duration. Department of Agriculture, Cooperation and Farmers Welfare, Government of India had sanctioned the project "Cluster Frontline Demonstration on Pulses" to ICAR-ATARI, Zone-X, Hyderabad by National Food Security Mission (NFSM) to diminish the quantity of imported pulses from other countries and as well as to sustain

production and consumption of pulses. KVKs are grassroot level organizations meant for application of technology through assessment, refinement and demonstration of proven technologies under micro farming situation in a district (Das *et al.*, 2010). This NFSM project was implemented by Krishi Vigyan Kendra, Adilabad with an objective to boost the production and productivity of pulses through CFLDs with appropriate technologies.

### MATERIALS AND METHODS

The present investigation of CFLDs was conducted during rabi seasons of 2018-19 and 2019-20 by KVK, Boregaon and Sunkidi at Adilabad district of Telangana State. In 2018-19, two villages namely Boregaon of Ichoda block and Pendalwada of Jainath blocks were chosen for this project. During 2019-20, one village namely Sunkidi of Tamsiblock was selected. Total 25 farmers were selected each year for the demonstration. Farmers were accomplished to follow the package of practices recommended by the State Agricultural University, Telangana and need based input material were provided to the farmers (Table 1). All the participating farmers were trained on various aspects of chick pea production technologies and they followed the package of practices like field preparation, seed treatment, seed rate, sowing method, fertilizer management, IPM practices etc. The field was ploughed two times and planking was done after each ploughing then seeds were treated with Trichoderma viride @ 10 g kg<sup>-1</sup> seeds and sown by seed cum fertilizer drill with of spacing 30 x 10 cm<sup>2</sup> and seed rate was 25 kg ha<sup>-1</sup> (Table 1). The seeds and other critical inputs were supplied to the farmers by KVK. For control plot, farmers followed conventional methods in existing varieties like JG-11. The yield data was collected for both CFLD and farmers practice for both the years and compiled (Table 2).

In the present study, technology index was operationally defined as the technical feasibility obtained due to implementation of Cluster Frontline Demonstrations in chick pea. To estimate the technology gap, extension gap and technology index as well as additional cost, additional returns and effective gain following formula used by Samui *et al.* (2000); Sagar and Chandra (2004) and Yadav *et al.* (2004) have been used.

#### **RESULTS AND DISCUSSION**

It is apparent from the data that the seed yield of demonstration plots was higher as compared to farmers practice might be due to high yielding variety and ICM practices. A comparison of yield performance between demonstrated practices and farmers practices is shown in Table 2. The NBeG-3 variety gives higher yield compared to control variety JG-11. It was observed that the average seed yield with the demonstration was 20.63 q ha<sup>-1</sup> as compared to 18.25 q ha<sup>-1</sup> with farmers practice. The average increase in the yield with demonstration was 13.01

Table 1: Differences between farmers practice and technology interventions for chick pea

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Practices	Demonstrated practice	Farmers practice
Method of sowing	Seed cum fertilizer drill	Line sowing behind the plough
Variety	NBeG-3	JG-11
Seed treatment	Trichoderma viridi @ 10 g kg seeds 1	No seed treatment
Seed rate & spacing	25 kg ha <sup>-1</sup> & 30 x 10 cm <sup>2</sup>	30 kg ha <sup>-1</sup>
IPM measures	Installation of pheromone traps @ 4 acre <sup>-1</sup> , Spraying of Neem oil 10000 ppm @ 2 ml lit <sup>-1</sup> $H_2O$ and Chlorpyriphos 50 EC @ 2 ml lit <sup>-1</sup> $H_2O$	Indiscriminate usage of pesticides

Table 2: Productivity, technology gap, technology index and extension gap in chick pea under CFLD

Year Area No. of		No. of	Yield (q ha <sup>-1</sup> )			% Increase	Technology	Extension	Technology
	(ha)	farmers	Potential	Demons- tration	Farmers practice	in yield	gap (q ha-1)	gap (q ha <sup>-1</sup> )	index (%)
2018-19	10	25	30.0	21.25	18.25	16.44	8.8	3.0	29.17
2019-20	10	25	30.0	20.00	18.25	9.59	10.0	1.8	33.33
Average	-	-	30.0	20.63	18.25	13.01	9.4	2.4	31.25

per cent when compared to farmers practice. Similar yield enhancement in different crops in frontline demonstrations has been illustrated by Sharma *et al.* (2012) and Singh *et al.* (2017). Singh *et al.* (2018) stated that the increase in the yield with demonstrations might be due to the adoption of recommended agro-technologies in FLDs during study period. Yield of the frontline demonstration trials and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology and extension gaps (Hiremath and Nagaraju, 2009). Similarly, Yadav *et al.* (2019) reported that selection of quality seeds is necessary for achieving higher yields in pulse crops.

The technology gap is the difference or gap between the demonstration yield and potential yield. A critical analysis of data (Table 2) revealed that the average technology gap was 9.4 q ha<sup>-1</sup>. The technology gap observed may be attributed to variation in the soil fertility status, non-congenial weather conditions, local specific crop management problems in order to harness the yield potential of specific crop cultivars under demonstration fields and the ability of farmers to follow the management practices (Choudhary *et al.*, 2009 and Singh *et al.*, 2018). Hence, location specific recommendations appears to be necessary to bridge the gap between the yields. These results are similar to the findings of Mishra *et al.* (2018) and Rajkumar *et al.* (2019).

The assessment of the data presented in Table 2 revealed that the average extension gap between demonstration and farmers practice was recorded 2.4 q ha<sup>-1</sup>. Extension gap in the present study indicates that there is a strong need to aware and motivate the farmers for adoption of improved farm technologies in chick pea over local existing practices. Refinement in the local farmers practices for higher adoption of local specific generated farm technology for sustaining crop productivity is another option for the research scientists (Teggelli *et al.*, 2015). Extension yield gaps are the indicators of lack of awareness for the adoption of improved farm technologies by the

Table 3: Average economics of chick pea under CFLD

farmers (Kaidan *et al.*, 1997). The results are in close conformity with Mishra *et al.* (2018) and Rajkumar *et al.* (2019), who reported that, location specific problems and the interventions may have immense proposition in the enhancement of crop productivity.

Further investigation of the data revealed that the average technology index reported was 31.25 per cent (Table 2). This value shows that there is a gap present between technology developed and technology adopted at farmer's field and depicts the feasibility in conducting a demonstration. However, farmer perception towards the technology involving high initial costs and adverse climatic conditions resulted in the increasing trend of technology index values during the demonstration years. The social environment in terms of irrational attitude, illiteracy and impassive behaviours towards the adoption of new technologies is also a major limiting factor to the improvement in agricultural productivity (Yadav et al., 2019). This in a long run over the years and with more penetration at field level may result in decreasing trend of the technology index with précised use of demonstrated technologies in the field and suitable climatic conditions during demonstration period. As technology index denotes the gap between technology generated at research farm and farmer's field, lower the technology index more feasible will be the technology (Hiremath and Hilli, 2012). The results are in close conformity with Ganga Devi et al. (2017) and Meena and Singh (2017).

The data obtained regarding the economic analysis for the chick pea was illustrated in Table 3. Close observation of data found that the average cost of cultivation (Rs. ha<sup>-1</sup>) with demonstration was Rs. 31658 ha<sup>-1</sup> which is lower than farmers practice (Rs. 32573 ha<sup>-1</sup>). The data concluded that, gross monetary returns (Rs. ha<sup>-1</sup>) as well as net monetary returns (Rs. ha<sup>-1</sup>) were increased with the technology demonstrated over farmers practice during the course of trial. The results revealed that the average gross monetary returns of Rs. 106657 ha<sup>-1</sup> and average net monetary returns of Rs. 74999 ha<sup>-1</sup> obtained with the

Treatments	Cost of Cultivation (Rs. ha <sup>-1</sup> )	Gross return (Rs. ha <sup>-1</sup> )	Net return (Rs. ha <sup>-1</sup> )	B:C ratio	Additional cost (Rs. ha <sup>-1</sup> )	Additional returns (Rs. ha <sup>-1</sup> )	Effective gain (Rs. ha <sup>-1</sup> )
Farmers practice	32573	94216	61644	2.89	915	12441	11526
Demonstration	31658	106657	74999	3.37			

demonstration over farmers practice with average gross returns of Rs. 94216 ha<sup>-1</sup>and average net returns of Rs. 61644 ha<sup>-1</sup>. Likewise, the average benefit cost ratio of demonstration plot was 3.37 which was more than the farmers practice (2.89). The increase in the yield and monetary returns with demonstration might be due to the selection of suitable variety, seed treatment with *Trichoderma viride* and timely application of fertilizers as well as integrated pest management practices. Farmer's non adaption of new technologies and practicing of old age technology and they are unable to afford costly inputs results in low returns and scanty incomes, which in return means less monetary beneficiary to them (Yadav *et al.* 2019). The results are in confirmation with the findings of Khedkar *et al.* (2017); Singh *et al.* (2018) and Mishra *et al.* (2018).

Further examination of the data showed that the demonstrated technology resulted in higher additional returns of Rs. 12441 ha<sup>-1</sup> and effective gain of Rs. 11526 ha<sup>-1</sup> as compared to farmers practice during the course of study. The higher additional returns and effective gain obtained under demonstration might be due to improved technology, non-monetary factors and timely operations of crop cultivation as well as scientific monitoring. Similar results were also reported by Meena and Dudi (2012) and Meena and Singh (2017).

## CONCLUSION

Cluster frontline demonstrations on chick pea during 2018-19 and 2019-20 concluded that highest yield of 21.25q ha-1 and 20.00 q ha-1 obtained with demonstration followed by 18.25 q ha-1 and 18.25 q ha-1 with farmers practice. Similarly, monetary benefits were also recorded highest with demonstrations as compared to farmers practice. The per cent increment in yield of chick pea to the extent of 13.01 per cent in demonstration over the farmers practice created greater awareness and motivated the other farmers to adopt the improved package of practices for chick pea. These demonstrations built the relationship and confidence between farmers and KVK scientists. It is concluded that the CFLD programme is an effective tool for increasing the production and productivity of chick pea and changing the knowledge, attitude and skill of the farmers. This has not only resulted in socio-economic security but also helped in attaining food and nutrition security to the community.

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# Forecasting of Onion Price in Lasalgaon Market and Potato Price in Agra Market

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#### ABSTRACT

In this study, to model and forecast the onion and potato price in Lasalgaon and Agra market respectively during the period March 2009 to March 2019, Auto-Regressive Integrated Moving Average (ARIMA) and Generalized Auto-Regressive Conditional Heteroskedasticity (GARCH) have been used. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test were used for checking the presence of unit root in the time series. Akaike Information Criterion (AIC) values were used for identifying the suitable ARIMA model. The residuals of the fitted ARIMA models revealed the presence of autocorrelation and ARCH effects, so GARCH model is also used for forecasting. Both the models were compared with respect to forecast accuracy measures. In both the cases, it is found that GARCH model performed better than ARIMA model.

Keywords: Forecasting, Agricultural market, ARIMA model, GARCH model

# INTRODUCTION

Price forecasting play a key role in price analysis and commodity trading. The forecast of agricultural prices is one of the difficult areas of time series forecasting (Jha and Sinha, 2014). Modelling and forecasting of price are crucial for policymakers and also for specific players in the marketing chain of agricultural commodities, starting from farmers to consumers (Lama *et al.*, 2015). Natural calamities such as draught, flood, pest and disease attack make agricultural commodity production and prices volatile, which results in significant risk and uncertainty in the price modeling and forecasting process (Jha and Sinha, 2013; Yashavanth *et al.*, 2017). Variations in food commodity prices in India are widespread and difficult to predict, creating a level of uncertainty that raises hazards for manufacturers, traders, customers and governments.

Excessive price volatility can threaten the family's welfare along with the farm's viability. It destabilizes farm income and prevents the farmers from investing and making optimum uses of the resources (Schnepf, 1999). The higher food prices are particularly catastrophic for the poor, where they spend big amounts of their total

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income on essential food (Jha and Sinha, 2013). Price forecast is particularly important for farmers because they rely on the anticipated prices while taking decision of production and marketing, and it may have financial consequences several months later (Jha and Sinha, 2013). Price uncertainty also carry substantial challenge to decision makers in preparing policies aiming at reducing production and marketing risks (Kumar *et al.*, 2011).

Farm produces in particular vegetable crops are prone to the varying prices from time to time as they are seasonal in nature and highly perishable. In addition, prices also react rapidly to actual and suspected changes in supply and demand conditions, resulting in high volatility and noisy nature of the prices. (Lama *et al.*, 2015). In the recent years, especially onion and potato among all the vegetables are characterized by high degree of price fluctuation.

Auto Regressive Integrated Moving Average (ARIMA) is one of the most effectively and commonly used time series model. The ARIMA methodology has been used by several authors for agriculture related forecasting such as cultivated areas (Prabakaran *et al.*, 2013), price (Assis *et al.*, 2010), productions (Paul *et al.*, 2014) and productivity

(Padhan, 2012) of different crops. Even ARIMA was used for forecasting of inland fish production in India (Paul and Das, 2010). Apart from ARIMA, Generalized Autoregressive Conditional Heteroskedasticity (GARCH) has also been used for forecast purposes because when uncertainty is present in the data, the AR-GARCH model offers better future point prediction than the ARIMA model. (Lama *et al.*, 2015). With this backdrop the paper tries to forecast the onion price in Lasalgaon and potato price in Agra market and compare between two methods employed for forecasting.

# MATERIAL AND METHODS

The present study of forecasting of onion and potato price was based on the secondary data published by www.agmarknet.gov.in. Daily price data of Lasalgaon and Agra market were collected for the period March 2009 to March 2019 and weekly prices (Rupees per quintal) were calculated. Since Lasalgaon for onion and Agra for potato are the market with the highest arrival in the country, so they were selected for the study. The time series variable is expected to be a linear function of past values and random shocks in an ARIMA model. A process  $\{y_t\}$  is said to follow an integrated ARMA model, denoted by ARIMA (p, d, q), if

$$\Phi(B) (1-B)^{d}y_{t} = \theta(B)\varepsilon_{t}$$

where,  $\varepsilon_t \sim WN (0, \sigma^2)$  and WN indicates white noise, B= Backward shift operator. The integration parameter d is a non-negative integer. When d = 0, ARIMA (p, d, q) = ARMA (p, q).

ARIMA methodology follow three steps, 1<sup>st</sup> step is identification where the parameters of the ARIMA model are identified. In the next step, which is estimation, the parameters identified in the 1<sup>st</sup> step are estimated and the appropriateness of the selected model is tested at the last that is at the diagnostic checking stage. If the model is found inadequate, these steps are repeated until the model is found satisfactory.

ARIMA model has two drawbacks, one of the problems is the presence of ARCH effect. ARCH or GARCH specifications can handle this issue. In ARCH model, the conditional variance of the error term depends on the prior error term of different lags. But the problem with this model is that at a greater lag the model consists of several parameters which complicates and lengthens the assessment. So, GARCH is used, where the conditional variance of the error term depends not only on the prior squared error but also on its conditional variance in the previous period. It is used to measure the extent of volatility in agricultural commodity prices. GARCH (i, j) model as defined below:

$$h_t = a_0 + \sum_{i=1}^q a_i \epsilon_{t-i}^2 + \sum_{j=1}^p b_j h_{t-j}$$

Here conditional variance  $h_t$  at time t depends not only on the squared error term in the previous time period but also on its conditional variance in the previous time period.

The sum of  $(a_i + b_j)$  gives the degree of persistence of volatility in the price series. The closer the sum to one, greater is the tendency of price volatility to persist for longer time in the variable under consideration

# **RESULTS AND DISCUSSION**

The characteristics of the price series used in this study are presented in Table 1. There are total 536 data points during the period March 2009 to March 2019. Highest prevailed price in that period for Lasalgaon and Agra market Rs. 5284.22 and Rs. 2175 respectively and lowest is Rs. 298 and Rs. 175 respectively. The visual introspection of both Lasalgaon market and Agra market presented in Figure 1 and 2 indicates that volatility is very much present in the series.

*Stationary test:* The basic assumption of any time series analysis is that the underlying series is stationary in nature. When mean and variance of that series remain unchanged,

Table 1: Summary	Statistics of	price series	s (March	2009 -
March 2019)				

Statistics	Lasalgaon	Agra
Mean	1188.30	761.70
Standard Error	37.47	17.02
Median	914.08	616.125
Mode	550	575
Standard Deviation	867.52	394.04
Kurtosis	4.68	0.87
Skewness	2.04	1.10
Range	4986.33	2000
Maximum	5284.33	2175
Minimum	298	175
Observations	536	536

Markets		AD	F Test	Phillips-Perron Test		
		t statistic	Prob.	t statistic	Prob.	
Lasalgaon	Level	-1.91	0.053	-1.89	0.055	
	1 <sup>st</sup> Difference	-18.46***	< 0.001	-18.55***	< 0.001	
Agra	Level	-1.63	0.09	-1.47	0.13	
	1 <sup>st</sup> Difference	-10.02***	< 0.001	-16.83***	< 0.001	

Table 2: Estimated ADF and PP statistic for unit root test of Lasalgaon and Agra market

the series is called stationary. In this study, to test the stationarity of the series Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test has been used. ADF test is a parametric test whereas PP is a non-parametric test. Both the test checks the presence of unit root in the data. ADF and PP test results confirms that both the series are nonstationary at level and stationary at 1<sup>st</sup> difference (Table 2).

*Fitting of ARIMA model:* The number of the Autoregressive terms (i.e. p) and the moving average terms (i.e. q) can be identified with the help of the Autocorrelation function (ACF) and Partial Auto-correlation Function (PACF) plot of the differenced series. The ACF and PACF plot of Lasalgaon and Agra market are presented in Figure 3-6. It can be found by trial and error method also by trying different combinations ARIMA




model. The best model from all the combinations was selected based on the lowest Akaike Information Criterion (AIC) value. Table 3 and 4 revealed that lowest value of AIC is associated with the value of p = 1 and q = 0 i.e. 6827.12 for Lasalgaon market and p = 1 and q = 2 i.e.

5878.61. So, the identified ARIMA model for Lasalgaon market is ARIMA (1,1,0) and for Agra market is ARIMA (1,1,2).

The parameter estimates of ARIMA models identified for onion and potato are given in Table 5.

Figure 6: PACF plot of the differenced data of Agra market



Table 3: Identification of the ARIMA (p, 1, q) model of Lasalgaon market

AIC values for ARIMA (p, 1, q) models				
	q =0	q =1	q =2	
<b>p</b> =0	6851.18	6828.73	6830.00	
p =1	6827.12	6828.49	6829.65	
p =2	6828.77	6829.89	6832.13	

Table 4: Identification of the ARIMA (p, 1, q) model of Agra market

AIC values for ARIMA (p, 1, q) models				
	q =0	q =1	q =2	
p=0	5989.75	5937.65	5902.25	
p =1	5908.7	5881.25	5878.61	
p =2	5878.76	5878.91	5880.61	

Table 5: Estimates of the parameters of ARIMA models

	ARIMA (1,1,0) for Lasalgaon	ARI	MA (1,1,2) for	Agra
	AR (1)	AR (1)	MA (1)	MA (2)
Estimate	0.22	0.68	-0.41	0.11
SE	0.04	0.07	0.08	0.05

Table 6: Residual Diagnostic of ARIMA models

**Testing of serial correlation and ARCH effect among residuals:** The Box-Jenkins approach has a fundamental assumption that the residuals will remain constant over time (Lama *et al.*, 2015). To check the validity of the ARIMA model, Portmanteau-Q test and ARCH-LM test was used. 1<sup>st</sup> test was used for checking the presence of serial correlation among the residuals and the 2<sup>nd</sup> test was used for testing the ARCH effect. The result of both the tests for ARIMA (1,1,0) and ARIMA (1,1,2) model are presented in the Table 6. Table 6 revealed that at different lags, both Portmanteau-Q and ARCH-LM test were found to be significant which means residuals are serially correlated and ARCH effect is also present.

*Fitting of GARCH model:* The GARCH model was fitted for both the Lasalgaon and Agra market price series. For both Lasalgaon and Agra market ARMA (1,1)-GARCH (1,1) model was identified as the best model based on in sample performance. The parameter estimates of ARMA (1,1)-GARCH (1,1) model of Lasalgaon market and Agra market along with Standard error and p value are presented in Table 7 and 8 respectively.

Lags	ARIMA (1,1,0) for Lasalgaon market			ARIMA (1,1,2) for Agra market			
	Portmanteau-Q	ARCH-LM	p value	Portmanteau-Q	ARCH-LM	p value	
4	128	185.8	< 0.001	52.7	346.6	< 0.001	
8	168	82.6	< 0.001	68.2	160.7	< 0.001	
12	204	52.5	< 0.001	92.7	85	< 0.001	
16	207	37.4	< 0.001	95.5	61	< 0.001	
20	209	28.7	< 0.001	97	45.7	< 0.001	
24	216	22.3	< 0.001	98.1	36.7	< 0.001	

Estimate	SE	P value
3.684	4.63	0.42
0.252	0.05185	< 0.001
1482	388.2	< 0.001
0.3184	0.05915	< 0.001
0.6662	0.04528	< 0.001
	Estimate           3.684           0.252           1482           0.3184           0.6662	Estimate         SE           3.684         4.63           0.252         0.05185           1482         388.2           0.3184         0.05915           0.6662         0.04528

Table 7: Parameter estimates of ARMA (1,1)- GARCH (1,1) of Lasalgaon market

Table 8: Parameter estimates of ARMA (1,1)- GARCH (1,1) of Agra market

	Estimate	SE	P value
Constant	3.75	5.94	0.52
AR	1.00	0.01	< 0.001
MA	0.20	0.04	< 0.001
Omega	820.3	328	< 0.001
Alpha	0.59	0.22	< 0.001
Beta	0.41	0.15	< 0.001

*Forecasting:* The detail results of forecasting performance of ARIMA and GARCH model are presented in the Table 9 and 10. The Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE) have been used for comparing the forecasting ability of both the models. Model with lowest RMSE and MAPE values are superior over the other for forecasting. The results revealed that

Table 9: Forecasted prices onion and potato

the GARCH (1,1) model perform better compare to the ARIMA (1,1,0) for onion in Lasalgaon market and ARIMA (1,1,2) for potato in Agra market

#### CONCLUSION

In this study, the performance of ARIMA and GARCH model have been evaluated for two important vegetable i.e. onion and potato. The best fitted ARIMA model for forecasting of onion prices in Lasalgaon market and potato prices in Agra market are ARIMA (1,1,0) and ARIMA (1,1,2) respectively during the period March 2009 to March 2019. But Portmanteau-Q test was found to be significant at different lags which indicates the presence of serial correlation. ARCH-LM test was also found significant, which means ARCH effect is present. The result of these two tests proved that ARIMA model is not adequate for the data series. So, GARCH model has been fitted for the forecasting. It was found that both Root Mean Square Error (RMSE) and Mean Absolute Percentage Error

Table 10: Forecast evaluation of onion and potato prices

	Lasalgaon		Agra		
	ARIMA (1,1,0)	GARCH (1,1)	ARIMA (1,1,2)	GARCH (1,1)	
RMSE	146.40	60.58	310.26	121.90	
MAPE	0.31	0.11	0.47	0.15	

		Lasalgaon			Agra	
Time	Actual (Rs/q)	Forecasted (Rs/q)	Forecasted (Rs/q)	Actual (Rs/q)	Forecasted (Rs/q)	Forecasted (Rs/q)
		ARIMA (1,1,0)	GARCH (1,1)		ARIMA (1,1,2)	GARCH (1,1)
Jan (2019) W1	420.40	509.7914	501.2557	501.66	454.73	584.15
Jan (2019) W2	392	526.7876	486.2203	531.66	452.82	515.49
Jan (2019) W3	372.12	543.3027	471.3957	596.66	451.49	447.13
Jan (2019) W4	355	559.3501	456.7793	574	450.57	397.67
Feb (2019) W1	382.75	574.9432	442.3679	546.66	449.92	427.42
Feb (2019) W2	427.83	590.0949	428.1587	575	449.48	470.66
Feb (2019) W3	402.75	604.8176	414.149	541.66	449.17	507.63
Feb (2019) W4	397.66	619.1235	400.3358	527	448.95	578.52
Mar (2019) W1	580	633.0243	547.12	535	448.80	560.50
Mar (2019) W2	658.33	646.5316	682.64	598.33	448.70	537.71
Mar (2019) W3	651	659.6565	698.06	610	448.62	569.26
Mar (2019) W4	734.33	672.4098	763.37	580	448.57	539.27

(MAPE) values were smaller in GARCH model, which means that GARCH model perform better than ARIMA model.

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# Buying Behavior of The Farmers Regarding Agrochemicals Use on Cotton Crop in Punjab

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#### ABSTRACT

Agrochemical refers to the broad range of pesticides including insecticides, herbicides, and fungicides. Use of agrochemicals in India is increasing at the rate of two to five per cent per annum and is about three per cent of total pesticides used in the world. Heavy reliance of agriculture on synthetic chemical fertilizers and pesticides is having critical effects on public health and environment. Consumer buying behaviour is a process of selecting, purchasing and disposing of goods and services according to the needs of the consumers. This study was designed to analyse the buying behavior of the farmers regarding agrochemicals used on cotton crop in Punjab. A total of 100 cotton farmers were randomly selected from Bathinda district. The study revealed that most of the respondents were seeking information from their peer group, nearly 43 per cent were consulting the private dealers for getting the information about agrochemicals. Most of the cotton farmers were purchasing the fertilizers from cooperative societies whereas for purchasing pesticides most of them prefers to go to private dealers. Brand of the product was most important factor considered by the farmers while purchasing agrochemicals followed by peer group advice, prior experience and product features whereas price of the product was given least importance by the farmers while purchasing the agrochemicals.

Keywords: Agrochemicals, Buying behaviour, Cotton

#### INTRODUCTION

Agrochemical refers to the broad range of pesticides including insecticides, herbicides, and fungicides. It may also include synthetic fertilizers, hormones and other chemical growth agents, and concentrated stores of raw animal manure (Anonymous, 2014). Pesticides are substances meant for preventing, destroying or mitigating any pest. More than 1000 agro chemicals are being manufactured and used for agriculture as well as public health purposes. About 90 per cent of this quantity is comprised of insecticides and herbicides with about equal share each. Fungicides represent about 10 per cent of the total. Use of pesticides in India is increasing at the rate of two to five per cent per annum and is about three per cent of total pesticides used in the world.

Punjab, the pivot state responsible for Green Revolution, among various states of India, due to which Punjab's farmers were able to make themselves selfsufûcient, non-reliant on others for the fulfilment of their fundamental food requirements (Sidhu and Byerlee, 1992).

According to Statistical Abstract of Punjab (2005) report, the grain production in Punjab has been increased from about 3 million tons in 1960-1961 to about 25.5 million tons in 2004-2005. Similarly, the cotton production has been increased from 0.12 million tons in 1960-1961 to 0.37 million tons in 2007-08 with a meagre 1.35 fold increase cotton cultivating land (Barik, 2010). This increase in output had some prime disadvantages, one of them was too much use of pesticides (Shiva 1991). Heavy reliance of agriculture on synthetic chemical fertilizers and pesticides is having critical effects on public health and environment. Fertilizers, especially nitrogenous fertilizers are excessively used by the farmers that are responsible for making soil unfertile. Agro-chemical inputs are misused, especially, pesticides has adverse consequences on the environment.

Use of pesticides is also high (923 g/ha) especially in crops like cotton, rice, vegetables, etc. The hackneyed use of pesticides in Punjab has altered the pest scenario, outbreak of several deadly diseases, environmental degradation and increasing input cost for agriculture leading the farmers under debt.

This study was designed to study the buying behavior of the farmers regarding agrochemicals used on cotton crop in Punjab. This study proved to be very significant in knowing the source of information of farmers regarding the purchase and use of agrochemicals, sources of purchase of fertilizers and pesticides and the factors effecting them while purchasing the agrochemicals.

### THEORETICAL FRAMEWORK

According to business dictionary, buying behavior is the purchase decision making pattern is a complex amalgam of needs and desires, and is influenced by factors such as the consumer's (1) societal role (parent, spouse, worker, etc.), (2) social and cultural environment and norms, and (3) aspirations and inhibitions.

Consumer buying behaviour is defined by Stallworth (2008) as a set of activities which involves the purchase and use of goods and services which resulted from the customers' emotional and mental needs and behavioural responses. It is further stated by Gabbot and Hogg (1998) that the process may contain different activities and stages.

Although the definitions given above are various, they all lead to common view that consumer buying behaviour is a process of selecting, purchasing and disposing of goods and services according to the needs and wants of the consumers. However, there is a general consensus among the researchers and academics that this process is subject to continual change over time as the purchase characteristics of the customers change due to their physical and psychological needs.

### MATERIALS AND METHODS

Out of Punjab state, Bathinda district of Punjab was selected purposively for the study as it is the major cotton growing belt. A total of 100 respondents were randomly selected from the district for the study. Bathinda District was selected because it is the main district of "Cotton belt".

### **RESULTS AND DISCUSSION**

Socio-economic characteristics are economic and sociological combined total measure of an individual's and individual's family's economic and social position in relation Table 1: Distribution of respondents according to their socioeconomic characteristics (n=100)

Categories	Frequency	Percentage
	(cotton)	(cotton)
Age	24	24
Young ( $< 35 \text{ yrs}$ )	21	21
Middle (35-50 yrs)	52	52
Old (> 50 yrs)	27	27
Education		
Illiterate	15	15
Primary	15	15
Middle	20	20
Matric	34	34
Graduate	16	16
Post graduate	0	00
Family type		
Nuclear	63	63
Joint	37	37
Family size		
Small (upto 5)	60	60
Medium (5-8)	20	20
High (more than 8)	20	20
Operational Land Holding		
Marginal (upto 1 hac.)	10	10
Small (1-2 hac.)	30	30
Medium (2-4 hac.)	40	40
Large (more than 4 hac.)	20	20
Gross income		
Low (Upto 4 lakhs)	40	40
Medium (4- 7 lakhs)	40	40
High $(> 7 \text{ lakhs})$	20	20
Trained about use of agroche	emicals	
Yes	0	00
No	100	100
Mass media exposure		
Low (4-8)	80	80
Medium (8-12)	20	20
High (12-16)	00	00
Read Package of practices		
Rahi	2	02
Kharif	- 4	04
Vegetables	0	00
, egembres	U	00

to others based on income, education and land owned, etc. The information pertaining to the socio-economic characteristics of the respondents is placed in Table 1. The age of the respondents was classified into three categories by using cumulative cube root method and these were categorized as young, middle and old. More than half of the respondents growing cotton crop were of middle age and only 27 per cent of the respondents were of old age. Most of the respondents were qualified up to matric level. Around 16 per cent of respondents were qualified up to graduation among the cotton growers. Among the cotton growers, respondents having nuclear families were 63 per cent. In case family size, 60 per cent of the respondents were having small family size and equal number of respondents *i.e.* 20 per cent were having medium and large family size. Among the cotton growers, 10 per cent of them were having marginal operational land holding, 30 per cent of them were having small operational land holding and 40 per cent of them and 20 per cent of them were having medium and large operational land holdings respectively. In case of gross income of the respondents, 40 per cent were belonging to small and medium gross income group and 20 per cent of them were having more than 7 lakhs of gross income. No respondent was trained about the use of agrochemicals. Among the total, 80 per cent of the respondents were having low level of mass media exposure and 20 per cent of them were having medium level of mass media exposure. Among the cotton growers, two per cent of the respondents have read the rabi package of practices and four per cent of the respondents have read kharif package of practices.

It is apparent from the data in the Table 2 more than half of the respondents i.e. 68 per cent were consulting their peer group for information regarding agrochemicals. These findings are in line with those of Nande *et al.* (2009).

 Table 2: Distribution of respondents according to their source of information about agrochemicals (n=100)

Source	Frequency (cotton)	Percentage (cotton)
Advice of dealers	43	43
Extension specialists	18	18
Demonstrations	9	9
Pamphlets or advertisements	28	28
Peer group	68	68

\*Multiple response

Out of all the respondents, 43 per cent of them were taking advice from dealers for getting information about agrochemicals, 28 per cent of them were using pamphlets or advertisements as their source of information, 18 per cent of them were getting information from extension specialists, nine per cent of them were getting information from demonstrations.

Data placed in the Table 3 depicts that 88 per cent of the respondents purchase fertilizers from cooperative societies and only 12 per cent of the respondents purchase fertilizers from the private dealers whereas no one among the respondents were purchasing the fertilizers from retailers and other government agencies such as State Agriculture Department and IFFCO, etc.

Table 3: Distribution of respondents according to the purchase of fertilizers (n=100)

- , , ,		
Source	Frequency (cotton)	Percentage (cotton)
Dealers	12	12
Cooperative societies	88	88
Retailers	0	00
Other government agencies	0	00

Data placed in the Table 4 depicts that 100 per cent of the respondents purchase pesticides/ fungicides/ weedicides from private dealers, twenty per cent of the respondents also purchase pesticides from cooperative societies. According to a study by Singh and Singh (2018), it was observed that problem of non- availability of recommended pesticides was faced by 41 per cent of the respondents while purchasing the pesticides.

It is evident from the Table 5 that 81 per cent of the respondents give foremost priority to the brand of the

Table 4:	Distribution	of	respondents	according	to	their
purchase	ofpesticides	/ fu	ingicides/ we	edicides (n=	=10	0)

Source	Frequency (cotton)	Percentage (cotton)
Dealers	100	100
Cooperative societies	20	20
Retailers	0	00
Other government agencies	0	00

\*Multiple response

Factors	Frequency (cotton)	Percentage (cotton)	Rank
Brand	81	81	Ι
Price	0	00	V
Prior experience	62	62	III
Peer group	67	67	II
Product feature	52	52	IV

Table 5: Distribution of respondents according to their priorities of in buying the agrochemicals (n=100)

\*multiple response

agrochemicals, 67 per cent of the respondents give priority to peer group advice, 62 per cent of them give preference to their prior experience in using the agrochemicals and the slightly more than half of them give preference to the product feature whereas least preference was given to the price of the product. According to the information collected, ranking was given to the factors as following Irank was given to Brand of the agrochemical, II rank to the experiences of their peer group, III rank was allotted to their prior experience, whereas IV rank was given to the features of the products used and price of the product was ranked last while giving priority to the factors effecting the respondents while purchasing the agrochemicals.

#### CONCLUSION

Farmers mostly rely on private dealers for gaining the information regarding agrochemicals. They also give priority to their peers regarding the use and purchase of agrochemicals. They do not give preference to the innovators and early adopters. Some of them contact extension specialists for the information about use and purchase of agrochemicals. Farmers give preference to the brand of the agrochemicals they are purchasing. All these factors effects the overall buying behavior of the respondents, which at the end effects the use of appropriate agrochemicals, outcomes of the agrochemicals used and cost of the production of crop.

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## Crop Based Livelihood Activities of Pineapple Growers and Constraints in its Cultivation: A Study in North Eastern Himalayan Region, India

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#### ABSTRACT

The present study was an attempt to explore the different Crop based livelihood activities maintained by pineapple growers of Arunachal Pradesh and also to identify the constraints experience by them in pineapple cultivation in NEHR, India. A total of 100 pineapple growers were taken from 4 villages of one selected block of the West Siang District, Arunachal Pradesh. The result indicates that 19 per cent of respondents were under the category of above 59 years of age and the average age of the respondents was 49 years. Around 40 per cent of the respondents were illiterate, and only 6 per cent of the respondents had received education up to class 12. The mean household size was six persons/family. Pineapple cultivation was carried out as a primary and secondary occupation by 96 per cent and 4 per cent of the respondents, respectively. The mean experience under pineapple cultivation was 20 years and the mean size of landholding was 11.613 acres. About 98 per cent of the respondents had allocated a small area of land (2.51-5 Acres) for pineapple. Around, 46 per cent of the respondents were growing five different crops for their livelihood, followed by 22, 21 and 3 per cent were growing four, three and six crops, respectively. Apart from the pineapple cultivation, 98 per cent and 71 per cent of the respondents were continuing rice and orange cultivation as crop-based livelihood activities. The mean annual income of respondents from pineapple cultivation and crop-based livelihood activities were Rs. 91,938 and Rs. 1,36,097, respectively. Further, pineapple cultivation had contributed around 67.5 per cent of the annual income from crop-based livelihood activities. Thus, it can be concluded that pineapple growers of the study area were earning remarkably from pineapple cultivation as well as from crop-based livelihood activities. Further, farmers in the study area were encountering constraints, like, lack of storage facility, poor road condition, lack of transportation, etc.

Keywords: Constraints, Crop-based livelihood, Livelihood, NEHR, Pineapple, Socio-economy

#### **INTRODUCTION**

Livelihood is a mean of securing the necessities, i.e., food, water, shelter and clothing of life. It involves the capacity of an individual to acquire necessities described above to satisfy their basic needs and their household in which the activities are usually carried out in a sustainable way. Improving rural livelihoods involves more than just maximising the production of crops or livestock. Regenerative livelihood activities are namely, apiculture, poultry keeping, pisciculture, silkworm production, drought-tolerant cash cropping, horticulture, processing of livestock and crop products, agroforestry for tree products, and micro-enterprises in the informal sector. On the other hand, extractive livelihoods activities are timber production, woodcarving, basketry, brick making, sand scooping, and charcoal making (Ngugi and Nyariki, 2005).

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Re-engineer of agricultural sector with the issues of climate change and assure higher income is urgently required (Patra et al., 2019). The diversity of livelihoods is not an exception and an important feature of rural survival and is closely allied to flexibility, resilience and stability (Pal et al., 2017). Crop diversification is one of the strategies that rural smallholder farmers could use to reduce their economic and livelihood vulnerability. Diversification of crop-based activities not only expands the number of potential crop types for the market but also improves the agroecosystem (Paul et al., 2015). Sustainable livelihood, which contributes to income and employment to the farm family, could be improved if they adopt horticulture-based farming systems more appropriately (Roy et al., 2019). According to Das et al. (2011), adoption of pineapple production into the offseason plays a vital role in nutrition

and livelihood opportunity for rural and tribal areas of the state for employment and income generation.

Pineapple (*Ananas comosus* L.) is one of the leading commercial fruit crops of the tropics. It is the second important fruit crop after banana and contributing to over 20 per cent of the world production of tropical fruits (Coveca, 2002). Pineapple is a commercially important fruit crop of India with around 114,000 ha area under this crop, 19.27 lakh tonnes annual production and 19.3 tones/ha productivity (Govt. of India, 2018). In pineapple cultivation, India ranks third, sixth and eighth in area, production and productivity, respectively in the world (Govt. of India, 2011). Pineapple is also the second most important fruit crop of the North Eastern Himalayan Region (NEHR) of India both in terms of area under plantation and production.

It is widely grown in almost entire NEHR including Assam, Tripura, Nagaland, Meghalaya, Manipur, Arunachal Pradesh, Mizoram and Sikkim. Arunachal Pradesh has an area of 83,743 sq. Km out of which 7,900 ha is under pineapple cultivation and its production is 37,710 tones and productivity is 3.4 tones/ha, thereby contributing 2.4 per cent share in country's production (Govt. of India, 2017). In NEHR, Arunachal Pradesh ranks third in respect of area under pineapple cultivation (Govt. of India, 2017).

Farmers of the study area are maintaining different livelihood activities, namely, orange, maize, rice and other crops cultivation, livestock (viz. Piggery, poultry, Mithun, cattle etc.) rearing along with pineapple cultivation for their livelihood and survival. This paper is an attempt to explore the different crop based livelihood strategies exist in the study area and significant constraints involved in these.

#### MATERIALS AND METHODS

The study was conducted in four villages (namely Higi Bagra, Lipu Bagra, Yamko Bagra and Angu) under Aalowest block, West Siang district of Arunachal Pradesh, as a large area is under pineapple cultivation. The district occupies an area of 8,325 Sq. Km. with a population of 1,12,274 (Census, 2011) and is situated between 90°30 to 97°30 East longitude and 26°28 to 29°31 North latitude.

The pre-tested structured interview schedule was used to collect information from the pineapple farmers. Purposive sampling technique was adopted, and 25 respondents from each village i.e., a total of 100 respondents had constituted the study population. To bring out the most pertinent constraint faced by the pineapple cultivators, all the reported constraints were classified into 7 categories. Further, based on the numbers of the farmers highlighted the problem/constraint, all the constraints were ranked (from I-VII) and considered as most important to least important, respectively. Data were tabulated, analysed and interpreted as per the objective of the study by using descriptive statistics.

#### **RESULTS AND DISCUSSION**

Socioeconomic characteristics of the respondents: The distribution of the study community based on their socio-economic features is presented in Table 1. Majority of the respondents (60%) were within the age group of 39-59 years and 19 per cent were under the category of above 59 years of age. The average age of the respondents was 49 years with a standard deviation (sd) value of 9.97. In respect to gender, only 2 per cent of respondents were from female. The literacy level among the respondents was low and 40 per cent of the respondents were illiterate and this finding has conformity with the results of Patra et al. (2019). Another 22 per cent of the respondents had a middle school education. And 15 per cent of the respondents had education upto matriculation. Only 6 per cent of the respondents had received education upto class XII. Thus, the educational status of the study area was in a pitiable state and maximum farmers were illiterate, and the remaining 1 per cent of the respondents had achieved higher education.

A household comprises every person who generally lives together under the same roof and eats from the same pot (Esiobu *et al.*, 2014). The majority (65%) of the respondents, had family/household size of 5 to 7 persons, while 15 per cent had the household size of above 8 persons and remaining with upto 4 persons. The mean household size of the family was 6 persons with an SD value of 1.66. This implies that farmers in the study area have a large household size. This finding supports the result of Onubuogu *et al.* (2013) and Mbakwe *et al.* (2016) in which they reported that large household size is a proxy to labour availability.

In case of occupation, study shows that 96 per cent of the respondents had opted pineapple cultivation as primary occupation and 4 per cent as secondary occupation as well as 4 per cent of them had continued business as primary occupation. Another 13 per cent of the pineapple growers were continuing as a government employee.

Characteristics	Frequency (f)	Percentage (%)	Mean	SD
Age (years)				
below 39 yrs	21	21	49.03	9.978
39-59 yrs	60	60		
Above 59	19	19		
Gender				
Male	98	98		
Female	2	2		
Educational qualification				
Illiterate	40	40	1.34	0.135005
Upto class V	16	16		
Upto class VIII	22	22		
Upto class X	15	15		
Upto class XII	6	6		
Graduate and above	1	1		
Family/household size				
Up to 4 person	20	20	6	1.66
5 to 7 person	65	65		
8 and above person	15	15		
Occupation				
Primary occupation				
Pineapple cultivation	96	96		
Business	4	4		
Secondary occupation				
Horticulture (pineapple cultivation)	4	4		
Agriculture	72	72		
Govt. Employment	13	13		
Political	8	8		
Experience in pineapple farming				
Low experienced (below 13 years)	23	23	20	7.824
Medium experienced (13-27 years)	63	63		
High experienced (above 27 years)	14	14		
Size of landholding				
Semi medium (5.01-10 Acres)	42	42	11.613	4.447
Medium (10-25 Acres)	57	57		
Large (>25 Acres)	1	1		
Land under pineapple cultivation				
Small (2.51-5 Acres)	98	98	0.675	0.820
Semi medium (5.01-10 Acres)	2	2		
Annual income from pineapple				
Low ( <rs.50,000)< td=""><td>38</td><td>38</td><td>91938</td><td>85457</td></rs.50,000)<>	38	38	91938	85457
Medium (Rs.50,000-1,50,000)	37	37		
High (>Rs.1,50,000)	25	25		

Further, majority of the respondents (63%) had an experience of 13 to 27 years and categorised as a medium level of experience holders. Another, 23 per cent of the respondents had a low level of experience i.e. below 13 years and remaining 14 per cent of the respondents had a high level of experience in pineapple cultivation i.e. more than 27 years. The mean experience of pineapple cultivation was 20 years which means that most of the farmers are well experienced in this field. In case of labour engagement in pineapple cultivation, majority of the respondents i.e., 54 per cent had a low level of labour engagement, 12 per cent of the respondents had a medium labour engagement and remaining 19 per cent of the respondents had a high level of labour engagement.

Further, in respect of landholding, 57 per cent and 42 per cent of the respondents had medium, and semimedium land holding respectively, and the remaining 1 per cent of the respondents had large landholding. The mean size of landholding was 11.613 acres, and the size of landholding ranged from 5.367 to 34.283 acres. In respect of land allocation for pineapple cultivation, 98 per cent of the respondents had allocated small land for pineapple cultivation and remaining 2 per cent had allocated semi medium area of land for pineapple cultivation which means that farm size under pineapple cultivation was small (Table 1).

*Crop based livelihood activities of the respondents:* In the study area, respondents had adopted various cropbased activities in their farming system for better livelihood. Crop based activities included rice, maize, chilli, ginger, potato, vegetables, sugarcane, orange, guava, banana, jackfruit, etc.

The study reveals that apart from the pineapple cultivation, 98 per cent of the respondents were involved in rice cultivation and 71 per cent in orange cultivation for their livelihood (Table 2). Similarly, 57 per cent were growing chilli, 47 per cent were growing banana, 37 per cent were growing maize, 32%were growing ginger, 17 per cent were growing sugarcane, 16 per cent were growing guava & jackfruit, and 23 per cent of the respondents were involved in other crops cultivation (other crops include potato, sweet potato, cucumber, pumpkin, mustard etc.) (Table 2).

This implies that most of the producers were practising crop diversification as a strategy for risk minimisation and income diversification, which in turn

Table 2: Distribution of respondents according to different crops based and number of crop-based livelihood activities carried out in a year (N=100)

Different crop-based activities	Frequency	Percentage
and number of activities	(f)	(%)
Different crop-based activities		
Rice	98	98
Orange	71	71
Chili	57	57
Banana	47	47
Maize	37	37
Ginger	32	32
Sugarcane	17	17
Guava	16	16
Jackfruit	16	16
others	23	23
Number of crop-based activities	maintained b	y respondents
2 activities	8	8
3 activities	21	21
4 activities	22	22
5 activities	46	46
6 activities	3	3

reduced food insecurity of most rural farm families. This finding is in line with the previous studies of Mekuria and Mekonnen (2018) and Dessie *et al.* (2019) accordingly, large numbers of respondents, i.e., 46 per cent were growing 5 different crops for their livelihood, followed by 22 per cent were growing 4 crops. 21 per cent had adopted 3 activities while only 3 per cent had adopted 6 crop-based activities for their livelihood (Table 2).

Also, majority of the respondents, i.e., 60 per cent had a low production of pineapple i.e. below 10,000 numbers, 26 per cent of the respondents had a medium production of pineapple i.e. between 10,000 to 20,000 numbers and only 14 per cent of the respondents had high production of pineapple, i.e. more than 20,000 numbers (Table 3). The mean production of pineapple was 11,640 numbers with an SD value of 13135.17 (Table 3). Rice is the principal food crop of the study region and majority of the respondents i.e., 80.61 per cent had a production between 1.080 to 2.490 tones. Another 12.25 per cent of the respondents had a production below 1.080 tones, and only 7.14 per cent of the respondents had a production above 2.49034 tones. The mean rice production was 1.665 tones with an SD value of 0.584. It is clear from the study that rice productivity was very low and in pitiable state in the study area as compared to national average. Therefore, modernization in rice cultivation is urgently needed. But modernization is a complex process and depend on knowledge and attitude of farmers in respect to adoption of improved technologies (Patra *et al.*, 2004). Accordingly, concerned authorities of state government should take initiative.

Further, orange cultivation has a direct influence in livelihood in Arunachal Pradesh, India (Makcha, 2015).

About 71 per cent of the respondents were growing orange, within which majority of the respondents i.e., 56.34 per cent had production below 880 nos., followed by, 33.80 per cent of the respondents had production between 880 to 2591 nos. and only 4.23 per cent of the respondents had production above 2591.368 nos. The mean orange production was 855.25 numbers with an SD value of 1736.118 (Table 3). Other crops were usually grown under kitchen garden or as mixed crop within pineapple orchard or in jhum field, mainly for self-consumption with some exception of selling for income.

Table 3: Details about respondents according to their crop production in quantity and terms of financial value for one year (2015-16) (N=100)

Production and income from different crops	Frequency	Percentage	Mean	SD
Production				
Pineapple (n=100)				
Low (<10,000 nos)	60	60		
Medium (10,000-20,000 nos)	26	26	11640	13135.17
High (> 20,000 nos)	14	14		
Rice (n=98)				
Below 1.080 tones	12	12.25		
1.080 to 2.490 tones	79	80.61	1.665	0.584
Above 2.490 tones	7	7.14		
Orange (n=78)				
Below 880.868 nos	40	56.34		
880.868 to 2591.368 nos	24	33.80	855.25	1736.118
Above 2591.368 nos	3	4.23		
Income				
Pineapple (n=100)				
Low ( <rs.50,000)< td=""><td>48</td><td>48</td><td></td><td></td></rs.50,000)<>	48	48		
Medium (Rs.50,000-1,20,000)	25	25	91,938	81188.01
High (>Rs.1,20,000)	27	27	67.5%	
Rice (n=98)				
Below Rs. 27,242.5	12	12.24		
Rs. 27,242.5 to Rs. 56,242.7	69	70.40	41,742	14500.2
Above Rs. 56,242.7	17	17.34		
Orange (n=78)				
Below Rs. 880.868	12	12.24		
Rs. 880.868 to Rs. 2591.368	69	70.40	1971	3501.321
Above Rs. 2591.368	17	17.34		
Annual income from crop-based livelihood activ	vities			
Below Rs. 1,00,000	49	49	1,36,097	87578.11
Rs. 1,00,000 to Rs. 2,00,000	31	31		
Above Rs. 2,00,000	20	20		

In terms of financial value, 48 per cent of respondents had income within Rs. 50,000 per annum from pineapple cultivation whereas, 25 per cent had per annum income of Rs. 50,000 to 1, 20,000 and remaining 27 per cent of the respondents had per annum income above Rs. 1, 20,000 from the pineapple cultivation. The mean income from pineapple cultivation was Rs. 91,938. In respect of rice cultivation, the majority (70.4%) of the respondents had a production of rice in terms of financial value was Rs. 27,242.5 to Rs. 56,242.7, followed by, 12.24 per cent of the respondents had a production with a financial value of below Rs. 27,242.5 and 17.34 per cent of the respondents had a production with a value of above Rs. 56,242.7. The mean of the economic value of rice production was Rs. 41,742.5, with an SD value of 14500.2 (Table 3). It further reveals that majority of the respondents (i.e., 56.339%) had a production of orange in terms of the financial value of below Rs. 880 followed by 33.80 per cent had a production of orange in terms of financial value between Rs. 880 to Rs. 2591.368, and only 4.22 per cent of the respondents had a production of orange in term of financial value of above Rs. 2591.368. The mean financial value in orange production was Rs. 1,971. Inrespect of orange cultivation, Patra et al. (2018) reported from Upper Subansiri district of Arunachal Pradesh, India that income from orange cultivation had a positive and significant relationship with adoption behavior index.

Study further reveals that 49 per cent of respondents had annual income from crop-based livelihood activities was below Rs. 1,00,000. Another, 31 per cent of the respondents had a yearly income between Rs. 1,00,000 to 2,00,000, and remaining 20 per cent of the respondents had an annual income from crop-based livelihood activities was above Rs. 2,00,000. The mean annual income of respondents from crop-based livelihood activities was Rs. 1,36,097 with an SD value of 87578. It is also clear from the study that pineapple was contributing around 67.5 per cent of annual income from crop-based livelihood activities. Thus, it can be concluded that pineapple growers of the study area were earning remarkably from pineapple cultivation as well as from crop-based livelihood activities.

*Types of constraints faced by respondents in pineapple cultivation:* Marketing is the most important constraints in the study area. All the respondents had reported that selling off all the farm products and non-functioning of the processing unit in the study area were the primary constraints involved in pineapple cultivation. They had viewed that restoration of the processing unit required to sell off their products as well as to reduce the post-harvest loss. Attack of mice and birds to fruits during the ripening stage was the next most important problem, and this was reported by 98 per cent of the respondents and ranked as II<sup>nd</sup> most important constraint. Attack of bees to fruits during ripening stage was reported by 97 per cent of the respondents.

Lack of storage was another important constraint in pineapple cultivation in the study area, which was reported by 96 per cent of the respondents and ranked as IV<sup>th</sup> important constraint. Respondents viewed that immediate marketing or selling of fruits after harvestings the only solution to counter this constraint. Constraint related to transportation in pineapple cultivation was reported by

S.No.	Category	Nature of constraints	F	%	Rank	
1	Marketing	Not all the products are sold	100	100	Ι	
		Non-functioning of a processing unit				
2	Mice and birds	Attacks of mice and birds at the fruit ripening stage	98	98	II	
3	Insects and pests	Attacks of bees at the time of fruit ripening	97	97	III	
4	Storage	Lack of storage facility	96	96	IV	
5	Transportation	Poor road condition	95	95	V	
		Lack of transportation facility				
		Distance between farm and market area				
6	Weeds	Problems in hand weeding	68	68	VI	
7	Orchard management	Difficult to manage the orchard because of unavailability of fencing material	54	54	VII	

 Table 4: Prioritisation of constraints involved in pineapple cultivation

95 per cent of the respondents and ranked as Vth constraint in pineapple cultivation. Associate constraints were poor road condition, a distance of farm to nearest road and market place, and lack of transportation facility. Weed infestation had emerged as VIth important constraint, and it was reported by 68% of the respondents to which they further stated that thorns of pineapple were the main problem for manual weed control. On the other hand, 54 per cent of the respondents reported that orchard management was also an important constraint and ranked as VIIth constraint associated with pineapple cultivation. It can be concluded that in NEHR and Arunachal Pradesh, low productivity of all crops is unchallenging issue due to various constraints in farming sector. Pandey et al. (2015) also reported from Arunachal Pradesh that training is an alternative to mitigate.

#### CONCLUSION

Crop based activities within the farming community in our country remains a source of income, livelihood and means to improve the livelihood. Crop diversification strategy plays a significant role as a source of income in the household. However, various socio-economic and institutional factors influenced the farmer's decision on the adoption of different crop-based activities. Study shows that the mean experience of pineapple cultivation was 20 years which means that most of the farmers are well experienced in this field. In respect of land allocation for pineapple cultivation, 98 per cent of the respondents had allocated small land (2.51-5 Acres) for pineapple cultivation. Around, 46 per cent of respondents were growing 5 different crops for their livelihood, followed by 22, 21 and 3 per cent were growing 4 crops, 3 crops and 6 crops respectively under crop-based livelihood activities. Apart from the pineapple cultivation, 98 and 71 per cent of the respondents were continuing rice and orange cultivation as crop-based livelihood activities.

Similarly, 57 per cent were growing chilli, and 47 per cent were growing banana, and 37 per cent were growing maize for their livelihood and survival. Study further reveals that 49 per cent of respondents had annual income from crop-based livelihood activities was below Rs. 1,00,000 and 31 per cent of the respondents had an annual income between Rs. 1,00,000 to 2,00,000, and remaining 20 per cent of the respondents had annual income from crop-based livelihood activities was above Rs. 2,00,000. The mean annual income of respondents from crop-based

livelihood activities was Rs. 1,36,097. Further, pineapple cultivation was contributing around 67.5 per cent of annual income from crop-based livelihood activities. Thus, it can be concluded that pineapple growers of the study area were earning remarkably from pineapple cultivation as well as from crop-based livelihood activities. Also, farmers in the study area were encountering constraints such as lack of storage facility, poor road condition and lack of transportation facility. Concerned authorities should facilitate to improve the markets and road infrastructure.

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# Usage Pattern of Online Social Networking among the Introvert visà-vis Extrovert Adolescent Boys

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#### ABSTRACT

The present study was undertaken to explore and compare the usage pattern of online social networking of 60 extrovert and introvert adolescent boys. Introversion-Extroversion inventory was utilized for sample selection. An inventory on online social networking was developed and utilized to assess the usage pattern of online social networking of extrovert and introvert adolescent boys. Percentage, mean percentage and t-test were computed for analysis of data. The results of the study revealed that usage pattern of online social networking in majority of extrovert and introvert boys was almost similar with little difference in few cases. No significant difference was observed among introvert and extrovert boys in usage pattern of online social networking.

Keywords: Extrovert, Introvert and Adolescents, Online social networking, Usage pattern

#### INTRODUCTION

Man cannot live without society. Family is the first place for learning to be in the group. In recent years, new relationships have started with the arrival of man-made machines called computer and internet. The primary tools that enable socialization on internet are social networking sites and instant messages.

Social networking sites can be broadly defined as an internet-based social spaces designed to facilitate communication, collaboration and content sharing across networks of contacts. People use social networking sites for countless activities. Among the most common uses are, connecting with existing networks, making and developing friendships or contacts, viewing content or finding information, creating and customizing profiles and so on.

Online social networking sites 'virtually' link individuals, who may or may not 'know' each other. Facebook, Twitter, Yahoo, Chat Messengers and Skype are examples of online social networking sites. It is through these sites that people talk, share and exchange their joys, sorrows, day-to-day happenings, education, relationship etc. with each other. Two factors are primarily responsible for the popularity of online social networking sites. Firstly, the networking factors itself, the ability to form different networks with people who share such things as location, day-to-day happenings, aspirations, hobbies and so on. Secondly, the supposition that online users want to freely create and share their own content without having to undergo mundane task of setting up and managing their own websites.

Applications such as Facebook appeal to very large audiences and appeal to the inherent inquisitiveness we have about other people and what they are doing with their lives. The use of an online social network then becomes a way of sustaining communication and continued sharing of experience and learning. Arnold (2014) in a recent survey found that in major cities such as Delhi, Mumbai, Kolkata, Chennai and Bangalore; Facebook emerged as the most popular social networking sites for the youths, while LinkedIn is the second most popular site. Almost 90 per cent of the users join such sites to follow or stay in touch with their friends for pictures.

Various Western and Indian researches have been done so far on social networking. But limited Indian researches have been done on online social networking pattern of introvert and extrovert adolescents, the results of which are not explicit. Therefore, present study is being undertaken to get clear understanding of the usage pattern of online social networking of introvert and extrovert adolescents.

### MATERIALS AND METHODS

The present study was conducted in co-educational private schools located within the municipal limits of Udaipur city of Rajasthan. Total sample consisted of 60 adolescents (30 boys under each extrovert and introvert categories) between the ages of 15-18 years, selected purposively from two co-educational private schools of Udaipur city.

Introversion-Extroversion Inventory developed by Aziz and Agnihotri (2001) was used for sample selection. An inventory on online social networking was developed and utilized to assess the usage pattern of online social networking among extrovert and introvert adolescent boys. It consisted of items related to usage pattern and purpose of online social networking covering five areas in each aspect respectively. There were overall 33 statements. Each statement had four alternative responses i.e. mostly, sometimes, rarely and never which were scored as 3, 2, 1, 0.

An inventory on online social networking was administered to all 60 students selected for the study in both the schools on prescheduled date. The filling up of the inventory was preceded by brief introduction and orientation about the process and purpose of administering the inventory. They were requested to give honest responses and were assured that their identity would be kept confidential and information provided by them would be used exclusively for research purpose. Each respondent was given the inventory individually and was asked to fill out the inventory under the supervision of the researcher. Percentage and t-test was used to analyze the data statistically.

#### FINDINGS AND DISCUSSION

The results of the usage pattern of online social networking of extrovert and introvert boys have been portrayed in Table 1.

Data from Table 1 reveals that most of the extrovert and introvert boys used Facebook as a social networking site that is, 60 per cent and 70 per cent extrovert and introvert boys respectively. None of the extrovert and introvert boys used Skype. The results are in line with Roy and Chakraborty (2015) findings which revealed that, Facebook is the most popular site among the adolescents as it provides individuals with a way of maintaining and strengthening social ties which can be beneficial in both social and academic settings. Data presented in Table 1 also highlights that, 50 per cent of extrovert boys and 46.67 per cent of introvert boys became aware about social networking sites from peer group followed by mass media. It can be because mostly adolescents spend their time with peer group which act as a major source of information about any new updates and technological advancements

Table 1: Percentage distribution of introvert and extrover
adolescent boys on the basis of usage pattern of online socia
networking (n=60)

Categories	ries Boys		
	Extrovert (n=30)	Introvert (n=30)	
Types of social networking s	ites used		
Facebook	60.00	70.00	
Twitter	6.67	0.00	
Yahoo	10.00	3.33	
Chat Messengers	23.33	26.67	
Any other	0.00	0.00	
Source of information about	social networking	sites	
Peer group	50.00	46.67	
Relatives	13.33	20.00	
Parents	10.00	3.33	
Mass media	26.67	30.00	
Approximate time spent per	day on social netwo	orking sites	
Less than 1 hour	33.33	40.00	
1-2 hours	40.00	26.67	
2-3 hours	13.67	23.33	
More than 3 hours	13.00	10.00	
Preferred time of online soci	ial networking		
Early morning	10.00	10.00	
Day time	3.33	10.00	
Evening	13.33	20.00	
Late night	53.33	40.00	
Entire day	20.01	20.00	
Place of using social network	king sites		
Home	93.33	86.67	
School library	3.33	3.33	
Cyber cafe	0.00	10.00	
Hostel	3.34	0.00	
Any other	0.00	0.00	
Device utilized for online so	cial networking		
Mobile	93.33	83.33	
Laptop	3.34	13.34	
Computer	3.33	3.33	
Any other	0.00	0.00	

Categories	Μ	Mean Standard		d deviation	t-value	
	Introvert boys	Extrovert boys	Introvert boys	Extrovert boys		
Usage pattern of online social networking	10.40	10.43	2.93	2.70	$0.04^{N.S.}$	

Table 2: Comparative analysis of usage pattern of online social networking pattern among introvert and extrovert boys (n=60)

\*Significant at 5% level of significance; NS = Not significant.

like social networking sites. Mass media however occupies the second position as a source of information.

Regarding approximate time spent per day on social networking sites, results from Table 1 depicts that time spent by extrovert boys varies from 1-2 hours in 40 per cent of cases and very few of them spent more than 2 hours. In contrast, time spent by introvert boys varies formless than 1 hour in 40 per cent of cases and only one-tenth of them spent more than 3 hours per day on social networking sites. In the present findings, extrovert boys spent more time on online social networking than introvert boys in order to enhance their existing friend circle and social relationship with new people. Results are congruent to Myers-Briggs (2009) findings who stated that extroverts use social networking sites more often.

Data from Table 1 regarding preferred time of online social networking shows that nearly 50 per cent of extrovert and introvert boys used online social networking sites at late night. It might be because many of them would perhaps have completed their homework and other activities by late night. Present findings are also congruent to the findings of Malhotra and Mahakud (2014) who found that most of the teenagers use online social networking at late night.

Results from the Table 1 regarding place of using social networking sites, reveal that majority of boys of both categories used social networking sites at home. Findings of the study suggests that majority of adolescents used online social networking at home. Probably, it might be because home is the only place where individuals spend most of their free time and beside this, number of households with internet facility might be very high in the city. Further, mobiles are not allowed in school premises.

Data from Table 1 further reveals that majority of extrovert and introvert boys used mobile for online social networking. Use of laptop and computer was meager for online social networking. The result of the present study get support from Lenhart (2015) who reported that due to convenience and constant access provided by mobile devices, especially smartphones, 92 per cent of teens prefer it for online social networking.

Results from Table 2 clearly indicate that there was no significant difference between introvert and extrovert boys in usage pattern of online social networking. Present findings are supported by the findings of Hills and Argyle (2005) who found that usage of social networking sites was not much associated with differences in personality.

#### CONCLUSION

Adolescents use online social networking for multiple purposes. Introversion and extroversion had its no effect in the usage pattern of online social networking in adolescent boys. To get better understanding of the present research it is recommended to extend this investigation to a larger sample size.

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# Analysis of Inherent Variability Among Livelihood Security Indices in Tribal Blocks in Madhya Pradesh

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#### ABSTRACT

This paper is concerned with the analysis of inherent variability among Livelihood Security indices in tribal blocks in Madhya Pradesh on the basis of 250 respondents collected in these blocks. The seven livelihood security indicators have been found taking into consideration the different sub-indicators within each security. The inherent variability has been analyzed using one way classified ANOVA approach and the least significant differences have been computed to judge over different security. It is found that there are three major categories which reveal that habitat, food and social security form stronger security rather than that of educational, occupational and health as well as occupational, health and environmental security having higher value of indices in comparison to present to their counterparts.

Keywords: ANOVA, Inherent variability, Integrated farming system, Least significant differences, Livelihood security

#### INTRODUCTION

Livelihood is defined as a set of activities, involving security of water, food, fodder, medicine, shelter, clothing and the capacity to acquire above necessity working either individually or as a group by using endowments (both the human and material) for meeting the requirements of the self and his/her household on a sustainable basis with dignity (Satpathy, 2015). Livelihood security plays an important role in its economy especially in tribal blocks of Madhya Pradesh. It makes significant contribution by considering different types of livelihood security in the study area. Farmers usually involve in different type of farming systems such as Crop + Dairy, including poultry, goat rearing, fishery etc. Integrated Farming System as a component of farming system which takes into account the concepts of minimizing risk, increasing production and profits whilst improving the utilization of organic wastes and crop residues (Radhamani et al., 2003). These integrated farming systems of the farmers really contribute towards the various types of livelihood security like food, occupational, habitat, educational, social, health and environmental. In this study seven types of livelihood security have been considered. These seven types of security are actually based on the different indicators, which are

involved in the different security viz; food and occupational security consist of four indicators while educational and social security, five indicators and habitat and health security, six indicators while environmental security is based on nine indicators in the study. Then, averaging the unit scores of each indicator within each security on the basis of total respondents and ultimately finding the mean value of relevant indicators in term as livelihood security indices.

The main objective of present paper is to investigate the inherent variability among livelihood security indices in tribal blocks of Mandla district in Madhya Pradesh using one way classified ANOVA approach.

#### MATERIAL AND METHODS

The data in relation to this study was collected in Mandla district of Madhya Pradesh, India, as the district is predominated by tribal farmers The geographical area of district is 5800 sq. Kms. The total population of Mandla districts is 10,54,905 out of which 4,59,151 are male and 4,65,565 are female (Anonymous 2011). Mandla district comprises of 9 blocks, out of which five blocks namely Mandla, Niwas, Nainpur, Gughari and Mawai were selected purposively as they possessed considerable population of integrated farming which were covering

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the whole district. In order to investigate the inherent variability among livelihood security indices during the year 2018-19, 250 IFS farmers were selected in this study.

Ex-post-facto research design was used in the study. In this study one dependent and eighteen independent variables were finalized for the investigation. The dependent variable is Livelihood security. which consists of seven security indicators viz, food, occupational, habitat, social, educational, health and environmental. The suitable empirical measuring techniques/scales/indices of independent variables were also collected from the available research reviews.

The inherent variability among seven livelihood security is given on the parallel line of one way classified ANOVA approach, which is given below.

$$OLSI_{ii} = \mu + LSI_{i} + e_{ii}$$

where, OLSI, stands for overall livelihood security index for the  $j^{th}$  observation on the  $i^{th}$  livelihood security.  $\mu$  stands for general mean, LSI; stand for effect of i<sup>th</sup> Livelihood Security, and e stands for the errors which are supposed to be normally, independently and identically distributed with mean zero and variance  $\sigma^2$ , considering observations as random with respect any conditions and the effects of livelihood security to be additive.

In order to prepare the concerned ANOVA table the various steps are followed.

$$1. \quad CF = \frac{(GT)^2}{N}$$

2. TSS =  $\Sigma\Sigma$ OLSI<sub>ii</sub> – CF

3. Sum of square due to LS class = 
$$\frac{\Sigma(LS)^2}{n} - CF$$

4. ESS = TSS - Sum of square due to LS class

Under this situation we postulate the hypothesis given below.

Ho = All the livelihood security class effect means are equal H1 = All the livelihood security class effect means are not equal

Then we compute,

$$F = \frac{MS \text{ due to } LS \text{ class mean}}{MS \text{ due to error}}$$

and compare this F - value with the tabulated value of F at the concerned (K - 1, N - 1) degrees of freedom, where K indicates that total number of security and n is total number of observations. If the calculated value F is found to be larger or equal to its tabulated value, the null hypothesis is rejected, and the conclusions are drawn accordingly. In order to compare LS means two at time, least significant differences are used.

## **RESULTS AND DISCUSSION**

Table 1 reveals about the analysis of variance for seven securities. The calculated value of F (5.084) is found to be larger than its tabulated value F5% (2.40), F1% (3.42). Hence we reject the null hypothesis and accept the alternative. This reveals that securities are found to be significant. The observations of seven security have been analyzed using the method given above and prepared the ANOVA table which is given as follow. The mean values of seven security have been arrange in ascending order of managing, given data.

Education	Occupation	Health	Environ- mental	Habitat	Food	Social
(0.458)	(0.536)	(0.578)	(0.624)	(0.800)	(0.867)	(0.908)

In order to find out the difference among security indices, we compute least significant differences value. These critical differences value such as Food vs. Occupational security as 0.204, followed by food vs. Habitat and Health security as 0.186, Food vs. Educational and Social security as 0.193, while Food vs. Environment security as 0.173. With the help of LSD values these seven securities have been recognized in three categories.

- Educational Occupational Health Security 1.
- 2. Occupational – Health – Environmental Security
- 3. Habitat Food Social Security

Table 1. Third yold of valuation for seven securities							
SV	df	SS	MS	F cal	F tab	F tab	
Livelihood Securities	6	2.545	0.424	5.084	F5% (6,32) = 2.40	F1% (6,32) = 3.42	
Errors	32	2.670	0.0834				
Total	38						

Table 1: Analysis of	f variance fo	or seven s	securities
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Now, the Habitat, food and social security are provides the more value of indices rather than that of educational, occupational, health and environmental security. Those farmers who are secured with respect to the habitat, food and social security these are called to be more secured, rather than of occupational, health and environmental security or educational, occupational and health security, however those farmers who are secure with respect to the occupational, health and environmental security are more secured than the farmers who have educational, occupational and health security. Similar results have also been, given by Ahmad and Garnett (2011); Raghav *et al.* (2013); Jaishankar *et al.* (2014) and Biswarup (2015).

The results are consistent with some of the findings as given in Singh *et al.* (2012). He also provided about integrated farming system for improving livelihood of small farmers indicated that this approach not only fulfil the household needs of a family but also environment safety.

Dadhwal *et al.* (2012) provided results about integrated farming systems for food and nutritional security revealed that this situation requires promotion of integrated farming system under integrated watershed management approach to improve soil moisture contents, soil amelioration or stabilization of degraded lands, agricultural productivity, livelihood and food security in the hill region. Our results are also found to be similar on the lines of Dadhwal (2012) and Gupta *et al.* (2015).

#### CONCLUSION

The livelihood security indices are important to determine whether the livelihoods are successful in following their livelihood strategies. Seven different livelihood securities indices are constructed on the basis of the prevailing condition of marginal and small tribal farmers in the study area. The security indices can be used for measuring the improvement of the situations of sampled farmers. Livelihood security indices are computed using standardized value of indicators of the relevant variable consisting of several indicators within its security. The indicators chosen for the study are based on the review of litterateur of previous researches. Each indicator is measured in different scale and then it is converted to standardized unit score called as an index, for the relevant indicators. Finally, three major groups are determined on the basis of LSD value using one way classified ANOVA approach. The strongest category like habitat, food and social security is found to be superior to occupational,

health, environmental & educational, occupational and health security. The security comprising educational, occupational and health security do not differ significantly with respect to each other while occupational, health, environmental are at par. Therefore, farmers who have habitat, food and social security they are supposed to be more secured than occupational, health, environmental and educational, occupational and health. This paper reveals that the farmers who consist of third group of security they are suppose to be more prosperous and socially forward in comparison to other of security.

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## **Context-Aware Recommender System for Maize Cultivation**

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#### ABSTRACT

Recommender systems are smart applications that can deliver useful suggestions for users where large quantities of alternatives are available. Our application scenario is Maize cultivation where the developed application can guide farmers in choosing each and every package of practices that is required to be followed. The system considers the current context of each farmer which is believed to vary from one another. An ontology based multi agent system has been developed to recommend farmers starting from which variety to grow up until the method of harvesting to be followed.

Keywords: Context awareness, Multi agent system, Ontology

#### INTRODUCTION

Over the past few decades Recommender systems (RS) are dominating the electronic market in increasing sales or in improving user experience with web viewing. These systems are most popularly used for recommending movies, books and music in online stores (Jannach et al., 2011). They automate the strategies adopted by human users to find out the most relevant content among the abundance of it. These systems are generally built based on the opinions of a community of like-minded members for deciding e.g. which book to read, which movie to watch, which place to visit for a holiday (Bedi, 2007) etc. These recommendations have been proved to be more useful when given enough importance to the current situation of the user while making such choices. Individual user's choices and preferences for resources or items change when the context of the user changes.

The change in context and its effect in decision making are closely related to the challenges faced by farmers while choosing the most appropriate package of practices for crop cultivation. Farms all around the country are so varied whether it's the nutrient status of the soil, its texture or the weather that is about to follow. Even the farmers themselves are so different from each other in terms of resource availabilities, access to information, or their budget of cropping. Farmers need to adopt cultivation practices that suits the local growing conditions as well as their own socio-economic conditions. But, crop cultivation guides are generally specific to areas as broad as an entire state. Most of the time suggestions are not appropriate for all the farms in an area because they are so different from each other. Changing patterns of rain and temperature fluctuations are so apparent even in the shortest of distances that the same suggestions do not always produce the best of results. This makes it difficult for the local growers to adapt to standard management practices coming from KVKs, portals or government officials. Several different ICT tools have come in rescue by suggesting package of practices to famers and have proved to be useful for quick and timely dissemination of agricultural information (Singh et al., 2020; Das, 2020). That's why the prototype of the presented mobile application here delivers package of practices recommendation to each farmer from variety selection to harvesting considering their own context of cultivation. Currently the application recommends package of practices suitable for Maize cultivation.

#### **REVIEW OF LITERATURE**

The idea of recommender systems came into picture in the 1990s to help users find relevant content among the abundance of information available on the web. Such systems tend to have a market of their own with applications specifically suggesting music (Chen *et al.*, 2001), books (Cui, 2009), news (Bomhardt, 2004), movies (Azaria *et al.*, 2013), videos (Davidson *et al.*, 2010) in online stores. Recommender systems generally employ any or a combination of these three recommendation generation algorithms which are (a) Collaborative Filtering, (b) Content-based Filtering and (c) Hybrid filtering. Collaborative recommendation works with the assumption that people who had similar choices in the past will have similar preferences in the future also (Herlocker et al., 2004). This kind of systems basically predicts preferences of users for any new item in collaboration with a group of other similar users. Wang et al. (2018) talked about content based filtering algorithms which utilize certain characteristics of an item and try to find out other similar items based on those characteristics. Later came hybrid recommendation algorithms (Burke, 2002) where both the ideas have been merged together to improve the recommendation process. Over the time it has been observed that new users who have not rated enough items could not be presented with any useful recommendation as the system is not aware of their choices. Middleton (2004) came to its rescue by exploring the idea of using ontological profiling to capture the user's interest in an efficient way apart from them to have explicitly rate the items for recommendation.

With the advancement of the Internet, many more such systems prove to be useful in recommending restaurants, tourist places, hotels etc. That's when the concept of Context (Dourish, 2004) came in. Ricci (2010) discussed that various mobile recommender systems make use of current context of the user along with user's behavior to improve personalization in mobiles. Adomavicius (2015) then described the concept of context and mentioned that the contextual information are tend to vary for different applications. The main idea of behind the developed system is to capture the current context of each and individual farmer and recommend them cultivation practices which are suitable on those contexts on the basis of the feedback provided by other farmers having similar contextual conditions in the past.

## PROPOSED CONTEXT-AWARE RECOMMENDER SYSTEM

This section describes the architecture and the work flow of the context-aware recommender system specifically designed for Maize cultivation. The system delivers recommendation on every package of practices followed in Maize, starting from the choice of land preparation method, time of sowing, seed rate, spacing, fertilizer dose, method of application, irrigation scheduling, weed management, insect, pest, disease management and finally method of harvesting. The system works in two phases, viz. phase one determines the priority of providing recommendation based on the contextual parameter values filled in by each famer and the second phase personalizes the list of package of practices accordingly available for each farmer.

Architecture of the system: This system is a multiple software agent based system. Software agents are technological proxies and works on behalf of every individual that has a role to play in the process of generating



Figure 1: Architecture of the context aware RS the recommendations. The application consists of user agent, recommendation agent and agents corresponding to every resource of recommendation (specified as specialized agents). The central recommendation agent allocates job to corresponding agent as per the needs of the individual user agent. If the user agent wants recommendation on irrigation scheduling, user agent communicates that to the central recommender agent, which then allocates the job to the irrigation scheduler agent to find out the most appropriate date for next irrigation. The system is made up of a context information collector module, context assessment module, recommendation generation engine, user agent, and local database. The context information collector module determines the current contextual attribute values. The context assessment module determines the priority level based on the contextual attribute values whether it is required or not to generate and push recommendations. Whenever the priority level comes out to be high, the recommendation generation engine executes and computes the recommendation for the respective package of practices. The local database is used to store the profile information of the users and login credentials and the values of contextual attributes. The following figure presents the architecture of the proposed system.

**Recommendation Generation:** Whenever the context assessment module computes the priority level to be high the user agent informs the recommender agent about the resources on which recommendations are required. Recommender agent then delegates the job to the corresponding specialized agent. The specialized agent then looks for the resources that are appropriate considering the given context of the farmer using the knowledgebase developed for each cultivation practices.

Step 1: Context Information Collector (CIC): Contextual attributes vary from one another for different cultivation practices to be recommended. Attributes have been classified as automatic and manual. Automatic attributes can be detected by the mobile device itself like weather information, temperature, relative humidity and location of the user. Other attributes are manual as they have to be explicitly filled in by the user for example labor and farm implement availability for land preparation choices or affordability of inorganic fertilizers for fertilizer requirement etc. The CIC module does both the job of implicitly detecting the automatic attribute values and also explicitly asking the user for manual attribute values.

Step 2: Priority Level Assessment: This module computes the priority level (low, medium or high) for recommendation generation using Fuzzy logic based on the values of the contextual attributes determined in the previous step. High priority implies that the current context of the farmer requires immediate recommendations to be pushed. Fuzzy logic has been used here to handle the vagueness in input and output values. Fuzzy logic (Zadeh 1988) is a multi-valued logic that allows the intermediate values to be defined between conventional evaluations like yes/no, black/white, true/false etc. The priority level for each recommendation stage has been computed using a varied number of contextual variables. These variables are defined as linguistic variables within the system and their values are mapped by the system as fuzzy number. Levels of these input variables as fuzzy sets are defined below:

Soil texture = {light, coarse, heavy}

Machinery affordability = {Inexpensive, Affordable, Expensive}

The levels of output variable i.e. priority level as fuzzy set has been defined below:

Priority level = {low, medium, high}

Standard triangular function has been used in the system to represent the input variables.

The relationship between the input and output variables are defined by the following rules:



Figure 2: Triangular membership function for input parameter soil\_type

- IF (farm\_size is "large") AND (labour is "costly" OR "unavailable") AND (farm\_implement is "unavailable") AND (budget is "low") THEN priority level is "High".
- IF (farm\_size is "large") AND (labour is "costly" OR "unavailable") OR (farm\_implement is "unavailable") OR (budget is "low") THEN priority level is "Medium".
- IF (soil\_texture is "light") AND (labor is "easy\_available") AND (farm\_implement is "available") THEN priority level is "Low".

The most widely used defuzzification method has been used here to calculate the crisp value of the output parameter context level within the system.

$$\int_{x} x. \mu_{c}(x) dx \Big/ \int_{x} \mu_{c}(x) dx$$

Here,  $\mu_{c}(x)$  is the aggregate output membership function.

**Step 3:** Degree of Relevance: Whenever the priority level comes out to be high, the central recommender agent retrieves the list of cultivation practices that are suitable for the given context of the farmer, based on the reference ontology. The reference ontology describes the package of practices in hierarchical structures, representing each

one of them as classes, sub classes and their instances. Individual instances correspond to the package of practices which are to be shown as the ultimate output of recommendation. Each instance has object and data properties describing its suitability according to the contextual attributes.

**Step 4:** Similarity Computation: Recommender agent then ask the respective specialized agent to find out similar farmer agents who have also rated the list of resources obtained from the above step. Similarity among the farmer agents are computed using the following cosine similarity method.

$$\operatorname{Sim}(a,b) = \frac{\sum_{u \in U} (r_{u,a} - \overline{r_u}) (r_{u,b} - \overline{r_u})}{\sqrt{\sum_{u \in U} (r_{u,a} - \overline{r_u})^2} \sqrt{\sum_{u \in U} (r_{u,b} - \overline{r_u})^2}}$$

Here, U be the set of all resources rated by both farmers a and b. u contains the set of resources that have been retrieved from the previous step.  $r_{u, a}$  and  $r_{u, b}$  are respectively ratings on set of resources u by farmers a and b,  $\overline{r_u}$  is the average rating on a particular resource.

#### EXPERIMENTAL DETAILS

The tools and technologies used in developing the prototype of the system are listed as:

• Java Agent Development Framework (JADE)



Figure 3: Priority level assessment using jFuzzyLogic

- Android Studio Version 3.3
- Microsoft SQL Server 2008
- Protégé 5.0
- jFuzzyLogic Library

JADE, a java based software agent development environment, has been used to develop and deploy the agents used in the system. Android Studio development kit has been used for developing the mobile application which acts as a proof of concept for the proposed system. SQL Server has been used to develop the local database used for storing farmer's profile information, their contextual attribute values and ratings given by them on individual varieties and package of practices. The Fuzzy Inference System (FIS) for handling the uncertainty in the contextual attributes has been implemented in the system with jFuzzyLogic library. This library is directly called by the agents in the system. Protégé, the ontology editor tool, was used to develop and edit the ontologies used in the system making it a semantically enhanced mobile application.

In a typical interaction with the mobile application, the system creates a corresponding farmer agent for every individual farmer. The agent then asks the target farmer to fill the values of contextual parameters. Some of these values are automatically filled in by the application itself like temperature, location, RH and some values have to be explicitly provided by the farmer himself. Individual farmers can also switch off any contextual parameter if they don't find it relevant, corresponding personal agent will not consider those parameters while generating recommendations particularly for that farmer. Farmer



Figure 4: Snapshot of the developed Mobile application recommending planting method

agent then tally the resources of recommendation, with the reference ontology, whether they fit the current situation or not. Then it asks the system generated recommender agent (RA) to provide it's feedback on those resources. The RA then finds out the agents who are similar with the target farmer agents and based on the ratings provided by them on the list of resources further recommendations are generated.

#### CONCLUSION

A context aware recommender system has been designed and developed for recommending package of practices to Maize farmers in the form of a mobile application. The architecture of the system has been explained. Different contextual parameters has been identified for different package of practices. On the basis of the values of the relevant contextual parameters, the priority level has been identified indicating whether it is necessary to generate recommendations now or not.

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## **AUTHOR GUIDELINES**

- 1. Society for Community Mobilization for Sustainable Development (MOBILIZATION) welcomes original articles. Articles (not exceeding 25,00-3,000 words) must be typed on one side of the paper, double-spaced, with wide margins on all four sides. An abstract (not exceeding 100-120 words) must accompany the article. The format followed must be Title, Name of the author(s), their affiliation, abstract, introduction, methodology, major findings, conclusion and reference.
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- 5. Use British, rather than American, spellings (labour, not labor; programme, not program). Similarly, use's', rather than 'z', in 'ise', 'ising', 'isation' words.
- 6. Write numerals between one and ninety-nine in words, and 100 and above in figures. However, the following are to be in figures only: distance: 3 km; age: 32 years old; percentage: 64 percent; century: 20<sup>th</sup> century; and years: 1990s.
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