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Journal of Community Mobilization and Sustainable Development  
Division of Agricultural Extension, Indian Agricultural Research Institute, New Delhi-12 (India)

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## ABOUT THE SOCIETY

**MOBILIZATION Society** was established in 2003 as an 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 940 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 3.46. The Journal of Community Mobilization and Sustainable Development, is also available on our website [www.mobilization.co.in](http://www.mobilization.co.in) and it has been registered with [www.indianjournal.com](http://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***

The National Agricultural Extension System of India over the last few decades has immensely evolved and has witnessed a paradigm shift in its modus operandi and approach. The farmers are no more considered as the mere recipient of input and information, rather an important component of policy planning. Of late, with the increased stress upon pluralistic extension management, the focus of the extension system has shifted to a holistic production-processing-supply environment. Concurrent to the shift, the technology transfer models are increasingly stressing upon an 'Agricultural Knowledge and Information System' in order to take into greater consideration the post production issues. Market intelligence and value chain management started receiving the primary focus amidst the huge postharvest losses.

The public agricultural extension system in the recent years has therefore required to look beyond production with added emphasis. Micro-scale on-farm processing units, value addition and other forms of secondary agriculture although are not new, a functional linkage between production and processing are found generally missing, especially in case of the small and marginal farmers. In India, over 80 percent of the farmers being small to marginal, the overall national loss in the food basket mainly due to dearth of processing facilities and market information becomes cumulatively too high. It is quite shocking to note that in India fruits and vegetables worth rupees over 133 billion are wasted every year. A production based farming business is therefore, hardly profitable without understanding the market dynamics, environmental and institutional factors of production. The present day threats posed by the climate change issues further add to the challenges of leveraging contingencies and a sustainable farm based livelihood. A serious multi-stakeholder involvement and convergence in an organized and committed way between agencies for a harmonious production-processing milieu is therefore felt increasingly essential.

In this context 8<sup>th</sup> National Seminar on "Extension beyond Production: Multi-stakeholder Convergence for Sustainable Rural Development" is being organised at ICAR Research Complex for NEH region, Umiam, Meghalaya during November 9-11, 2016 by the Society of Community Mobilization for sustainable Development.

We are happy to bring out January-June, 2016 issue and it has enveloped the research domain in the areas of Experiential learning programme, Role performance, Adoption studies and constraints in adoption, Identification of training needs, Spatio-temporal variation in status of crop diversification, Economic dimensions of enterprises, Yield gap analysis and Innovation management.

I extend my heartfelt thanks to the members of the editorial team - Drs. M.S. Nain, R. Roy Burman, S.K. Dubey, Nishi Sharma, L.K. Tyagi, S.R.K. Singh and Souvik Ghosh who meticulously edited the papers to bring out the issue on time. I also extend my special thanks to Dr. Sudipta Paul in editing research papers for this issue of the journal. I also express my sincere gratitude to the researchers for contributing the quality research papers for the journal.

**J.P. Sharma**  
*Chief Editor*



# Explanatory Variables for Perceived Utility of Experiential Learning Programme of Indian Council of Agricultural Research

Bushe Lekang<sup>1#</sup>, M.S. Nain<sup>2\*</sup>, Rashmi Singh<sup>3</sup> and J.P. Sharma<sup>4</sup>

<sup>1</sup>PhD Scholar, <sup>2</sup>Senior Scientist, <sup>3</sup>Principal Scientist, Division of Agricultural Extension, ICAR-IARI, New Delhi-110012

<sup>4</sup>Joint Director Extension, ICAR-IARI, New Delhi-110012

#Present address: Agriculture Lecturer- Serowe College of Education, Botswana

## ABSTRACT

Indian Council of Agricultural Research introduced a programme in 2006 named Experiential Learning Programme aimed at equipping undergraduates with entrepreneurial skills. Since its inception, explanatory factors of perceived utility have not been studied, hence this study is aimed at finding those factors. An explanatory study aimed at finding out among students and teachers which institutional and curriculum related factors have influenced the utility of the programme. The findings revealed that the students' perceived administrative issues and teaching methods to have negatively influenced imparting of entrepreneurial skills while teachers also perceived teaching methods to have had a negative influence. Both students and teachers perceived administrative issues to have positively influenced development level of entrepreneurial competencies of students. Students perceived administrative issues, relevance of courses, teaching methods and extra-curricular activities to have positively influenced the stages of entrepreneurship education completed by students. The overall utility was perceived by students to have been positively influenced by administrative issues and teaching methods, while teachers perceived extra-curricular activities to have influenced it negatively. Administrative issues, teaching methods and extra-curricular activities used therefore can be attributed to the performance of the programme. There is therefore need to review administrative procedures to enhance entrepreneurial culture within institutions. Teachers' competencies in handling experiential learning for entrepreneurship development need to be established so that the necessary corrective measures may be taken.

**Keywords:** Entrepreneurial skills, Entrepreneurial competencies, Entrepreneurial education stages

## INTRODUCTION

Entrepreneurial skills development involves building human capacities through formal and or informal training imparting basic entrepreneurial skills such as financial, technical, creative, managerial, intellectual, marketing, communication and technological skills (Anho, 2011). Economic, social, technical, managerial and regulatory factors influence entrepreneurship education (Azizi *et al.*, 2010). The outcomes of such entrepreneurial education programme are shaped by its characteristics, perspective as well as moderating factors for the participant (Valerio *et al.*, 2014). To develop entrepreneurship skills, curriculum and related extra-curricular activities are important (Alberta and Libecap,

2000) as well as appropriate teaching methods which engage students to acquire practical skills when used enable students to acquire the right entrepreneurial skills (Esene, 2015). Entrepreneurship is learned through experience and trial and error, hence emulating real life situation during its teaching was crucial (Higgins and Elliott, 2011). Experience-based teaching methods when effectively used reduce the gap between theory and practice (Cavicchi *et al.*, 2014). An appropriate group size for experiential learning should consist of 4-5 individuals since the number allow higher engagement of learners (Hannon and Lonappan, 2013).

In an attempt to build practical skills, entrepreneur spirit and facilitate employability among under graduate

\*Corresponding author email id: msnain@gmail.com

students, Indian Council of Agricultural Research developed a one year programme in 2006 for Agricultural Universities called Experiential Learning Programme. A scheme on creating facilities for establishing experiential learning farms, model plants, engineering workshops, veterinary and plant clinics was launched during the tenth five year plan in 2006 to facilitate hands-on training. The units named Experiential Learning Units are aimed at promoting entrepreneurship, knowledge and marketing skills through meaningful hands on experience and working in project mode, from assembling inputs to sale of what is produced.

The programme offered during the final year, had been mandatory to undergraduate students in Agricultural Universities. It focuses on hands-on training based mainly on practice in technologically advanced methodologies for production and integrated farming systems in pre-selected vocations such as production of fruits, vegetables, ornamental, medicinal and aromatic plants, fish, poultry, milk, eggs, meat and wool, and processing for value added products. To strengthen hands-on training, students also go for internships in private industrial houses, technology transfer and rural development programmes related to their vocation (Katyal and Bisht, 2005). Predictors of the utility of Experiential Learning Programme are yet not known. The present study was undertaken to establish the perceived predictors of the utility of the programme by the students and teachers with the view of suggesting areas of improvement within the programme.

## MATERIALS AND METHODS

An exploratory research design study was conducted in six purposively selected agricultural universities in five places from four states in North India namely Punjab, Uttar Pradesh, Haryana and Uttarakhand. The universities used were Punjab Agricultural University (PAU) and Guru Angad Dev Veterinary and Animal Sciences University (GADVASU) in Ludhiana, Chaudhary Charan Singh Haryana Agricultural University (CSHAU) in Hisar, Govind Ballabh Pant University of Agriculture and Technology (GBPUAT) in Pantnagar, Sardar Vallabh Bhai Patel University of Agriculture and Technology (SVBPUAT) in Meerut, Chandra Shekhar Azad University of Agriculture & Technology (CSAUAT) in Kanpur.

Nine units from all the universities were used made up of 2 units each from CSAUAT, GADVASU, and PAU, while CCHAU, GBPUAT and SVBPUAT had one unit. The units were discipline based henceforth the names of disciplines will be used instead of the units themselves. All students from the sampled unit who had gone through the programme, Masters of Science first year students in their respective disciplines, were used as respondents as well as the teachers within the discipline who were engaged in the programme. A total of 140 students and 40 teachers from all the universities were used. Two sets of questionnaire, one for students and the other for teachers were prepared based on the experiential learning programme guidelines and literature review. The two sets of questionnaire were used to assess relevance and adequacy of courses, the extent to which the objectives of the Experiential Learning Programme were being met which was assessed through perceived entrepreneurship skills, perceived competencies acquired and perceived entrepreneurship education stages completed, and administrative issues which influenced the performance of the programme were studied.

Inter-correlations among independent variables and the dependent variable of perceived utility of experiential learning programme were determined. Correlations were used to describe the relationships between perceived utility of Experiential Learning Programme and the independent variables. Spearman rank-order ( $r_s$ ) was used to measure association where ordinal variables were correlated with ordinal variables, Rank biserial coefficient ( $r_{rb}$ ) was used when nominal data was correlated with ordinal data while Phi coefficient was used where nominal variables were correlated with another nominal variable. Those variables which showed substantial relationship ( $r \geq .10$  or more) were then used in logistic regression analysis to come up with predictors for the dependent variable (Kothari, 2004).

## RESULTS AND DISCUSSION

### *Inter-correlations between dependent variable and independent variables as perceived by students:*

Inter-correlations as presented in Table 1 showed significant association between entrepreneurial skills and the following independent variables: administrative factors ( $r = -.22$ ), teaching methods ( $r = -.26$ ), sex



**Table 1: Correlation coefficients for perceived utility by students**

Factors	Correlation coefficients			
	Skills	Comp- etence	Stages	Utility
Administrative	-.22*	.19*	.24*	.27*
Relevance of courses	-.12	.21*	.21*	.17
Adequacy of courses	.02	.08	.12	-.03
Teaching methods	-.26*	.16	.34*	.23*
Extra curricula activities	.01	.06	.27*	.12
Age	-.17	.07	-.07	.10
Sex	.29*	.11	.04	.15
Birth order	.07	-.15	-.11	-.08
Background	.05	.11	.13	.15
Caste	.04	.13	.09	.22*
Size of group	.36*	-.09	-.10	-.03
Previous training	.24*	.08	.01	.12
Role model	.02	.18*	.17	.25*
Education level of father	.08	-.06	.14	.06
Education level of mother	.07	-.07	.03	.05
Occupation of father	-.03	.07	.16	.03
Occupation of mother	.06	-.08	-.03	-.11
Presence of family owned business	.02	-.04	.03	-.06

\*Significant correlations at p=0.05

(r =.29), size of working group (r =.36), and previous training (r =.24). Significant associations were found between entrepreneurial competencies and administrative factors(r =.19), relevance of course (r =.21) as well as role model (r =.18). Entrepreneurship education stages had significant association with administrative factors(r =.24), relevance of course (r =.21), teaching methods (r =.34) and extra curricula activities (r =.27), while utility had significant association with administrative factors(r =.27), teaching methods (r =.23), caste (r =.22) and role model (r=.25). Size of working group and previous training showed positive association. This is contrary to Hannon and Lonappan (2013) who stated that big working groups do not allow full participation of all group members as well as close monitoring of their activities hence the recommended group size is normally 4-5 students.

**Inter-correlations between dependent variable and independent variables as perceived by teachers:**

Entrepreneurial skills showed significant association with teaching methods (r =-.28) and background (r =.29). Significant associations were found between entrepreneurial competency and administrative factors

(r = .18) extra curricula activities (r =.25), caste (r =-.18), years of experience (r =.18), and background (r =-.18). Entrepreneurship education stages had significant association with caste (r =-.18) and size of working group (r =-.20), while utility had significant association with extra curricula activities (r = -.34), and background (r =.25) as shown in Table 2. Teaching methods have been found to play an important role in the delivery of any curriculum. As part of the characteristic of an entrepreneurship programme they determine the outcomes of a programme as stated by Valerio *et al.* (2014).

**Table 2: Correlation coefficients of perceived utility by teachers**

Factors	Correlation coefficients			
	Skills	Comp- etence	Stages	Utility
Technical	.01	-.05	.05	.03
Involvement of stakeholders	-.07	-.01	-.09	.02
Financial	.11	-.06	.14	.08
Administrative	-.09	.18*	-.10	.03
Teaching methods	-.28*	.04	.08	-.02
Extra curricula activities	-.17	.25*	-.13	-.34*
Age	.00	.16	-.11	-.07
Sex	.17	.14	.14	.16
Background	.29*	-.18*	.15	.25*
Caste	-.04	.31*	-.18*	.15
Years of experience	-.17	.18*	.10	-.06
Size of group	-.06	-.01	-.20*	-.16
Programme duration	-.06	-.01	-.07	-.15
Number enrolled	-.02	-.08	-.12	-.04

\*significant correlations at p =0.05

**Perceived predictors of entrepreneurial skills by students and teachers:**

**Students:** Administrative factors, teaching methods, sex, size of working group and previous training were found to predict perceived entrepreneurial skills. The total variance explained by these factors was 28% as shown by Nagelkerke R<sup>2</sup> value. Size of working group (alpha =.00) and sex (alpha =.05) proved to be significant predictors of perceived entrepreneurial skills as shown in Table 3. From the regression analysis findings, the model of entrepreneurial skills as perceived by students is as presented below:

$$\text{Entrepreneurial skills} = 0.10 - 0.20 (\text{Administrative}) - 0.33 (\text{Teaching methods}) + 0.78(\text{Sex}) + 0.51 (\text{Size of working group}) + 0.62 (\text{Previous training}) + e$$

The model reveals that perceived administrative issues and teaching methods had a negative influence on the acquisition of entrepreneurial skills. According to Valerio, Parton and Robb (2014) the outcomes of an entrepreneurial education programme are shaped by its characteristics, which encompass among others administrative issues and teaching methods. Institutional policies and operations, and teaching methods used did not enable students to acquire the expected entrepreneurial skills. Sex, size of working group and previous training were found to have a positive influence on perceived acquisition of skills. The study group had more males than females which could have led to positive influence as stated by Saxena (2005) and Keat et al. (2011) that males were more inclined to entrepreneurship than their female counterparts.

**Teachers:** Teaching methods and background were found to predict perceived entrepreneurial skills by teachers. The total variance explained by these factors was 21% as shown by Nagelkerke R<sup>2</sup> value as shown in Table 3. From the regression analysis findings, the model of entrepreneurial skills as perceived by teachers is as shown: Entrepreneurial skills = 2.98 - 0.77 (Teaching methods) + 1.09 (Background) + e

Teaching methods were perceived to have had a negative influence on perceived entrepreneurial skills acquired. This means that the methods used were not suitable experiential learning to occur which would have allowed students to acquire entrepreneurial skills. Esene (2015) pointed out that appropriate teaching methods

**Table 3: Predictors of entrepreneurial skills as perceived by students and teachers**

Factors	B	Wald	Sig.	Exp (B)	Nagelkerke R <sup>2</sup>
<b>Students</b>					
Administrative	-.20	.75	.39	.82	.28
Teaching methods	-.33	1.94	.16	.72	
Sex	.78	3.84	.05	2.19	
Size of working group	.51	8.86	.00	1.66	
Previous training	.62	1.31	.25	1.86	
Constant	.10	.01	.92	1.11	
<b>Teachers</b>					
Teaching methods	-.77	2.27	.13	.46	.21
Background	1.09	2.41	.12	2.97	
Constant	2.98	2.57	.11	19.77	

which engage students to acquire practical skills when used enable students to acquire the right entrepreneurial skills. Background of teachers was found to have positive effect on perceived entrepreneurial skills, possibly because entrepreneurship as opined by Rao and Pakreek (1978) was a process developed through socialization. Personal background characteristics would therefore influence their entrepreneurial skills and how they view entrepreneurship.

**Predictors of entrepreneurial competency development level as perceived by students and teachers**

**Students:** Administrative issues, relevance of courses and role model predicted perceived entrepreneurial competencies. The total variance explained by these factors was 100% as shown by Nagelkerke R<sup>2</sup> value as shown in Table 4. As a result it can be explained that, Entrepreneurial competencies = -127.31 +11.98 (Administrative) + 48.67 (relevance of course) -2.29 (Role model) + e

Students perceived administrative issues and relevance of course to have positively influenced the development level of entrepreneurial competencies while role model had a negative influence. Administrative issues and relevance of course form part of the characteristics of an educational programme. Their positive effect on development level of entrepreneurial competencies is in line with Valerio, Parton and Robb (2014) who stated that the outcomes of an entrepreneurial education programme are shaped by its characteristics. Taking into consideration the course content and exercises that would lead to development of entrepreneurial competencies, it is not surprising for these factors to have had a positive effect as compared to entrepreneurial skills. More logistics related to acquisition of the necessary resources and challenge of guiding individual students from groups of twenty students within a limited time are likely to have had an effect on the perceptions about the various that could have an effect on the perceived outcome.

**Teachers:** Administrative factors, extra curricula, caste and years of experience predicted perceived entrepreneurial competencies by teachers. The total variance explained by these factors is 22% as shown by

Nagelkerke R<sup>2</sup> value (Table 4). As a result it can be explained that Entrepreneurial competencies = 39.65 + 0.01 (Administrative) – 0.60 (Extra curricula) – 18.55 (Caste) + 0.73 (Years of experience) + e

From the model, teachers perceived administrative issues and years of experience to have positively influenced the perceived entrepreneurial competency development level of students. The positive effect of administrative issues which are part of programme characteristics concurs with Valerio, Parton and Robb (2014), that the outcomes of an entrepreneurial education programme are shaped by its characteristics. United Nations Development Program (1999) stated that entrepreneurial skills and knowledge could be enhanced through structured training and institution building programs. Experience trainers are therefore likely to have better skills and knowledge to impart to the trainees hence the positive perceived effect of years of experience on perceived entrepreneurial competency development level. On the other hand extra curricula activities and caste were perceived to have a negative effect on perceived level of entrepreneurial competency development level. The negative effect of extra-curricular activities is contrary to Alberta and Libecap (2000) who stated that appropriate extra-curricular activities are important in developing entrepreneurship competencies. The negative effect might therefore mean such activities were in appropriate or they did not exist. Rao and Pakreek (1978) view entrepreneurship as a process developed through socialization hence the

negative effect of caste could imply that the castes from which teachers came could not socialize them for entrepreneurship hence their perception.

**Predictors of entrepreneurship education stages as perceived by students and teachers**

**Students:** Administrative issues, relevance of courses, teaching methods and extra curricula were found to predict perceived entrepreneurship education stages by students. The total variance explained by these factors is 46% as shown by Nagelkerke R<sup>2</sup> value. Significant predictors of entrepreneurship education stages were relevance of courses (sig. = .02) and teaching methods (sig. = .03) as shown in Table 5. It can therefore be explained that Entrepreneurial education stages = -7.93 (Administrative issues) + 1.01 (Relevance of courses) + .94 (Teaching methods) + 0.74 (Extra curricula).

Students perceived administrative issues, relevance of courses, teaching methods and extra curricula to have influenced completion of entrepreneurship education stages positively. All the factors are related to characteristics of educational programme hence the findings are in accordance with Valerio, Parton and Robb (2014) that the outcomes of an entrepreneurial education programme are shaped by its characteristics.

**Teachers:** Perceived stages of entrepreneurship education completed by students, was found to be predicted by caste and size of working group. The factors explained 24% of the total variance as shown by Nagelkerke R<sup>2</sup> value. The factors were however found not to be significant predictors of entrepreneurship education stages (Table 5) and the model can be explained in an equation as: Entrepreneurial education stages = 99.99 – 18.03(Caste) – 17.95(size of working group) + e

Caste and size of working group were found to have a negative influence on the stages of entrepreneurship education completed by students as perceived by teachers. Entrepreneurship as viewed by Rao and Pakreek (1978) as a process developed through socialization, this could mean the castes from which the teachers came did not socialize them into entrepreneurship. The negative effect of the size of the working groups concurs with Hannon and Lonappan (2013) who stated that large working groups were not

**Table 4: Perceived predictors of entrepreneurial competencies by students and teachers**

Factors	B	Wald	Sig.	Exp (B)	Nagelkerke R <sup>2</sup>
<b>Students</b>					
Administrative	11.98	.00	.99	15.97*10 <sup>4</sup>	1.00
relevance	48.67	.00	.99	13.65 *10 <sup>20</sup>	
Role model	-2.29	.00	1.00	.10	
Constant	-127.31	.00	.98	.00	
<b>Teachers</b>					
Administrative	.01	.00	.99	1.01	.22
Extra curricula	-.60	.52	.47	.55	
Caste	-18.55	.00	1.00	.00	
Years of experience	.73	.57	.45	2.07	
Constant	39.65	.00	1.00	16.59*10 <sup>16</sup>	

**Table 5: Perceived predictors of entrepreneurial education stages by students and teachers**

Factors	B	Wald	Sig.	Exp (B)	Nagelkerke R <sup>2</sup>
<b>Students</b>					
Administrative	.52	2.37	.12	1.68	.46
Relevance	1.01	5.35	.02	2.74	
Teaching methods	.94	4.54	.03	2.55	
Extra curricula	.74	3.04	.08	2.09	
Constant	-7.93	13.06	.00	.00	
<b>Teachers</b>					
Caste	-18.03	.00	1.00	.00	.24
Group size	-17.95	.00	1.00	.00	
Constant	91.99	.00	1.00	8.947*10 <sup>39</sup>	

good for experiential learning instead groups of 4-5 individuals were appropriate. Though this might be true to some extent considering the fact that learning process might be slowed when the teacher has to guide individuals in a large group, the stages themselves are more aligned to levels of formal education which are primary, secondary and tertiary. At tertiary level students are expected to get to start-up stage, therefore failure to reach that stage might be attributed to other factors such as administrative issues which tend to recur in most of the aspects of entrepreneurial utility.

#### **Perceived predictors of experiential learning programme utility by students and teachers:**

**Students:** Perceived utility of experiential learning programme was found to be predicted by administrative factors, teaching methods, caste and role model. The factors explained 77% of the total variance as shown by Nagelkerke R<sup>2</sup> value. The factors were however not significant predictors of entrepreneurship education stages (Table 6) and were explained in the form of an equation as:

$$\text{Utility} = -22.95 + 5.96 (\text{Administrative issue}) + 2.30 (\text{Teaching methods}) + 5.76 (\text{Caste}) + 5.57 (\text{Role model}) + e$$

Students perceived the overall utility of the programme to have been positively influenced by administrative issue, teaching methods, caste and role model. The positive effect of administrative issue and teaching methods which are part of the characteristics of the programme concurs with Valerio, Parton and

Robb (2014) that the outcomes of an entrepreneurial education programme are shaped by its characteristics. Caste and role model are part of an individual's socialization hence that concurs with Rao and Pakreek (1978) that entrepreneurship is developed through socialization.

**Teachers:** Background of teachers and extra curricula activities predicted perceived utility of experiential learning programme. They collectively explained 71% of the total variance in perceived utility as shown by Nagelkerke R<sup>2</sup> value. The factors were however not significant predictors of entrepreneurship education stages (Table 6) and explained in equation form as:

$$\text{Utility} = 19.24 + 18.68 (\text{Background}) - 4.21 (\text{Extracurricular activities}) + e$$

Teachers perceived background and extra curricula activities to have had positive and negative influence on utility respectively. The positive effect of background, that is rural or urban background could be attributed to motivational factors as stated by Rao and Pakreek (1978) entrepreneurs have been found to be having high achievement motivation; hence they constantly strive to achieve some work. Push and pull factors which may exist both in the rural and urban background could lead teachers to become entrepreneurial thus making them better equipped to impart entrepreneurial skills to their students. The negative effect of extra-curricular activities is contrary to Alberta and Libecap (2000) who stated that appropriate extra-curricular activities are important in developing entrepreneurship competencies. The negative effect might therefore mean such activities were in appropriate or they did not exist.

**Table 6: Perceived predictors of utility by students and teachers**

Factors	B	Wald	Sig.	Exp (B)	Nagelkerke R <sup>2</sup>
<b>Students</b>					
Administrative	5.96	.88	.35	389.37	.77
Teaching methods	2.30	1.78	.18	9.95	
Caste	5.76	1.25	.26	316.56	
Role model	5.57	1.08	.30	263.56	
Constant	-22.95	1.20	.27	.00	
<b>Teachers</b>					
Background	18.68	.00	1.00	12.98*10 <sup>7</sup>	.71
Extra curriculum	-4.21	2.29	.13	.02	
Constant	19.24	2.33	.13	22.70 *10 <sup>7</sup>	

As from the point of view of students, administrative factors, teaching methods and role model predicted the utility of the programme. These results are supported by Azizi *et al.* (2010) who found economic, social, technical, managerial and regulatory factors to have influenced entrepreneurship education. Curriculum and related extra-curricular activities have been found to play an important role in the success of an entrepreneurship program (Alberta and Libecap, 2000).

The variance explained by the independent variables in models for perceived entrepreneurial skills, and competencies was low (21- 46%) as perceived by both students and teachers except for the perceived entrepreneurial competency as perceived by students (100%) and overall utility which had 71% and 77% as perceived by teachers and students. It is therefore, even though an acceptable variance explained according to Beavers *et al.* (2013) is 75 – 90% or as little as 50% of the variance should be accounted for, in social research, variation accounted for should not necessarily be the bone of contention. The focal point of social research according to Fichman (1999) should be whether there exists an effect or not, hence the magnitude of the effect need not always be an issue of concern as the outcomes by nature are stochastic. Abelson (1985) also noted that explained variance of cumulative processes such as educational interventions, even if they may have small variance contributions to the independent variables in single-shot studies, they require to be dealt with on conditional basis as it may in the long run grossly devalue the variance contribution, the process through which such variables operate in the real world is important than the magnitude of variance explained. This study dealt with perceptions which could not be estimated in certainty in any way hence the focus was only on whether there was an effect of independent variables on the utility of the programme and the models were presented as such.

### CONCLUSION

As perceived by students administrative issues and teaching methods had a negative influence on the acquisition of entrepreneurial skills which implies that policies and operations were not favorable for imparting skills. Sex, size of working group and previous training had a positive influence acquisition of entrepreneurial

skills. From the teacher's perspective, teaching methods and background were perceived to have had a negative and positive effect on perceived entrepreneurial skills acquired respectively. Administrative issues and relevance of course positively influenced the development level of entrepreneurial competencies while role model had a negative influence as perceived by students. Teachers perceived administrative issues and years of experience to have positively influenced the perceived entrepreneurial competency development level of students. Students perceived administrative issues, relevance of courses, teaching methods and extra curricula to have influenced completion of entrepreneurship education stages positively. Caste and size of working group were found to have a negative influence on the perceived stages of entrepreneurship education completed by students as perceived by teachers. Students perceived the overall utility of the programme to have been positively influenced by administrative issue, teaching methods, caste and role model. Teachers perceived background and extra curricula activities to have had positive and negative influence on utility respectively. Since administrative issues, teaching methods and extra curricula activities influenced most aspects of utility either positively or negatively, there is therefore need to review the administrative procedures to enhance entrepreneurial culture within institutions. Teachers' competencies in handling experiential learning for entrepreneurship development need to be established so that the necessary corrective measures may be taken.

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# Role Performance of Subject Matter Specialists in *Krishi Vigyan Kendras* of Northern India

Pankaj Kumar<sup>1</sup> and Prabhjot Kaur<sup>2</sup>

<sup>1</sup>Assistant Extension Specialist and <sup>2</sup>Professor of Extension Education, Department of Extension Education, Punjab Agricultural University, Ludhiana, Punjab

## ABSTRACT

Role performance of Subject Matter Specialists (SMSs) of *Krishi Vigyan Kendras* (KVKs) was imperative to study for evaluating the overall output of KVKs. Study was conducted in twenty KVKs of Northern India. A scale was constructed using Likert technique to study the role performance. Findings revealed that most of the respondents were male (63.91%), in middle category of age (49.48%), from Home Science discipline (18.56 %), residing between 1 to 53 km distance (74.22%). life members of professional societies (81.44%), having doctorate education (63.92 %), married (95.88%), having post graduate (58.06%) and serving spouse (76.34), rural background (57.73%), having nuclear families (51.55%), family occupation service (69.07%) and service experience of 1-11 years (55%). Assessment of the training needs of the farmers of the district, finding out location specific problems, demonstrating improved technologies of agriculture on the farmers' fields, drawing up of a suitable plan of work, keeping oneself professionally up to date, identifying the key communicators, actively involving himself in evaluation of programme, developing and maintaining good relations with superiors, subordinates and associates, providing diagnostic services, attending visiting farmers and other visitors and dealing politely with them and delivering invited lectures were the top ranked roles performed by SMSs in different role segments respectively. Overall role performance was high as 51.55 percent respondents fallen under this category followed by medium (44.33%) and low role performance category (4.12%). In comparison of different role segments, overall mean score of the role segment office work and reporting was highest (4.65) followed by management (4.46) and Subject matter authority (4.41). In core activities of FLDs and OFTs role performance was least and core activity training was in the middle of the different role segments.

**Keywords:** Role performance, Subject matter specialists, *Krishi vigyan kendra*, Role segments

## INTRODUCTION

*Krishi Vigyan Kendras* (KVKs) plays an important role in the development of agriculture in India. Impact of KVK training on knowledge extent of trainees was significant as against untrained respondents (Gautam *et al.*, 2014). KVKs which have six subject matter specialists of different subjects headed Programme coordinator act as mini university at the district level. In the beginning, the mandate of KVKs was confined only to provide skill based training to the farmers, farm women and rural youth in agriculture as a whole and other allied vocations such as apiculture, mushroom cultivation etc. With the consolidation of other front-

line extension projects of the Council during the Eighth Five Year Plan, the mandate was enlarged and revised to take up on-farm testing, long term vocational training, in service training for grass root extension workers and front-line demonstrations on major cereal, oilseed and pulse crops and other enterprises (Venkatasubramanian *et al.*, 2009). In the organizations every person is expected to behave in a particular manner while performing a specific role (Prasad, 2000). Every scientist has to play a set role related with a position in an organization and so is the case with Subject Matter Specialists. They are responsible for successful execution of the mandate of KVKs. They are expected to perform many duties related to farmers'

training, in-service trainings, on farm testing (OFT), front line demonstrations (FLDs), communication, feedback, evaluation and follow-up of trainings etc. To work under the mandate of KVKs, SMSs have to play many roles. Many times they are not even aware of the roles they are already playing, while organizing various activities. Although they execute their job excellently but due to their lack of acquaintance with role concept, the role performance becomes difficult to judge. So in the light of these the present study was conducted with the specific objective to determine the role performance of SMSs in selected KVKs of Northern India.

### MATERIALS AND METHODS

The study was conducted in the Punjab, Haryana and Himachal Pradesh states. A total of twenty KVKs were selected using probability proportion to number. Eight KVKs from Punjab i.e. Jalandhar, Fatehgarh Sahib, Ludhiana, Ferozepur, Kapurthala, Amritsar, Bathinda, Mansa, seven from Haryana i.e. Sonapat, Panipat, Jind, Kaithal, Rohtak, Kurukshetra and Faridabad, and five from Himachal Pradesh viz. Kangra, Una, Bilaspur, Kullu and Mandi were selected randomly. For determining the role performance, all the subject matter specialists (total 97) working in the selected KVKs were taken as the respondents. A scale was developed to measure the role performance using Likert technique. In this scale role performance was divided into 11 role segments. A total of 96 role items under these role segments were finalized. The data were collected through mailed questionnaire or personal interview. The statistical analysis was done using tools such as mean, standard deviation, analysis of variance and Tukey post hoc test. The mean was used to classify the different variables in low, medium and high categories. ANOVA was applied to know any significance difference between different role segments and Tukey post hoc test was applied to know which two role segments differs significantly.

### RESULTS AND DISCUSSION

**Socio-personal characteristics of the respondents:** Socio personal characteristics of the respondents such as age, sex, discipline and distance of place of posting etc were studied. Data placed in the Table 1 tells about the socio-personal characteristics of the respondents. It is obvious from the table that most of the respondents

were male (63.91%) and were falling in the middle category (38-48 years) of age with a percentage of about 49. Home Science was leading discipline of the respondents. One point is kept to be in mind that Home Science was reported one discipline as a whole which further consisted of several other disciplines of this science. In that sense the Agronomy was come out to be the main discipline. As far the distance of residence from place of posting is concerned about 7 per cent respondents were residing on campus, where as majority (74.22%) of the respondents were residing between 1 to 53 km distance. Majority of the respondents were life members of professional societies (81.44%), having doctorate education (63.92 %) and married (95.88%). Among the married respondents, majority was having post graduate (58.06%) and serving spouse (76.34) followed by housewives (18.28%), while only one respondent was having spouse doing farming. Further majority of the respondents were coming from rural background (57.73%), having nuclear families (51.55%) and family occupation was service with a percentage of around 69 per cent. As far the service experience of the respondents was concerned, it was having a wide range from one year to 31 years. However majority (55%) was having service experience of 1-11 years. The finding of the study was quite in line with Singh and Kumar (2012) who reported that qualification of most of the trainers was found to be Ph.D., 5-10 years of experience of their service, maintained nuclear type of family with one exception of age as most of the trainers in KVKs were 30-40 years old.

**Role Performance Regarding Organization of Trainings:** Organization of the trainings is a prime objective of the KVKs. SMSs working in KVKs are expected to perform this role meticulously. Data in Table 2 highlights the role performance of SMSs in this role segment and it is quite clear that assessment of the training needs of the farmers of the district was most performed role by them by securing a mean score of 4.61. This was followed by organizing discussion session for the better understanding of subject matter (mean score 4.58) and delivering well prepared lecture to the trainees (mean score 4.57). However use of proper AV aids was the least performed role with a mean score of 4.18. Careful selection of the trainees for a training programme was also one of the least performed roles which is otherwise a primary step of the organization



**Table 1: Distribution of the respondents according to their socio-personal characteristics**

Socio-personal characteristics	Category/range	f	Percentage
Sex	Male	62	63.91
	Female	35	36.08
Age	28-38	29	29.90
	38-48	48	49.48
	Above 48	20	20.62
Discipline	Agronomy	13	13.40
	Vegetables	9	9.28
	Agricultural Engineering	4	4.12
	Entomology	9	9.28
	Home Science	18	18.56
	Soil Science	11	11.34
	Extension Education	11	11.34
	Pomology	6	6.19
	Animal/Vet. Science	3	3.09
	Plant Pathology	6	6.19
	Forestry	4	4.12
	Nematology	1	1.03
	Agri Economics	2	2.06
	Distance of residence from place of posting (km)	On campus	7
1-53		72	74.22
53-105		11	11.34
105-157		7	7.21
Membership of professional societies	No membership	5	5.16
	Annual	35*	36.08
	Life	79*	81.44
Education	M.Sc/Post graduation	35	36.08
	Ph. D	62	63.92
Marital status	Married	93	95.88
	Unmarried	4	4.12
	Widow/widower	-	0
Education of spouse	Matric	2	2.15
	10+2	1	1.08
	Graduation	21	22.58
	Post-Graduation	54	58.06
	Ph. D.	15	16.13
Occupation of spouse	Service	71	76.34
	Housewives	17	18.28
	Business	4	4.30
	Farming	1	1.08
Family back ground	Rural	56	57.73
	Urban	41	42.27
Family type	Joint	47	48.45
	Nuclear	50	51.55
Family occupation	Agriculture	18	18.56
	Business	3	3.09
	Service	67	69.07
	Agriculture + Service	9	9.28
Service Experience	1-11	55	56.70
	11-21	26	26.80
	Above 21	16	16.50

**Table 2: Distribution of SMSs according to their role performance regarding organization of trainings**

Role items	Mean score	Ranks
Assessment of the training needs of the farmers of the district	4.61	1
Careful selection of the trainees for a training programme	4.20	9
Developing need based curriculum	4.52	4
Use of proper AV aids	4.18	10
Preparing and distributing the training material amongst farmers and extension staff	4.27	6
Delivering well prepared lecture to the trainees	4.57	3
Organizing discussion session for the better understanding of subject matter	4.58	2
Arranging field trips to the demonstration sites, experiment fields and other relevant places	4.23	7.5
Measuring the impact of training programme	4.23	7.5
Modifying training programme on the basis of feedback received	4.35	5

of trainings. Two probable reasons may be behind this, either number of farmers who want training were less or the SMSs were selecting trainees on first come first serve basis.

**Role Performance Regarding On-Farm Trials:** On farm testing is among the core components of KVKs' mandate. This exhibits the research capabilities of the SMSs in KVKs. As far the role performance is concerned, the data in Table 3 clearly denotes that finding out location specific problems was leading (mean score 4.62) followed by critically observing and recording data of trials (mean score 4.44) and laying out the experiments properly (mean score 4.62). Carrying out experiment on own initiation in the field which is neglected one and applying appropriate statistical tools to analyse the data were the least performed role with a mean score of 3.85 and 3.87 respectively. This clearly indicated that either SMSs were overburdened with work and had less time to perform these roles or they may be needed specific training to perform these roles.

**Role Performance Regarding Front Line Demonstrations:** Front line demonstrations are

another basic role segment of KVK work to make significant adoption of newly recommended technologies. In this segment, demonstrating improved technologies of agriculture on the farmers' fields was the most performed role (mean score 4.48) as given in Table 4. However conducting survey to ascertain the socio-economic conditions of farmers and the farming situations under which the crop is grown and organizing orientation training for all the participating individuals/agencies about all aspects of technologies and methodologies to be demonstrated were least performed roles with a mean score of 3.84 each followed by informing, all participating agencies/persons well in advance about the date and venue prior to the launching of the demonstrations (mean score 4.01). Several other important roles were also among the least performed roles. It was reported by them although they were aware of all the roles and all roles are very important also, but KVKs has to accomplish the target of at least 100 FLDs every year. So if all the above mentioned roles had to be performed then very less time will be left for the other activities. So they had to compromise on one or other role in FLDs.

**Table 3: Distribution of SMSs according to their role performance regarding on-farm trials**

Role items	Mean score	Ranks
Finding out location specific problems	4.62	1
Carrying out experiment on own initiation in the field which is neglected one	3.85	8
Stating the objectives of the research clearly	4.23	4
Laying out the experiments properly	4.32	3
Critically observing and recording data of trials	4.44	2
Applying appropriate statistical tools to analyse the data	3.87	7
Carrying out research on the farmers' field to refine the research	3.95	5
Publishing the findings of the on-farm-research trials	3.91	6

**Table 4: Distribution of SMSs according to their role performance regarding front line demonstrations**

Role items	Total score	Ranks
Introducing new technology through progressive farmers	4.43	2
Demonstrating improved technologies of agriculture at the farmers' fields	4.48	1
Developing a comprehensive plan for organizing the demonstrations	4.08	10.5
Proper selection of site for demonstration	4.14	9
Conducting survey to ascertain the socio-economic conditions of farmers and the farming situations under which the crop is grown	3.84	15.5
Conducting survey to find the existing level of adoption of technologies and the productivity	4.08	10.5
Analysing agro-economic constraints of the representative farmers sample to identify the critical factors/inputs for the adoption of technologies	4.04	12
Organizing a orientation training for all the participating individuals/agencies about all aspects of technologies and methodologies to be demonstrated	3.84	15.5
Informing, all participating agencies/persons well in advance about the date and venue prior to the launching of the demonstrations	4.01	14
Supervising and guiding all important farm operations carried out by the demonstrating farmers	4.16	6
Organizing field day	4.42	3
Keeping records of various expenses incurred and yields for deriving cost benefits	4.36	4
Monitoring on continuous and regular basis through visits to FLD plots, recording observations, getting the feedback from the farmers and extension workers	4.15	7.5
Facilitating the Monitoring teams comprising of Senior Scientists/Officers of the ICAR system/SAUs	4.03	13
Documenting, reporting, circulating the results of demonstration among all the concerned personnel and demonstrating farmers	4.25	5
Publishing the success stories in popular extension journals, newspapers and magazines	4.15	7.5

**Role Performance Regarding Programme Planning and Execution:**

As in all of development projects, programme planning and execution is the backbone and KVKs are not exception. Role performance of SMSs in this segment was studied in terms of five role items. Data given in the Table 5 denotes the role performance regarding programme planning and execution. It is clear from the table that drawing up of a suitable plan of work was the most performed role with a mean score of 4.35 which was almost equally followed by implementing or helping in implementation of plan of work with a mean score of 4.34. However, development of Strategic Research and Extension plan of the District was the least performed role (mean score 4.06) despite the fact that ATMA (a core agency for the agricultural development of the district) emphasizes on

development of Strategic Research and Extension plan of the district (Anonymous, 2014) and KVKs are key stake holder of ATMA. Reason behind this may be attributed to the fact that SMSs of KVKs were so involved and overburdened in the different roles expected by their controlling authorities that they consider this a spare exercise. Here role ambiguity and role conflict plays the role as SMSs might be confused or unclear about this role.

**Role Performance Regarding Subject Matter Authority:**

The perusal of the data in table 6 reveals that keeping oneself professionally up to date, maintaining close association/links/contacts with parent department, keeping close contacts with other technical departments and selecting, interpreting and making solutions to the specific problems were the main

**Table 5: Distribution of SMSs according to their role performance regarding programme planning and execution**

Role items	Mean score	Ranks
Collecting and analyzing the facts pertaining to the agricultural production problems of the farmers	4.26	3
Drawing up of a suitable plan of work	4.35	1
Implementing or helping in implementation of plan of work	4.34	2
Reconsidering the plan in the light of results of evaluation of the programme	4.16	4
Development of Strategic Research and Extension plan of the District	4.06	5

**Table 6: Distribution of SMSs according to their role performance regarding subject matter authority**

Role items	Mean score	Ranks
Maintaining close association/links/contacts with parent department	4.64	2
Keeping close contacts with other technical departments	4.45	3.5
Keeping oneself professionally up to date	4.70	1
Selecting, interpreting and making solutions to the specific problems	4.45	3.5
Attending professional meetings, conferences, seminars and workshops	4.29	5
Attending refresher training courses to update the subject matter knowledge	4.21	6
Reading periodicals, journals, magazines and other literature to get latest research developments	4.16	7

roles performed by the respondents with a mean score of 4.70, 4.64 and 4.45 respectively. Interestingly, reading periodicals, journals, magazines and other literature to get latest research developments was the least performed role. It was reported that except from extension magazines, respondents were not having access to research journals and in many cases even to internet at office. Further they had to comply with the recommendations of the SAUs, so they were mostly interested in these only. Although a very high and significant gain in knowledge was reported by Tiwari *et al.* (2011) in refresher trainings but here the respondents kept this at second but last rank. So they found other activities more effective and performed these for achieving subject matter authority than refresher trainings.

**Role Performance Regarding Communication and Feedback:** As far the role segment of communication and feedback is concerned, the data in Table 7 clears the picture that identifying the key communicators was top ranked role performed with a mean score of 4.46. Here also as a matter of surprise giving feedback regarding cultural difficulty and attitude of farmers in adoption of new technology was least performed role. Perhaps authorities wanted to make adoption of the new technologies without any excuse so the respondents didn't emphasize much on this role.

**Table 7: Distribution of SMSs according to their role performance regarding communication and feedback**

Role items	Mean score	Ranks
Identifying the key communicators	4.46	1
Using key communicators in the diffusion and adoption of agricultural innovations	4.43	2
Giving feedback regarding the non-availability of certain inputs which hinder the adoption of new technology	4.30	4
Giving feedback regarding cultural difficulty and attitude of farmers in adoption of new technology	4.14	5
Informing the insect/pest outbreaks/attacks and other calamities which need emergency reporting to concerned authorities	4.34	3

**Role Performance Regarding Evaluation:**

Evaluation is an important activity of any programme or project and so is the KVK. Here in this role segment activity as denoted in Table 8, involving himself in evaluation of programme was the most performed role with mean score of 4.34 while evaluating the different individual activities of KVK was the least performed role which comes at 4<sup>th</sup> place.

**Role Performance Regarding Management:**

Management is no doubt a necessary skill for running the organizations in efficient way. In KVKs several roles are required for proper management. Data in Table 9 revealed that developing and maintaining good relations with superiors, subordinates and associates was most performed role (mean score 4.59) followed by developing contacts with progressive farmers (mean score 4.53) and observing the norms and standards set by the organization/authorities (mean score 4.51). Whereas keeping informed all concerned associates about what has been decided at organizational level and effectively supervising the execution of the plan were the least performed roles with a mean score 4.32 each.

**Role Performance Regarding Services and Supplies:**

It is quite clear from the data presented in table 10 that providing diagnostic services was the most performed role by the respondents with a mean score

**Table 8: Distribution of SMSs according to their role performance regarding evaluation**

Role items	Mean Score	Ranks
Actively involving himself in evaluation of programme	4.34	1
Self-evaluation	4.28	3
Evaluating the different individual activities of KVK	4.11	4
Impact analysis of KVK	4.29	2

**Table 9: Distribution of SMSs according to their role performance regarding management**

Role items	Mean score	Ranks
Observing the norms and standards set by the organization/authorities	4.51	3.5
Developing and maintaining good relations with superiors, subordinates and associates	4.59	1
Developing contact with progressive farmers	4.53	2
Keeping informed all concerned associates about what has been decided at organizational level	4.32	5.5
Establishing working relationships with small, marginal farmers and financial institutions	4.51	3.5
Effectively supervising the execution of the plan	4.32	5.5

of 4.49. This was followed by collaborating with other departments such as Markfed, IFFCO, KRIBHCO and Department of Agriculture etc. for providing services to farmers (mean score 4.44) and helping farmers in difficult situation e.g. pest attack, epidemics, draught, flood, etc. (mean score 4.42). Whereas helping farmers in marketing the produce (13<sup>th</sup> rank) was least performed role followed by procuring and supplying fruit plants, seed etc as per the demand of the farmers (12<sup>th</sup> rank) and providing services in collecting soil and water samples (11<sup>th</sup> rank). This result might be astonishing that providing services in collecting soil and water samples was one of the least performed roles. However it should be kept in mind that this is a subject specific role. The SMSs from Soil Science or who is the

in-charge of soil lab is mainly responsible for this. So as the data were collected from all the SMSs regardless of their discipline, as an amalgam this role fell among the least performed.

**Role Performance Regarding Office Work and Reporting:** It can be observed from the data given in Table 11 that attending visiting farmers and other visitors and dealing politely with them was the most performed role (1<sup>st</sup> rank) followed by ensuring timely replies to the correspondence from superior officers, farmers and other departments (2<sup>nd</sup> rank) and preparation and timely submission of various periodic reports prescribed by University and Zonal Project Directorate as well as preparing and submitting special

**Table 10: Distribution of SMSs according to their role performance regarding services and supplies**

Role items	Mean score	Ranks
Helping farmers in marketing the produce	3.71	13
Providing services in collecting soil and water samples	3.84	11
Providing diagnostic services	4.49	1
Providing specialized services about seed multiplication programme	3.93	9
Submission of indents well in time to ensure the supply of inputs	4.37	5
Ensuring the delivery of technical inputs to farmers before planting/sowing season	4.25	7
Helping farmers in difficult situation e.g. pest attack, epidemics, draught, flood, etc.	4.42	3
Collaborating with other departments such as Markfed, IFFCO, KRIBHCO, Department of Agriculture etc for providing services to farmers	4.44	2
Paying advisory visits to farms and homes	4.40	4
Launching a special programme in case of epidemic	4.32	6
Procuring and supplying fruit plants, seed etc as per the demand of the farmers	3.79	12
Joint touring with agricultural extension officers for the solution of agricultural problems	3.90	10
Providing technical guidance and other specialized services to the farmers in establishing individual projects	4.14	8

**Table 11: Distribution of SMSs according to their role performance regarding office work and reporting**

Role items	Mean score	Ranks
Preparation and timely submission of various periodic reports prescribed by University and ZPD	4.73	3.5
Preparing and submitting special reports like survey report, FLD report as per requirement	4.73	3.5
Attending visiting farmers and other visitors and dealing politely with them	4.80	1
Attending the visits of the superiors	4.69	5
Ensuring timely replies to the correspondence from superior officers, farmers and other departments	4.74	2
Ensuring timely submission of financial statements to authorities concerned	4.63	6
Assisting office in the preparation of budget and the other day to day work	4.41	8
Proper use of vehicle according to instructions/guidelines	4.49	7

reports like survey report, FLD report as per requirement (jointly at 3<sup>rd</sup> place). However assisting office in the preparation of budget and the other day to day work was least performed role.

***Role Performance Regarding Supporting Activities:***

All the miscellaneous extension activities were kept under the role segment of supporting activities. Response was tabulated and presented in Table 12. The perusal of data reveals that assisting the Programme Coordinators in holding SAC meetings and delivering invited lectures was jointly at the top of all of the roles in this segment with a mean score of 4.53. However arranging film shows for farmers (14<sup>th</sup> rank) and holding agricultural fairs (13<sup>th</sup> rank) were least performed roles. This result is quite expected as film shows are losing sheen these days in the sampled area and holding agricultural fairs is a very time consuming task with not so much impact at KVK level.

***Difference between Different Role Segments w.r.t. Role Performance:*** Overall mean score of each

segment of role performance was calculated to compare each segment with each other and to see that which role segments were widely performed by Subject Matter Specialists. Data given in Table 13 depicts the overall mean score of role performance in each role segment. It denotes that overall mean score of the role segment office work and reporting was highest (4.65) followed by management (4.46) and Subject matter authority (4.41). But quite to surprise that the roles of FLDs and OFTs which were core of the KVKs work came at last place and organization of training (another core activity) was in the middle of the list. It clearly indicated that there might be existence of role ambiguity or role conflict resulted due to clashes of other unimportant work in the way. To find out the difference between different role segments one way ANOVA test followed by Tukey post hoc test was performed. Outcome of the test reveals that there was significant difference between different role segments as a whole. Segment wise, role segment of office work and reporting was significantly different from on-farm trials, front line demonstrations

**Table 12: Distribution of SMSs according to their role performance regarding supporting activities**

Role items	Mean score	Ranks
Arranging Ex trainee sammelan	4.26	5
Arranging film shows for farmers	3.82	14
Participating in short duration training/workshops organized by different agencies	4.16	8
Holding agricultural fairs	3.94	13
Organization of exhibitions	4.10	10.5
Arranging farm tours	4.01	12
Organizing campaigns to solve the problems of masses	4.10	10.5
Assisting the Programme Coordinators in holding SAC meetings	4.53	1.5
Delivering invited lectures	4.53	1.5
Delivering TV/radio talks	4.33	4
Publishing the research/extension publications	4.37	3
Holding the special days like world food day, world environment day	4.15	9
Organizing technology weeks	4.21	7
Facilitating the formation of self-help groups, farmers' club etc.	4.24	6

**Table 13: Overall mean performance score of different role segments**

Role Segment	Overall Mean Score	Standard Deviation	Ranks
Organization of trainings	4.37	.176	4
On-farm trials	4.15	.294	10
Front line demonstrations	4.15	.194	10
Programme planning and execution	4.23	.124	7
Subject matter authority	4.41	.207	3
Communication and feedback	4.33	.126	5
Evaluation	4.26	.100	6
Management	4.46	.115	2
Services and supplies	4.15	.282	10
Office work and reporting	4.65	.136	1
Supporting activities	4.20	.204	8

F value = 5.395(significant at 5%)

programme planning and execution, services and supplies and supporting activities at 5 per cent level of significance. While other pairs of role segments were not differing significantly as in comparison to each other. Findings of study were different from Jain *et al.* (2005) who reported that dimension wise job performance shows that about half of the respondents had high level of job performance in 'training imparting' activity, medium level in 'research trials' and 'field days' and low level in 'demonstration' and 'campaign' activity. Similarly Wankahade *et al.* (2007) reported in their study on role performance of Agricultural Assistants (AA) that the area wise role performance indicated low level of performance with regard to technical and input supply and quality control roles.

**Overall Role Performance of the SMSs:** It was imperative to find the individual role performance as a whole. Hence the overall role performance score was calculated by adding all role items score with respect to individual Subject Matter Specialists. On the basis of this overall score respondents were divided into three categories of role performance i.e. low, medium and high. The perusal of the data given in Table 14 denotes the overall role performance of the respondents. It is evident from the table that nearly half of the respondents (51.55%) were having high role performance, about 44 per cent fallen under medium role performance category and only 4.12 per cent of the respondents were having low performance with regard to overall role of the SMSs. Results of the study are in line with Nagayach *et al.* (2011) who reported that role performance of Assistant Veterinary Officers indicated that majority (71%) of the respondents fall in the high

**Table 14: Distribution of the SMSs according to their overall role performance score**

Category	Role performance score	F	%
Low	252-328	4	4.12
Medium	328-404	43	44.33
High	404-480	50	51.55

level of performance, while 20 per cent fall in medium and only 9 per cent fall in low level of role performance category. However findings are different from Kadam *et al.* (2012) who reported that the majority of the experts (51.92 per cent) of KVKs fell in the category of moderate performance of role followed by 35.58 and 12.50 per cent of them good and poor level of role performance categories, respectively. In contrary to these Jain *et al.* (2005) reported that the overall job performance of two - third of DESs was of moderate level and Wankahade *et al.* (2007) in their study on role performance of Agricultural Assistants revealed that the Agricultural Assistants themselves and their supervisors expressed medium level of role performance. In this way, Singh (2002) reported the overall role performance of 70.00 per cent GPMs was medium to low, as regards overall role performance the GSMs in majority perceived medium level performance of roles.

## CONCLUSION

Role performance is very important aspect of the organizations. Based upon the mandate of KVK, the whole working was divided into 11 major role dimensions. Office work and reporting was the top role performing dimension followed by management,

subject matter authority. SMSs were performing role of organization of training at 4<sup>th</sup> position of their roles' priority. Further the FLDs and OFTs which is on the priority of KVK mandate were least performed as far the role playing is concerned. It clearly shows the existence of role ambiguity or role conflict. So to keep the true spirit of the KVKs for which they were established, the roles of SMSs should be clearly communicated by the authorities. The core activities should not be overpowered by the other miscellaneous activities to which other line departments are also holding. However the promising observation is that most of the SMSs were falling under the high role performance category. So Only need is to show them direction towards which their efforts are required and reducing the unimportant activities with regard to KVKs' mandate by the controlling officers.

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# Adoption of Improved Late Sown Mustard Cultivation Practices - A Case Study in Bihar

Sunita Kushwah<sup>1\*</sup>, Sushil Kumar<sup>2</sup> and S.R.K. Singh<sup>3</sup>

<sup>1</sup>SMS (Horticulture), Krishi Vigyan Kendra, Banka, <sup>2</sup>SMS (Agronomy), Krishi Vigyan Kendra, Katihar, <sup>3</sup>Senior Scientist (AE), ICAR-ZPD Zone VII, Jabalpur, Madhya Pradesh, India

## ABSTRACT

Mustard is an important oilseed crops and contributes around 23.2 percent of total oilseed production in India. However, its productivity in Bihar is very low. Attempts are being made to improve productivity and to increase area under mustard by adoption of HYVs (High yielding varieties). In order to compare conventional mustard with HVY, 65 front line demonstrations were carried out in systematic manner on farmer's fields to show the worth of new varieties in comparison to local check. To facilitate the farmers through FLD's about potentialities of new improved production management practices of late sown mustard for the adoption, knowledge, satisfaction and effective scientific package of practices. The demonstrations resulted enhancement in productivity. The yield was found to be increased from 7 (q/ha) in local check to 11 (q/ha) in FLDs. Similarly, the benefit: cost ratio can be further improved to 2.92 as compared to 1.6 in local check. Lack of market and support price (93.47) was recorded major constraints in late sown mustard cultivation. Hence, increase in yield over farmer's practices was evident which indicated the need of educating farmers through front line demonstration.

**Keywords:** Knowledge, Adoption, Mustard cultivation, Improved production technology

## INTRODUCTION

The Indian agriculture has considered as backbone of Indian economy. About 70 percent population lives in rural areas. Oil seeds constitute the second largest agricultural commodity in India after cereals accounting for nearly 5 percent of gross national products. . The total oil seed production of India is 25.56 MT and share of mustard production is 8.94 MT (Anonymous, 2010). The acreage under mustard in Bihar did not much increase during last five years. Area, production and productivity in Bihar presently are 0.85 lakh ha, 0.81 lakh tones and 959 kg/ha, respectively. India is the leading country for oilseed production but we are not sufficient to fulfill the requirement of people of country. The constraints in production are use of traditional varieties, inadequate moisture availability at sowing time and late sowing of mustard particularly in rice-fallow areas, broad-casting method of sowing and use of high

seed rate and aphid infestation. Limited adoption of the HYV were mainly due to non-availability of the seeds of the desired variety (Dwivedi *et al.*, 2011). KVK's role in agriculture and its allied sector is crucial as it is ideally placed to disseminate field-tested proven technologies with appropriate modulation which addresses location specific problems and concern on the prevailing natural and socio-economic conditions, needs and priorities. Although enough viable and adoptive technologies have been evolved, many of these have not reached to the end-users (Singh *et al.*, 2013).

Keeping the above point in view, the FLD on mustard using new crop varietal technology with inclusion of sulphur-based fertilizers were started with the objectives of showing the productive potential of the new production technologies under real farm situation over the locally cultivated late sown mustard crop.

\*Corresponding author email id: sunita17kk@rediffmail.com

## MATERIALS AND METHODS

An extensive survey was conducted to collect information pertaining to various usage of mustard in the Katihar district. 65 respondents from seven villages (who grow mustard) were selected from 5 block viz Balrampur, Azamnagar, Barari, Kadwa and Pranpur for collection of data. An interview schedule was prepared and administered to the respondents and data were analyzed. Preferential ranking technique was utilized to identify the constraints faced by the farmers in mustard production. Farmers were also asked to rank the constraints they perceived as limiting mustard production in order of preference. The quantification of data was done by first ranking the constraints and then calculating the rank based quotient (RBQ) as given by Sabarathoram (1988), as mentioned below-

$$RBQ = \frac{f_i (n+1 - i^{th})}{N \times n} \times 100$$

Where,

$f_i$  = number of farmers reporting a particular problem under  $i^{th}$  rank.

$N$  = number of farmers

$n$  = number of problems identified.

Based on to ranks farmers problems were identified, the front line demonstrations (FLD's) were planned and conducted at the farmer's field under technology demonstration. In all 65 full package front line demonstration in 20 ha area were conducted to convince farmers about potentialities of improved variety of late sown mustard Rajendra Suflam during 2012-13 and 2013-14.

All the farmers trained for improved package of practices through training programmes. Materials for the present study with respect to front line demonstrations and farmers practices are given in table-1. In case of local check plots, existing practices being used by farmers were followed. In general soils of the area under study were slightly acidic in reaction and deficient in some of the nutrients required for normal crop growth. In the present evaluation study, the data on out put of mustard cultivation were collected from FLD plots, besides the data on local practices commonly adopted by the farmers of this region were also collected. To study the impact of front line

demonstrations, a total of 65 farmers were selected as respondents through proportionate sampling. Production and economic data for FLD's and local practices were collected and analyzed. The technology gap and technology index were calculated using the following formulas as given by Samui *et al.* (2000).

Technology gap = Potential yield- Demonstration yield

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} \times 100$$

The harvest index was worked out by using following formula given by Donald (1962).

$$\text{Harvest index} = \frac{\text{Seed yield (kg/ha)}}{\text{Seed yield (kg/ha) + Stalk yield (kg/ha)}}$$

Knowledge level of the farmers about improved cultivation practices of the late sown mustard variety before frontline demonstration and after implementation was measured and compared by applying dependent 't' test. The farmers selected for FLD's were facilitated by KVK, Katihar scientists in performing field operations like technologies demonstrated are mentioned in Table 2.

The selected respondents were interviewed personally with the help of a pre test and well structured interview schedule. Client satisfaction Index was calculated by using formula as developed by (Kumaran and Vijayaragavan, 2005).

$$\text{Client satisfaction index} = \frac{\text{Individual obtained score}}{\text{Maximum possible score}}$$

The data thus collected were tabulated and statistically analyzed to interpret the results.

## RESULT AND DISCUSSION

The results of 65 front line demonstrations conducted during 2012-13 and 2013-14 in 20 ha area on farmers fields indicated that the cultivation practices compared under FLD programme were use of improved varieties (Rajendra Suflam), good seed quality, line sowing, balanced dose of fertilizer applications and control of aphid infestation, produced on an average more yield of late sown mustard as comparison to local check (*Maghi*). The data revealed that the front line

**Table 1: Particulars showing the details of mustard grown under FLD and existing practices**

Cultural operations	Existing practices	Front line demonstration improved cultivation practices
Use of seed	Used local seed (Maghi)	Rajendra Suflam adopted for late sown
Seed quality	Bold, Brownish	Bold, Blackish brown
Method of sowing	Broadcasting	Line sowing followed by thinning at 30 DAS.
Fertilizer application	60:0:0 (kg N:P:K/ha)	80:40:40:30 (kg N:P:K:S/ha)
Control measures	1 spray of insecticide when severe infestation	3 spray of Imidachloropid @ 1 ml/3 lit of water spray at 15 days interval when aphid population reached to the threshold level i.e. 44 aphids/ plant

demonstration reflects good impact over the farming community.

A comparison of productivity levels between demonstrated variety and local checks is shown in Table 2. During the period under study, it was observed that in front line demonstrations, the improved mustard variety Rajendra Suflam recorded higher seed yield (11 q/ha) as compared to local check variety (7 q/ha). The percentage increase in yield over check was recorded 78.5 percent. It is evident from Table 2 that performance of improved high yielding variety Rajendra Suflam performed well as comparison to local check conducted in different locations of the district. Yield of the demonstration and potential yield of the crop was compared to estimate the yield gap which were further categorized into technology index and harvest index. Potential yield recorded for variety Rajendra Suflam (16.3 q/ha). The technology gap shows the gap in the demonstration yield over potential yield and it was 5.3 (q/ha). The observed technology gap resulted from Table 2 is due to various constraints like low soil fertility, availability of low moisture content during sowing time, weather condition and climatic hazards etc. Hence to reduce the yield gap location specific recommendation for variety, soil testing and timely sowing appears to be

necessary. Technology index showed the suitability of variety at farmer's field. Lower technology values indicated that feasibility of variety among the farmers is more. It is revealed from Table 2 technology index (32.51%) indicated that mustard late sown mustard variety (Rajendra Suflam) is much better than the local one. Stalk yield recorded 25.85 (q/ha) for local check while for high yielding variety 38.70 (q/ha). Harvesting index recorded higher for demonstrated variety i.e. 0.221 and 0.213 for local check. It indicated that Rajendra Suflam is more feasible variety for the farmers (Singh and Kumar, 2012).

The economics of late sown mustard production under front line demonstrations were estimated and the results have been presented in Table 3. Economic analysis of the yield performance revealed that front line demonstrations recorded higher gross return (Rs. 38000/ha) and net return (Rs 25000/ha) with higher benefit cost ratio 2.92 compared to 1.6 of local check (Table 3). Similar results were also reported by (Hiremath and Nagaraju, 2009) and Singh *et al.* (2014).

**Technology satisfaction among respondents:** The extent of satisfaction level of farmers about performance of demonstrated varieties was measured

**Table 2: Yield, technology gap, technology index and harvesting index of front line demonstration**

Variables	Seed yield (q/ha)	% increase over check	Potential yield (q/ha)	Technology gap (q/ha)	Technology index (%)	Stalk yield (q/ha)	Harvesting index
Local check	7					25.85	0.213
Demonstration	11	78.51	16.3	5.3	32.51	38.70	0.221

**Table 3: Economics of local check and front line demonstration**

Variables	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	Benefit cost ratio
Local check	10,000.00	16000.00	6000.00	1.6
Demonstration	13,000.00	38000.00	25000.00	2.92

by Client Satisfaction Index (CSI) and results presented in Table 4. It is observed that majority of the farmers indicated high (43.07%) to the medium (33.85%) level of adoption or satisfaction for improved cultivation practices and HYV of mustard. Whereas, 23.08 percent respondents expressed lower level of satisfaction with respect to improved late sown variety and cultivation practices. The medium to higher level of satisfaction with respect to improved cultivation practices, linkage with farmers, services rendered etc. indicated stronger conviction, physical and mental involvement in the front line demonstration. It is resulted that front line demonstration had good preference among the respondents. Similar findings obtained by (Tomar, 2010; Dudi and Meena, 2012).

**Table 4: Extent of farmers satisfaction of improved cultivation practices of late sown mustard (n=65)**

Satisfaction level	Mean of level	Percentage
Low	15	23.08
Medium	22	33.85
High	28	43.07

Figures in parentheses indicate percentages

**Knowledge gain regarding new variety and technology among respondents:** Knowledge level of respondent farmers on various aspects of improved mustard production technologies before conducting the front line demonstration and after front line demonstration was measured and compared by applying dependent 't' test. It could be seen from Table 5 that farmers mean knowledge score has increased by 47.70 after implementation of frontline line demonstrations. The increase in mean knowledge score of farmers was observed significantly higher as the computed value of 't' (6.25) was significant at 5 percent probability level. It indicates that there was significant increase or gain in knowledge level of farmers that have resulted in higher adoption of improved farm practices. This shows positive impact of front line demonstration on knowledge of the farmers that have resulted in higher

adoption of improved farm practices. The results obtained in trial might be due to the concentrated educational effort and close monitoring made by KVK scientists.

**Constraints in late sown mustard cultivation:** In the cultivation of late sown mustard problems encountered and ranking given by the farmers are mentioned in Table 6. Preferential ranking technique was utilized to identify the constraints faced by the farmers in late sown mustard production. A perusal of table indicates that lack of market and support price ranked first by 65 respondent's with RBQ value (93.45). Disease and insect pest infestation, lack of high yielding varieties of late sown mustard, lack of moisture availability in the field during sowing, low soil fertility and weed infestation were major constraints faced by the mustard farmers. While lack of technical support, Undulated topography of land, lack of credit facilities, illiteracy among the farmers and crop damage by wild animals were also found as a constraints to reduce the production of late sown mustard crop. The view is also supported by Singh *et al.* (2007).

**Table 6: Rank based quotient obtained by the mustard respondents (n=65)**

Problem encountered	RBQ	Overall rank
Lack of high yielding varieties of late sown mustard	86.42	III
Lack of technical support	70.42	VII
Lack of moisture availability in the field during sowing	83.68	IV
Undulated topography of land	69.15	VIII
Weed infestation	72.14	VI
Disease and insect pest infestation	88.25	II
Lack of market and support price	93.45	I
Low soil fertility	78.47	V
Illiteracy among farmers	50.75	X
Lack of credit facilities	58.43	IX
Damage by wild animals	40.75	XII

**Table 5: Knowledge gain in improved late sown mustard cultivation practices (n= 65)**

Improved farming practices of late sown mustard	Mean scores		Mean difference	"t" value
	Before FLD implementation	After FLD implementation		
	32.30	80.00	47.70	6.25*

\*Significant at 5% probability level, degree of freedom=64

## CONCLUSION

The study was under taken with the help of 65 front line demonstrations conducted by Krishi Vigyan Kendra, Katihar to ascertain the economics of late sown mustard production technology by using high yielding varieties and find out the adoption of HYV of mustard. The results revealed that lack of market and support price was recorded as a major constraint while disease and insect pest infestation, lack of high yielding varieties of late sown mustard, lack of moisture availability in the field during sowing were also recorded as a main constraints which inhibits the adoption of late sown mustard cultivation. The yield of HYV of late sown mustard (Rajendra Suflam) in demonstration was recorded (11 q/ha) as compared to local check (7 q/ha). The benefit cost ratio for HYV was 2.92 as compared to local check. The impact of FLD was also analyzed which showed that there was significant improvement in knowledge level and satisfaction on the part of mustard farmers.

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# Identification of Training Needs of Rural Females in Improved Home and Farm Managerial Practices in Western Uttar Pradesh

Kirtimani Tripathi<sup>1</sup> and Thiru Selvan<sup>2</sup>

<sup>1</sup>Krishi Vigyan Kendra, Bulandshahr, Uttar Pradesh

<sup>2</sup>Department of Forestry and Biodiversity, Tripura University, Agartala, Tripura

## ABSTRACT

Training is the most essential mandate in the KVKs. Different disciplines including the capability building of Home Managers who are also the integral part of agricultural practices in western Uttar Pradesh need a call of attention. The different areas include design of high nutrient efficiency (HNE) diets, storage loss minimization techniques, income generation activities, location specific drudgery reduction technologies. Therefore, these are the topics of utmost importance as per the preference of rural females. It is necessary to include all these topics in the training programmes to bridge the technological gap between existing and recommended home and farm managerial practices. The present study which was carried out in five villages of district Bulandshahr through complete enumeration and it revealed that training in the areas of income generation activities followed by drudgery reduction technologies is utmost essential among the rural women for improved home and farm management practices.

**Keywords:** Training, Managerial, Practices, Home managers

## INTRODUCTION

Women plays a dynamic role in India's agro based economy and household chores. In western Uttar Pradesh 95% of rural women are involved in agricultural practices. The rural women are involved in activities starting from land preparation to harvesting. If we talk about home then also women is efficiently managing all the chores without any expectation. Still in India women are not that free to move out of their farms and homes. At home level also they face so many obligations regarding their managerial qualities. Productivity in terms of health, time management, work simplification and drudgery reduction can be increased by making them aware of using the existing technologies with utmost efficiency. Therefore it is essential to provide them the relevant information on improved home and farm managerial practices through trainings which is actually an important mandate of KVKs. To be effective, trainings must be based on the need and interest of the learner and should deal with their real problems. Organizing on and off farm trainings on potential oriented technologies will be helpful in

increasing the rate of technological adoption. Therefore identification of training needs of farm women is very important before organising a training programme for them. Considering all the facts, the present study has been designed to identify the training needs of farm women of western Uttar Pradesh in improved home and farm managerial practices.

## MATERIALS AND METHODS

The study was carried out in district Bulandshahr, which is situated in the Meerut region of Uttar Pradesh, surrounded by many low Ganga canals. It is 80 km away from the national capital. Flourish with sandy loam soil and water the district has high productivity of agricultural crops. Rural women play a key role in agriculture and making the home managed more efficiently. Five villages, viz. Rehmapur Shyawali, Alipur Gijhauri, Nai Basti, Baral and Machkauli, representing diverse stages of development and prosperity in terms of women empowerment were selected. A complete enumeration of 225 respondents (females) involved in home and farm activities was made.

Seven areas of Home and farm practices namely diet efficiency, storage loss minimization, income generation, drudgery reduction, Women and child care, health and hygiene were selected to assess the training needs of rural women. Desired information were collected through “interview schedule” specially developed for this purpose, and the responses were recorded on a 3 point continuum i.e. most essential, essential, least essential with their respective scores as 3, 2 and 1. In order to prioritize the training needs in various areas of home and farm managerial practices, the frequency number of respondents in each area was multiplied by the respective score allotted to most essential, essential and least essential categories and summation was done. Ranking to different areas of improved home and farm managerial practices was then given in accordance with the summed score (Gupta and Tripathi, 2002).

**RESULTS AND DISCUSSION**

It is evident from the Table 1 that in the training needs of the area of high nutrient efficiency (HNE) diet respondents laid maximum emphasis on diet

management of different diseases including diabetes, heart diseases, gout and stones etc. followed by HNE diet for hard workers who work at farm, weaning babies, old aged, school going children, knowledge about different nutrients etc. Preparation of HNE for adolescents was acquired to be least essential as were bounded by the myths and shyness.

Most of the respondents indicated their preference for learning the safe grain storage techniques and were least keen to know about different types of food deteriorating factors (Table 2). This is because of the fact that they store their grains in bulk for their use whole year and wanted to know about organic methods used for the purpose. Respondents preferred to know the clear ideas about the different techniques involved in these practices. Present findings go with findings of Sriput *et al.* (2006) who reported that grain storage techniques and that too done organically is always preferred among the rural women.

The findings of Table 3 are in conformity with the findings of Kesarwani *et al.* (1989), who also reported that among the income generation activities stitching

**Table 1: Training needs in design and development of high nutrient efficiency diet**

Design and development of high nutrient efficiency diet	Most Essen.	Essen.	Least Essen.	Total score	Mean score	Rank
Knowledge about different nutrients	24(10.67)	131(52.22)	70(31.11)	404	1.80	VII
Preparation of HNE diet for weaning infants	94(41.78)	72(32.00)	59(26.22)	485	2.15	III
Preparation of HNE diet for school going children	44(19.56)	136(60.44)	45(22.67)	449	1.99	VI
Preparation of HNE diet for pregnant and lactating women	52(23.11)	122(54.22)	51(22.67)	451	2.00	V
Preparation of HNE diet for adolescents	15(6.67)	101(44.89)	109(48.44)	365	1.58	VIII
Preparation of HNE diet for old people	81(36.00)	92(40.89)	52(23.11)	479	2.13	IV
Preparation of HNE diet for different diseases	121(53.78)	94(41.78)	10(4.44)	561	2.49	I
Preparation of HNE diet for labours(hard workers)	103(45.78)	74(32.89)	48(21.33)	505	2.24	II

*Figures in parentheses indicate percentage of respondents*

**Table 2: Training needs in storage loss minimization techniques**

Storage loss minimization techniques	Most Essen.	Essen.	Least Essen.	Total score	Mean score	Rank
Knowledge about the different types of food deteriorating factors	36(16.00)	52(23.11)	137(60.89)	349	1.55	V
Safe grain storage techniques	126(56.00)	98(43.56)	01(0.44)	575	2.56	I
Safe vegetables and fruits storage techniques	102(45.33)	120(53.33)	03(1.33)	549	2.44	II
Safe preserved food items storage techniques	91(40.44)	111(49.33)	23(10.22)	516	2.29	III
Knowledge about different types of adulterants and techniques of testing them	52(23.11)	83(36.88)	90(40.00)	412	1.83	IV

*Figures in parentheses indicate percentage of respondents*

and tailoring was mostly perceived by the rural women and girls. Mushroom production technology was found to be least preferred because of the marketing of the produce. Though national capital is near the vicinity of the research area and has good market but due to the low keeping qualities and unavailability of the spawn of mushroom from the laboratories was least preferred in training.

Drudgery reduction is something closely associated with the women who do agricultural operations. They are actually indulged in all the agricultural practices like land preparation, seed treatment, sowing, transplanting,

irrigation, weeding, harvesting and post harvest management. When the training need is assessed it was found that almost all respondents were curious to know about the new and improved drudgery reduction tools followed by time management techniques (Table 4). Least favoured was budgeting as according to the study conducted regarding control of income by the rural women it was concluded that they have least or no control on income due to male dominancy over their economic generations.

Table 5 indicates that the large portion of rural females showed less desire for training in women and

**Table 3: Training needs in income generation activities**

Income generation activities	Most Essen.	Essen.	Least Essen.	Total score	Mean score	Rank
Stitching and tailoring	110(48.89)	108(48.00)	07(3.11)	553	2.46	I
Tie and dye work	21(9.33)	30(13.33)	172(76.44)	295	1.31	IX
Vegetable and fruits preservation	94(41.78)	103(45.78)	28(12.44)	516	2.29	II
Bee keeping	73(32.44)	96(42.67)	56(24.89)	467	2.08	V
Sericulture	71(31.56)	84(37.33)	70(31.11)	451	2.00	VI
Mushroom production	11(4.89)	21(9.33)	193(85.78)	268	1.19	X
Vermicompost production	81(36.00)	93(41.33)	51(22.67)	480	2.13	IV
Soft toy making	32(14.22)	45(20.00)	148(65.78)	334	1.48	VIII
Designing and Parlour	65(28.89)	80(35.56)	80(35.56)	435	1.93	VII
Grading and packaging of grains	83(36.89)	97(43.11)	45(20.00)	488	2.17	III

*Figures in parentheses indicate percentage of respondents*

**Table 4: Training needs in location specific drudgery reduction technologies**

Drudgery reduction techniques	Most Essen.	Essen.	Least Essen.	Total score	Mean score	Rank
Time management techniques	128(56.89)	92(40.80)	05(2.20)	473	2.10	II
Introduction of new and improved drudgery reduction tools	224(99.56)	01(0.44)	-	674	3.00	I
Budgeting	21(9.33)	27(12.00)	177(78.67)	294	1.31	III

*Figures in parentheses indicate percentage of respondents*

**Table 5: Training needs in women and child care**

Women and child care	Most Essen.	Essen.	Least Essen.	Total score	Mean score	Rank
Care of pregnant women	73(32.44)	112(49.78)	40(17.78)	483	2.15	IV
Care at the time of delivery of baby	62(27.56)	99(44.00)	64(28.89)	448	1.99	V
Care of new born babies	81(36.00)	118(52.44)	26(11.56)	504	2.24	III
Care of malnourished children	105(46.67)	113(50.22)	07(3.11)	548	2.44	I
Care of patients of different diseases	98(43.56)	102(45.33)	25(11.11)	523	2.32	II
Care of adolescents	53(23.56)	70(31.11)	102(45.33)	401	1.78	VII
Care of old aged	61(27.11)	74(32.89)	90(40.00)	411	1.83	VI
Care handled in family planning	25(27.11)	65(28.89)	137(60.89)	336	1.49	VIII

*Figures in parentheses indicate percentage of respondents*



**Table 6: Training needs in health and hygiene**

Health and hygiene	Most Essen.	Essen.	Least Essen.	Total score	Mean score	Rank
Importance and techniques of purification of water	71(31.56)	122(54.20)	32(14.20)	489	2.17	II
Importance of sanitation	65(28.89)	118(52.44)	42(18.67)	473	2.10	III
Care taken during Menstruation	23(10.22)	56(24.89)	146(64.89)	327	1.45	IV
Safe milk production from livestock	82(36.44)	112(49.78)	31(13.78)	501	2.23	I

Figures in parentheses indicate percentage of respondents

**Table 7: Training needs perceived by rural females in main areas of home and farm managerial practices**

Storage loss minimization techniques	Most Essen.	Essen.	Least Essen.	Total score	Mean score	Rank
Design & development of high nutrient efficiency diet	83(36.89)	117(52.00)	25(11.11)	495	2.20	IV
Storage loss minimization techniques	101(44.89)	107(47.56)	17(7.56)	534	2.38	III
Income generation techniques	191(84.89)	34(15.11)	-	641	2.85	I
Location specific drudgery reduction	183(81.33)	42(18.67)	-	630	2.80	II
Women and child development	51(22.67)	122(54.22)	52(23.11)	449	2.00	V
Health and Hygiene	32(14.22)	102(45.33)	91(40.44)	391	1.74	VI

Figures in parentheses indicate percentage of respondents

child care as they believe that they perform their homely tasks efficiently and did not pay much attention to the training need in this particular area. It was still found that 46.67 percent of the respondents were keen to get the training on care of malnourished children followed by care in different diseases, new born babies and pregnant women, respectively. In this regard it was also found that they get fresh food to eat and milk to drink so much emphasis is not required.

It is evident from the Table 6 that training needs regarding safe milk production was most perceived area of interest. In Western Uttar Pradesh 95.7 per cent rural women are involved in animal husbandry practices like feed and fodder, milking of cattle etc Durgarani (2006). So knowledge about different technologies involved in increasing the milk production was preferred. Least acquired (64.89 percent) was care taken during menstrual cycle. The reason behind is prejudice and shyness behind the topic.

Finally it was observed that out of six areas, income generation activities were perceived as the top most priority area (mean score- 2.85) for trainings by majority of respondents followed by drudgery reduction techniques (mean score- 2.80), storage loss minimization techniques (mean score- 2.38), development of HNE diets (mean score- 2.20), women and child care (mean score- 2.00), and health and hygiene (mean score- 1.74) (Table 7).

## CONCLUSION

The study provided some directions in proper organization of training programmes in relation with perceived training needs in home and farm managerial practices. It is concluded that the trainings are most essential in the areas like income generation activities as they showed their interest in adding unconventional sources of income other than agriculture. Another area of interest is drudgery reduction techniques through which they can save time and learn the technique of work simplification. Therefore these areas are found to be of utmost importance according to the preference of rural females. It is necessary to include all these topics in the training programmes to bridge the technological gap between existing and recommended home and farm managerial practices.

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# Spatio-temporal Variation in Status of Crop Diversification and Its Impact on Farming in West Bengal

Debkumar Kisku<sup>1</sup> and Souvik Ghosh<sup>2\*</sup>

<sup>1</sup>P.G. Scholar, <sup>2</sup>Professor, Department of Agricultural Extension, Agricultural Economics and Agricultural Statistics, Institute of Agriculture, Visva-Bharati, Sriniketan

## ABSTRACT

Present paper highlights the spatio-temporal variation in crop diversification and its impact on farming scenario through an integrated analysis at state, district, sub-division, block and village level. The crop diversity in the state of West Bengal (2007-2012) indicated through Simpson Index ranging from 0.715 to 0.764. The cropping scenario in Paschim Medinipur district over a period of TE 2004 to TE 2013 revealed the crop diversity from 0.617 in TE 2004 to 0.641 in TE 2013. Sesame was most preferred oilseeds cultivated in the district covering 7.63 per cent of total area; while the area under rapeseed and mustard was about two per cent that was contrasting to the scenario of West Bengal. Areas under potato (7.29%) and vegetables (5.75%) showed the progress of the district towards diversification from food grains to more remunerative crops. A total of seven different cropping patterns were followed by the farmers, where 13 out of 120 farmers adopted more than one cropping pattern. The cropping pattern of Paddy-Potato-Sesame was preferred by most of the farmers (56.39%). It is worth mentioning here that oilseeds crops (sesame, rapeseed/mustard) were found to be less cost intensive having relatively higher B:C ratio and lesser risk due to low investment as compared to crops like onion, potato, boro rice, etc.

**Keywords:** Crop diversity, High value crops, Rice equivalent yield, Net income

## INTRODUCTION

Diversification is the single most important source of poverty reduction for small farmers in South and South East Asia (FAO and World Bank, 2001). The question of sustainable income and employment in the rural areas seems to be very much dependent on the degree of diversification of land use towards cultivating various crops. In view of this, crop diversification has been an important issue of agricultural development not only in India, but also in other parts of the world. In India, the growth of area under cultivation in different states remained stagnant in the current decades and the growth of yield of various crops has reached the saturation level. Efforts are now being made in different regions of India to cultivate those crops, which are remunerative and environment friendly (De and Chattopadhyay, 2010). With a tardy shift of labour toward non-farm sectors, within agriculture, crop

diversification out of staples toward high-value crops (HVCs) is one of the alternatives that can augment incomes, generate employment, and reduce poverty (Barghouti *et al.*, 2004; Joshi *et al.*, 2004; Weinberger and Lumpkin, 2007; Birthal *et al.*, 2013). Crop diversification into high-value crops (HVCs) can be a strategy to improve livelihood outcomes for farmers. It is often established that households diversifying toward HVCs are less likely to be poor, the biggest impact being for smallholders. Furthermore, using continuous treatment matching, the relationship has been established between degree of diversification (share of area dedicated to HVC) and poverty. Growers of HVCs need to allocate at least 50% area to HVCs to escape poverty. Effect of diversification on poverty is in general positive but it withers after a threshold probably because of constraints i.e., capital on smaller farms and labor on larger ones (Birthal *et al.*, 2015).

\*Corresponding author email id: souvik.ghosh@visva-bharati.ac.in

Indian agriculture in general started to diversify away from the cereals way back in 1983-84. This was a time when the growth of cereals production in India started showing signs of stagnation. However, this diversification away from cereals took many directions (Chand *et al.*, 2008). On this backdrop the present study was conducted to assess spatio-temporal variation in status of crop diversification and its impact on farming in West Bengal.

**MATERIALS AND METHODS**

The status and types of crop diversification was studied through different steps; firstly, through the analyses of crop diversity on the basis of areas under various crops during past years (2001-2014) in Paschim Medinipur district that was randomly selected as one of the agriculturally progressive districts West Bengal. It was compared with overall scenario of crop diversity in the state of West Bengal (2007-15). The differential crop diversity in different parts/ sub-divisions of Paschim Medinipur district in 2013-14 was also revealed. Thereafter, the same was followed for two selected blocks. Finally, the analyses of existing types of cropping patterns and mean acreage, production, productivity, cost of cultivation and net income of different crops grown by 120 sampled farmers were studied. Different types of cropping patterns were compared with the help of rice equivalent yield (REY).

The Simpson Index (SI) was calculated, which used to indicate a clear dispersion of crops in a geographical region (Joshi *et al.*, 2003). Mathematically, SI is defined as:

$$SI = \frac{N}{1 - \sum_{i=1}^N P_i^2}$$

where, N = Total number of crops; P<sub>i</sub> = Proportion of acreage under i<sup>th</sup> crop to total cropped area.

SI assumes 1 for complete diversification and 0 for perfect concentration

The status of crop diversification and its impact on the farming situation of farmers was realized through delineation of cropping patterns followed by the selected farmers, average areas of the crops grown along with their production, productivity, cost of cultivation and net income of the farmers for the individual crops as well as the specific cropping pattern being adopted and compared with the help of rice equivalent yield

(REY) calculated through following formula. The relative preference of the high value crops was also realized on the basis of it.

$$REY = \frac{\text{(Economic yield of the alternative crop x unit price of same crop)}}{\text{Unit Price of Rice}}$$

Moreover, the farming scenario was also studied with following indices.

Cultivated land utilization index (CLUI) was estimated by summing the products of land area planted to each crop, multiplied by the actual duration of that crop divided by the total cultivated land area, times 365 days.

$$CLUI = \frac{\sum_{i=1}^n a_i d_i}{A \times 365} \times 100$$

where, i = 1,2,3.....n  
 n = total number of crops  
 a<sub>i</sub> = area occupied by the i<sup>th</sup> crop  
 d<sub>i</sub> = days that the i<sup>th</sup> crop occupies  
 A = cultivated land area available for 365 days

Crop diversity index (CDI) was calculated to understand the diversified cropping pattern in the selected area. The value of CDI is zero for a land area growing only one crop and approaches to unity as the level of diversity increases. This has been estimated for all the (*kharif*, *rabi* and summer) seasons. Crop diversity index (CDI) was calculated by using the following equation:

$$CDI = 1 - \sum_{i=1}^n (a_i/A)^2$$

where, i = 1,2,3.....n  
 a<sub>i</sub> = area planted to the i<sup>th</sup> crop;  
 A<sub>i</sub> = total area planted under all crops

Multiple Cropping Index (MCI) indicates the sum of the areas planted to different crops harvested during the year, divided by the total cultivated area.

$$MCI = \frac{\sum_{i=1}^n a_i}{A} \times 100$$

where, i=1,2,3.....n  
 a<sub>i</sub>=area planted under i<sup>th</sup> crop; A=Net cultivated area

## RESULTS AND DISCUSSION

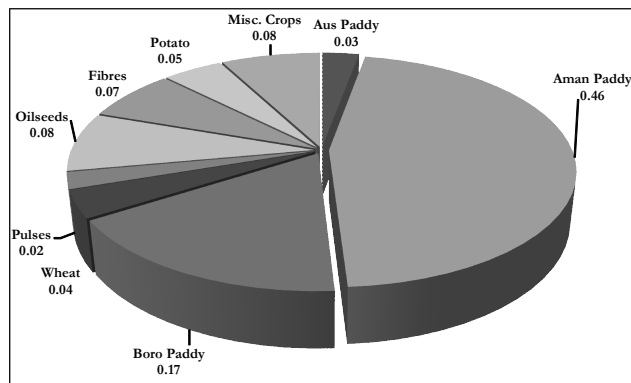
The acreage of different crops in West Bengal during past years (2007-2012) showed the dominance of food grains, especially the rice, although the area under boro (summer) rice showed declining trend (Table 1). The oilseeds were the second dominant crops in which Rapeseed and Mustard occupied more than half of the area under oilseeds. Fibre crops, primarily jute, and potato are other principal crops. The Simpson Index was calculated to realize the crop diversity which

showed the index values ranging from 0.715 to 0.764. Mean percentage area occupied by different crops in West Bengal (2007-12) is depicted in Figure 1. The food grains occupied about 70 per cent area with area under pulses less than 2.50 per cent of total area under main crops. Therefore, the diversity was seen through mainly oilseeds (8.22%), fibres (7.22%) and potato (4.69%) crops during *rabi* and summer seasons. However, concentration of aman rice during *keharif* was found in most areas of the West Bengal. During 2014-15, area

**Table 1: Area (thousand ha) under principal crops in West Bengal (2007-12)**

Crops	2007-08	2008-09	2009-10	2010-11	2011-12
<b>Food grains</b>					
1. Rice	5719.8	5935.6	5630.1	4944.2	5433.6
Aus	281.9	292.4	214.1	212.2	213.3
Aman	3926.4	4086.6	3986.3	3362.3	3999.4
Boro	1511.5	1556.6	1429.7	1369.7	1220.9
2. Wheat	352.6	307.0	315.8	316.6	315.6
3. Barley	2.0	2.7	1.8	2.0	
4. Maize	77.0	90.9	97.7	88.7	97.7
5. Other Cereals	17.9	16.4	15.1	13.3	10.1
Total Cereals	6169.3	6352.6	6060.5	5364.8	5859.3
6. Gram	25.3	21.9	21.8	22.3	23.3
7. Tur	1.0	0.5	0.7	1.6	1.1
8. Other Pulses	174.7	161.6	159.9	173.2	174.5
Total Pulses	201.0	184.0	182.4	197.1	198.9
Total Food grains	6370.3	6536.6	6242.9	5561.9	6058.2
<b>Oilseeds</b>					
1. Rapeseed & Mustard	407.6	412.6	410.1	410.8	419.3
2. Linseed	5.9	4.5	4.7	4.2	4.3
3. Other Oilseeds	293.8	286.4	267.2	255.7	255.2
Total Oilseeds	707.3	703.5	682.0	670.7	678.8
<b>Fibres</b>					
1. Jute	609.9	584.3	614.3	568.4	599.0
2. Mesta	7.4	7.8	5.3	6.1	5.4
3. Other Fibres	8.3	3.7	2.2	1.2	0.9
Total Fibres	625.6	595.8	621.8	575.7	605.3
<b>Miscellaneous crops</b>					
1. Sugarcane	16.5	17.4	13.9	15.0	16.3
2. Potato	400.9	386.0	387.0	408.8	379.3
3. Tobacco	11.6	12.6	14.1	14.3	17.4
4. Tea	115.0	115.0	115.0	115.0	115.0
5. Chillies (dry)	62.2	63.1	63.5	63.9	64.2
6. Ginger	10.8	11.1	11.1	11.3	11.5
Total Miscellaneous crops	617.0	605.2	604.6	628.3	603.7
<b>Minor crops</b>					
Gross Cropped Area	9157.51	8616.231	8320.577	7733.721	8121.584
Simpson Index Showing Crop Diversity	0.764	0.724	0.722	0.758	0.715

Source: Department of Statistics and Programme Implementation, Govt. of West Bengal



**Figure 1: Mean Percentage area occupied by different crops in West Bengal (2007-12)**

under food grains was 6240 thousand ha producing 17.05 million tonnes (6.44% to all India). Food grains area included 5500 thousand ha under rice producing 15.31 million tonnes (14.37% to all India) that was highest in the country. Wheat and maize occupied 340 and 130 thousand ha areas, respectively. The areas under oilseeds and pulses were 790 and 260 thousand ha, respectively contributing to 2.84 and 1.30 per cent of production in the country. Potato occupied 386.61 thousand ha area producing 11.59 million tonnes (25.56% to all India) that was second highest in the country after Uttar Pradesh. About 67.53 per cent area under jute and mesta produced 8.62 million bales (180 kg each) contributing 74.45 per cent of total production country.

The cropping scenario in Paschim Medinipur district over a period of triennium (TE) 2004 (2001-04), TE 2007, TE 2010 and TE 2013 revealed the dominance of food grains (Table 2) with an increasing area under boro rice and maize, and decreasing area of wheat, aus rice and pulses in the district. It indicated the shift towards non-food crops like oilseeds and potato during *rabi* and summer season. The crop diversity indicated through Simpson Index also showed an increasing trend during the period from 0.617 in TE 2004 to 0.641 in TE 2013.

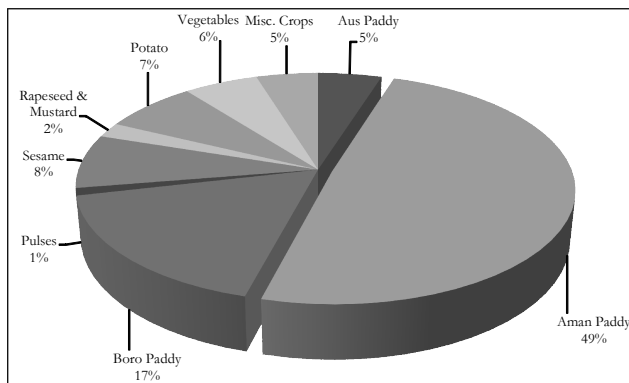
As per the data of 2013-14 (Figure 2), about half of the gross cropped area was occupied by the aman paddy (49.26%). Boro paddy cultivation was in 17.21 per cent of the gross cropped area. Sesame was most preferred oilseeds cultivated in the district covering 7.63 per cent of total area (about 70% of area under oilseeds); while the area under rapeseed mustard was

about two per cent that was contrasting to the scenario of West Bengal. A good amount of areas under potato (7.29%) and vegetables (5.75%) showed the progress of the districts towards diversification from food grains to more remunerative/high value crops. The Simpson

**Table 2: Area (thousand hectares) under principal crops in the district of Paschim Medinipur**

Crops	Triennium			
	TE 2004	TE 2007	TE 2010	TE 2013
<b>Food grains</b>				
1. Rice	619.83	667.23	681.13	665.70
Aus	51.27	44.97	37.60	41.70
Aman	463.30	495.07	477.73	462.06
Boro	105.27	127.20	165.80	161.93
2. Wheat	13.27	10.20	5.10	4.21
3. Maize	0.63	0.93	0.90	1.70
4. Other Cereals	0.10	0.10		
Total Cereals	633.77	678.40	687.13	671.60
5. Gram	0.30	0.20		
6. Tur	0.87	0.43	0.20	0.27
7. Other Pulses	7.63	6.33	4.97	6.34
Total Pulses	8.80	6.83	5.17	6.78
Total Food grains	642.57	685.23	692.30	678.38
<b>Oilseeds</b>				
1. Rapeseed and Mustard	19.30	19.63	14.33	14.94
2. Linseed				
3. Other Oilseeds	46.87	69.37	84.20	79.24
Total Oilseeds	66.17	89.00	98.53	94.24
<b>Fibres</b>				
1. Jute	5.33	5.30	4.67	3.54
2. Mesta				
3. Other Fibres	0.43	0.43	0.53	0.37
Total Fibres	5.77	5.73	5.20	3.90
<b>Miscellaneous crops</b>				
1. Sugarcane	2.97	2.27	1.93	3.25
2. Potato	58.43	69.13	65.67	66.22
3. Tobacco				
4. Tea				
5. Chillies (dry)	5.50	5.70	5.57	5.68
6. Ginger	1.37	1.60	1.67	1.62
Total Miscellaneous crops	68.27	78.70	74.83	76.77
Total Cropped Area	783	859	871	853
Simpson Index (SI)	0.617	0.618	0.633	0.641
<i>Showing Crop Diversity</i>				

Source: Bureau of Applied Economics and Statistics; Department of Statistics and Programme Implementation, Govt. of West Bengal



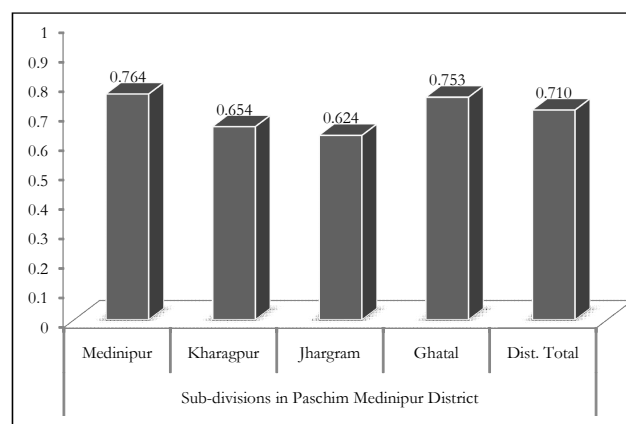
**Figure 2: Percentage area occupied by different crops in Paschim Medinipur District (2013-14)**

Index over a period of TE 2004 to TE 2013 and for the year 2013-14 showed an increasing trend from 0.617 to 0.710.

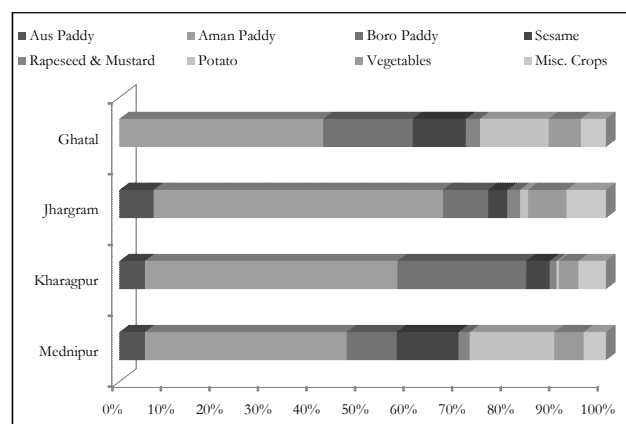
Among four sub-divisions of Paschim Medinipur district, maximum area under food grains was in Kharagpur sub-division (319.39 thousand ha) followed by Jhargram sub-division (172.23 thousand ha), Medinipur sub-division (161.52 thousand ha) and Ghatal sub-division (88.62 thousand ha), occupying 85 per cent, 79 percent, 59 percent and 63 per cent of gross cropped area, respectively. Area under pulses was highest in Kharagpur sub-division (3.91 thousand ha) followed by Jhargram sub-division (3.54 thousand ha), Medinipur sub-division (1.36 thousand ha) and Ghatal sub-division (1.76 thousand ha), respectively. An area of 99.53 thousand ha was under boro rice in Kharagpur sub-division that was found strikingly high as compared to other sub-divisions, 28.33 thousand ha in Medinipur sub-division being the next. Among the pulses, moong was most cultivated one followed by lentil and khesari in all the sub-divisions. The area under the oilseed was maximum in Medinipur sub-division (44.94 thousand ha) followed by Kharagpur sub-division (25.89 thousand ha), Ghatal sub-division (21.55 thousand ha) and Jhargram sub-division (17.94 thousand ha), occupying 16 per cent, 7 percent, 15 percent and 8 per cent of gross cropped area, respectively. Therefore, it was evident both Medinipur and Ghatal sub-divisions showed higher proportion of areas under oilseeds as compared to the district as well as state level (about 10% and 8% of gross cropped area). Potato was most extensively grown in Medinipur sub-division (47.90 thousand ha) and Ghatal sub-division (20.33 thousand ha) covering about 17 per cent and 14 per cent of gross

cropped area, which were more than the proportion in district and state level (about 7% and 5% of gross cropped area). The vegetables were grown in all the sub-divisions; however, it was having highest acreage in Jhargram sub-division (17.19 thousand ha) followed by Medinipur sub-division (16.69 thousand ha), Kharagpur sub-division (14.98 thousand ha) and Ghatal sub-division (9.47 thousand ha) occupying about 8 per cent, 6 per cent, 4 per cent and 7 per cent of total cropped area, respectively.

The varied crop diversity in four sub-divisions was quite evident from the Simpson Index values ranging from 0.624 to 0.764 (Figure 3). Both Medinipur and Ghatal sub-divisions showed higher diversity with index values of 0.764 and 0.753 (better than the district value of 0.710), which was due to relatively higher areas under oilseeds, potato and vegetables (Figure 4).



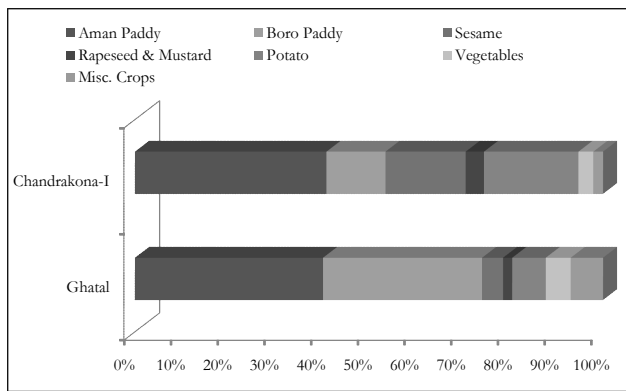
**Figure 3: Simpson index (SI) showing crop diversity in different sub-divisions in Paschim Medinipur District (Year 2013-14)**



**Figure 4: Percentage area occupied by different crops in four different sub-divisions of Paschim Medinipur District (2013-14)**

Present study was conducted through survey of 120 farmers representing from eight villages, four villages each in Ghatal and Chandrakona-I blocks of Ghatal sub-division in Paschim Medinipur district. Therefore, the cropping scenario in these two blocks was also studied that was found contrasting (Figure 5). The proportion of area under aman rice was similar (40-41% of gross cropped area). However, boro rice area was strikingly higher in Ghatal block (9500 ha) as compared to Chandrakona-I block (5000 ha) occupying 34 per cent and 12.60 per cent of gross cropped area. It is interesting to note the diversification through growing of oilseeds (sesame in 6800 ha and rapeseed mustard in 1550 ha) and potato (8000 ha) in Chandrakona-I block, which covered 21 per cent and 20 per cent of gross cropped area, respectively. In comparison, the area both under oilseeds and potato was low in Ghatal block (7.7% and 7.2% of gross cropped area). The area under vegetables was relatively higher in Ghatal (1495 ha) as compared to Chandrakona-I block (1265 ha); however, the flower was only cultivated in Chandrakona-I block (covering an area of 4100 ha). The extent of crop diversity was studied through Simpson Index which was found 0.712 and 0.744 in Ghatal and Chandrakona-I block, respectively.

After the analyses of types and status of crop diversity at state level, district level, sub-division level and block level during the past years, it was important to assess the same at grass-root level. Therefore, the different cropping patterns being followed by a sample of 120 farmers representing from eight villages, four villages each in Ghatal and Chandrakona-I blocks of



**Figure 5: percentage area occupied by different crops in Ghatal and Chandrakona-I Blocks under Ghatal sub-division of Paschim Medinipur District (2013-14)**

Ghatal sub-division in Paschim Medinipur district were explored and compared with respect to their impact on farming scenario including overall farm output.

A total of seven different cropping patterns were followed by the farmers (Table 3), where 13 out of 120 farmers adopted more than one cropping pattern. The cropping pattern of Paddy-Potato-Sesame was preferred by most of the farmers (56.39%) followed by Paddy-Potato-Paddy (17.29%) and Paddy-Rapeseed-Paddy (12.03%). It was interesting to find Onion-Potato-Paddy cropping pattern being adopted by four farmers by growing the onion crop in kharif season in addition to the aman paddy. Other cropping patterns were Paddy-Potato-Rapeseed/Mustard (6.02%), Paddy-Fallow-Paddy (4.51%) and Paddy-Potato-Fallow being followed by one farmer.

**Table 3: Different types of cropping pattern followed by the selected farmers in Paschim Medinipur District**

Cropping Pattern	Freq- uency	Perce- ntage
Paddy-Potato-Sesame	75	56.39
Paddy-Potato-Paddy	23	17.29
Paddy-Rapeseed-Paddy	16	12.03
Paddy-Potato-Rapeseed/Mustard	8	6.02
Paddy-Fallow-Paddy	6	4.51
Onion -Potato- Paddy	4	3.01
Paddy-Potato-Fallow	1	0.75
13 out of 120 farmers sampled in present study adopt more than one cropping pattern	133	100.00

Area, production, productivity, cost of cultivation and net income with respect to the crops grown by the selected farmers under different cropping pattern is presented in Table 4.

Mean area under aman paddy was found to be 1.65 acre producing on an average 25.21 qi of grains with mean productivity of 3.82 tonnes per ha. Average cost of cultivation (operational expenses) was Rs. 28070/- per ha providing average net income of Rs. 10137/- per ha. While the aman paddy was predominant (with frequency of 129) across the cropping patterns followed by the farmers, boro paddy was found to be grown in 49 out of 133 cases. The average productivity (5.50 t/ha) as well as production (35.42 qi) of boro paddy was quite high that was grown by the farmers in an average area of 1.61 ha. The cost of cultivation of boro rice was



found relatively higher as compared to aman rice with an average operational expense of Rs. 34240/- per ha; however it was varied by Rs. 5200/- as evident from the SD value. Boro rice brought an average net income of Rs. 20780/- to the farmers.

The potato was second most dominant crops (frequency of 111) in the cropping patterns followed by the farmers with an acreage of 1.47 acre which provided about 120 qi of production with an average productivity of about 20.41 tonnes per ha. Although the average cost of cultivation per ha was found remarkable high (Rs. 131926/-) with a variation of Rs. 10122 (as indicated through SD value), it was found to be most remunerative with an average net income of about Rs. 52000/- per ha.

Most of the farmers preferred to grow sesame (frequency of 75) resulting a shift from boro rice to sesame during summer. From an average area of 1.28 acre sesame produces 6.14 qi with mean productivity of 1.20 t/ ha. The average cost of cultivation of sesame grown in one ha was seen relatively less (Rs. 16477/-) leading to a higher average net profit (Rs. 30761/- per ha).

Rapeseed/Mustard was grown by the selected farmers both in rabi (frequency 16) and summer (frequency 8) season with relatively more mean acreage and productivity in rabi season (1.91 acre, 1.07 t/ha) as compared to summer season (0.53 acre, 0.89 t/ha). In case of farmers following Paddy-Potato-Rapeseed/Mustard cropping pattern, the cost of cultivation of rapeseed/Mustard was found to be relatively less (Rs. 16160/- per ha) in comparison to that of rapeseed grown in *rabi* season (Rs. 18370/- per ha) following the Paddy-Rapeseed-Paddy cropping pattern. The per ha average net income was found to be Rs. 17460/- and Rs. 15050/- in *rabi* and summer season, respectively.

Four farmers had grown onion in *kharif* in addition to aman paddy in a small area (0.45 acre) getting a production of 15.44 qi with mean productivity of about 8.58 t/ha. The net income was found to be about Rs. 36000/- per ha.

As evident from Table 4, the selected farmers (120) cultivated 224 ha in a year with Multiple Cropping Index (MCI) of 279.17 per cent. The Cultivated Land Utilisation Index (CLUI) was found 84.35% showing the year around intensive cultivation in the region. Crop

**Table 4: Area, production, productivity, cost of cultivation and net income with respect to the crops grown by the selected farmers under different cropping pattern in Paschim Medinipur District**

Crop (with Season and No. of farmers)	Area (acre)	Production (qi)	Productivity (t/ha)	Cost of cultivation (Rs./ha)	Net income (Rs./ha)
	Mean±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
1. Paddy (Aman/ <i>Kharif</i> ) (n=129)	1.65±0.89	25.21±6.93	3.82±1.05	28070±3255 (B:C Ratio: 1.36:1)	10137±1543
2. Paddy (Boro/Summer)(n=49)	1.61±1.04	35.42±5.47	5.50±1.31	34240±5200 (B:C Ratio: 1.61:1)	20780±1970
3. Potato( <i>Rabi</i> )(n=111)	1.47±0.80	120.01±10.82	20.41±1.84	131926±10122 (B:C Ratio: 1.39:1)	51754±5250
4. Sesame (Summer)(n=75)	1.28±0.67	6.14±1.28	1.20±0.25	16477±1042 (B:C Ratio: 2.87:1)	30761±1561
5. Rapeseed ( <i>Rabi</i> )(n=16)	1.91±0.81	8.16±1.37	1.07±0.18	18370±1332 (B:C Ratio: 1.95:1)	17460±961
6. Rapeseed/Mustard (Summer)(n=8)	0.53±0.47	1.88±0.66	0.89±0.31	16160±1092 (B:C Ratio: 1.93:1)	15050±861
7. Onion ( <i>Kharif</i> )(n=4)	0.45±0.36	15.44±4.5	8.58±2.50	40580±5092 (B:C Ratio: 1.89:1)	36125±1540

Gross Cropped Area: 224 ha (Area under Paddy: 50.22%, Area under Non-Paddy Crops: 49.78%)

Cultivated Land Utilization Index (CLUI): 84.35%

Multiple Cropping Index (MCI): 279.17%

Crop Diversity Index (CDI): 0.744

Note: SD stands for Standard Deviation value; B:C Ratio stands for Benefit (Gross Income):Cost (Cost of Cultivation) Ratio.

diversity of 0.744 showed the extent of crop diversification. The value of CDI may range from 0 (mono-cropping) to 1 (diversified cropping). In the selected area, cultivations of non-food remunerative crops / high value crops in *rabi* and summer season resulted to higher CDI value. The ratio of area under paddy and non-paddy crops was 50:50 indicating crop diversification towards more remunerative/ high value crops. BIRTHAL *et al.* (2015) reported that growers need to allocate at least 50% area to HVCs to escape poverty.

Different types of cropping pattern followed by the sampled farmers were compared not only on the basis of crop-wise production but also overall output in term of Rice Equivalent Yield. The REY of crops were found to be different, highest being the potato (18.34 t/ha) followed by onion (7.72 t/ha), sesame (4.8 t/ha), rapeseed/mustard in *rabi* season (3.75 t/ha) and rapeseed/mustard in summer season (3.2 t/ha).

Farmers (4) with cropping pattern of Onion-Potato-Paddy achieved highest REY of 47.43 qi/acre (11.86 t/ha) while growing onion in 0.45 acre during *kharif*, potato in 1.75 acre during *rabi* and boro rice in 1.50 acre (Table 5). However, the comparison between the cropping patterns would be proper if all the three crops grown in a given cropping pattern were given equal area; accordingly, the REY of Onion-Potato-Paddy would have been 10.53 t/ha (Figure 6), being the best among all.

Farmers (8) followed Paddy-Potato-Rapeseed/Mustard obtained REY of 38.68 qi/acre (9.67 t/ha) by growing paddy in 2.02 acre in *kharif*, potato in 1.76 acre

in *rabi* and rapeseed/mustard in 0.53 acre in summer season. However, the same cropping pattern with equal area for all crops would give REY of 8.43 t/ha (Figure 6).

In case of Paddy-Potato-Sesame cropping pattern that was predominant in the study region, farmers (75) cultivated aman paddy in 1.56 acre, potato in 1.45 acre in *rabi* and sesame in 1.28 acre in summer season which gave REY of 36.12 qi/acre (9.03 t/ha). As indicated in Fig. 6 with equal area to all crops the same cropping pattern would provide an overall output in term of REY 9 t/ha.

Paddy-Potato-Paddy cropping pattern being followed by the farmers (23) had grown aman paddy in an average area of 1.78 acre, potato in 1.44 acre in *rabi* and boro paddy in 1.57 acre and achieved REY of 34.98 qi/acre (8.74 t/ha). The same cropping pattern with equal area in each crop would provide REY of 9.23 t/ha.

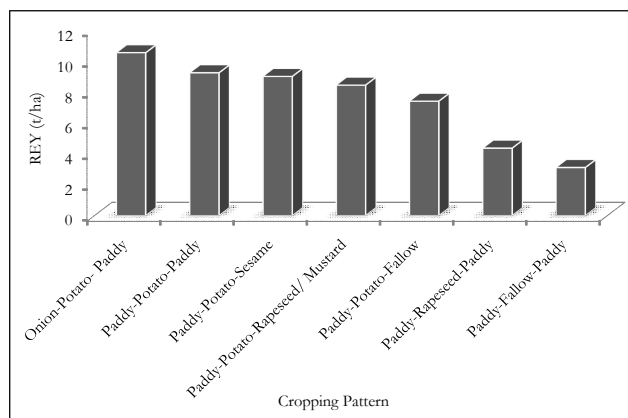
One farmer had followed Paddy-Potato-Fallow cropping pattern by growing aman paddy in 1 acre and potato in 0.5 acre keeping the land fallow during summer which produced an output of 20.81 qi/acre (5.2 t/ha). However, the output would be REY of 7.40 t/ha considering equal area under the crops

Although potato was predominant crop in *rabi* season, 16 farmers had grown rapeseed during *rabi* season following Paddy-Rapeseed-Paddy cropping pattern in which mean cultivated area of those crops were 2.08 acre, 1.91 acre and 2.08 acre, respectively.

**Table 5: Comparing of different types of cropping pattern followed by the selected farmers in Paschim Medinipur District through rice equivalent yield (REY)**

Cropping Pattern	Crop grown in <i>kharif</i> season		Crop grown in <i>rabi</i> season		Crop grown in summer season		REY (qi/acre)
	Area (acre)	Production (qi)	Area (acre)	Production (qi)	Area (acre)	Production (qi)	
Paddy-Potato-Sesame(n=75)	1.56	23.84	1.45	118.38	1.28	6.14	36.12
Paddy-Potato-Paddy(n=23)	1.78	27.20	1.44	117.56	1.57	34.54	34.98
Paddy-Rapeseed-Paddy(n=16)	2.08	31.79	1.91	8.17	2.08	45.76	17.49
Paddy-Potato-Rapeseed/Mustard(n=8)	2.02	30.87	1.76	143.69	0.53	1.89	38.68
Paddy-Fallow-Paddy(n=6)	0.98	14.98	—	—	0.98	21.56	12.43
Onion-Potato- Paddy(n=4)	0.45	15.44	1.75	142.87	1.50	33.00	47.43
Paddy-Potato-Fallow(n=1)	1.0	15.28	0.50	40.82	—	—	20.81

Note: REY was calculated as per the average selling rates of the farmers viz. Paddy @ Rs. 1000/qi, Potato @ Rs. 900/qi, Sesame @ Rs. 4000/qi, Rapeseed/Mustard @ Rs. 3500/qi and Onion @ Rs. 900/qi



**Figure 6: Rice equivalent yield (REY) of different cropping pattern (considering equal area under each crop) followed by the selected farmers in Paschim Medinipur District**

This cropping pattern produced an overall output in term of REY 17.49 qi/acre (4.37 t/ha). The same cropping pattern with equal area under each crop would have given an overall output of REY of 4.36 t/ha.

It is evident that presence of potato crop in a cropping pattern had made the overall farm output better than a cropping pattern without potato crop. Similarly, the concentration of paddy crop in the cropping pattern would be less remunerative as evident from the output of the farmers (6) in term of REY 12.43 qi/acre (3.11 t/ha) in Paddy-Fallow-Paddy cropping pattern.

Figure 6 depicts the most remunerative cropping pattern in the study area in a decreasing order of farm output calculated in term of rice equivalent yield. However, it is worth mentioning here that oilseeds crops (sesame, rapeseed/mustard) were found to be less cost intensive having relatively higher B:C ratio (Table 4) and lesser risk due to low investment as compared to crops like potato, onion, boro rice, etc. Therefore, many farmers prefer the oilseeds in their cropping pattern. Moreover, the easy management practices and less irrigation requirement influenced the farmers to opt for the oilseeds in areas, where water availability and farmers investment capacity was less.

Present study revealed the impact of crop diversification on farming scenario in term of overall farm output. Crop diversification from food crops to high value crops resulted in higher farm output and

income for the farmers; however, it was varied depending on the type of cropping pattern being followed. Joshi *et al.* (2006) have shown that the main source of crop income growth in India during 1980s was the technology led growth of yields of various crops and diversification emerged as the dominant sources of growth in agricultural income during the 1990s. Diversification towards horticultural crops led to the rise in agricultural income in the 1990s more than that in the 1980s. Moreover, compared to the southern and western regions, impact of crop diversification was less in eastern region including West Bengal in 1990s. Dasgupta and Bhaumik (2014) examined the trend and pattern of diversification of the crop sector in West Bengal during the period 1980-81 to 2009-10. In this context, they examined the impact of crop diversification on agricultural output growth in West Bengal. The sources of growth of the crop sector accounted for about 80 per cent of the total value of agricultural output in West Bengal.

Most preferred cropping pattern included potato and/or oilseeds (sesame and rapeseed/mustard) in the present study area. Similar pattern of diversification was reported by number of researchers (Chand *et al.*, 2008; De and Chattopadhyay, 2010; Dasgupta and Bhaumik, 2014; Majumder, 2014, Birthal *et al.*, 2015). Vyas (1996) also observed that the small and the marginal farmers who dominate the agricultural scenario of most of the Indian states, including West Bengal, can generate higher farm income and employment and mitigate risks by adopting a diversified crop portfolio. There are spatial variations in cropping pattern and its change, which is visible not only across the states but also within them. This is observed also in the present study. De (2003) revealed that the cropping pattern in West Bengal in terms of allocation of acreage remained skewed towards boro paddy, potato and oilseeds. The same was found in present study conducted at Paschim Medinipur district of West Bengal.

Majumder (2014) revealed that from both the aspects of area and production it can be observed that over the time span of three decades the cropping pattern in West Bengal is increasingly dominated by boro paddy, oilseeds (including, rapeseed and mustard) and potato. These crops are either HYV or cash crops and hence are more remunerative over other crops. The

oilseeds have another advantage. Besides being remunerative, they also require less irrigation which makes them ideal for cultivation in the areas with less rain or irrigation. This observation is similar to that of present study. By farm size, the biggest impact of HVCs on poverty is assessed for smallholder farmers with landholdings less than or equal to 2 ha (Birthal *et al.*, 2015).

### CONCLUSION

The present study revealed status and types of crop diversity at state level, district level, sub-division level and block level during the past years (2001-2015) in West Bengal. The different cropping patterns being followed by the farmers at village level in Paschim Medinipur district showed the crop diversification towards non-paddy/non-food grain crops like potato, sesame, rapeseed/mustard especially during *rabi* and summers season occupying 50 per cent of total gross cropped area in the region. Paddy-Potato-Sesame was found as predominant cropping pattern. The boro/summer paddy cultivation was still preferred by many farmers. The marginal and small farmers were able to enhance the overall farm output following the crop diversity ensuring household food security as well as employment and income security. The crop diversification was found to be the effective survival strategy adopted by the marginal and small farmers ensuring the reduced risks in farming.

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# Economic Dimensions of Enterprises Established Under Agri-Clinics and Agri-Business Centres

P.S. Armorikar<sup>1</sup>, B.S. Hansra<sup>2</sup>, M.J. Chandre Gowda<sup>3</sup> and P.K. Jain<sup>4</sup>

<sup>1</sup>Director, Directorate of Extension, Department of Agriculture Cooperation and Farmers Welfare, Govt. of India

<sup>2</sup>Professor Emeritus, Amity International University; <sup>3</sup>Principal Scientist (Agricultural Extension), ATAERI, Bengaluru

<sup>4</sup>Associate Professor, School of Agriculture, IGNOU

## ABSTRACT

Establishment of Agri-clinic and Agri-business Centres (ACABC) scheme was launched by Government of India in April 2002 with an objective to supplement the efforts of public extension for agricultural development and to create gainful self-employment opportunities to unemployed agricultural youths. Through this intervention, various efforts are being made to impart training to unemployed youths who possess qualification in agriculture and allied subjects to facilitate them to establish their own agri-ventures. Cumulative progress of the scheme indicates that out of 47,884 candidates trained under the scheme, 20,684 of them could establish agri-ventures up to April 2016. The present study was conducted in Uttar Pradesh and Madhya Pradesh, which were purposively selected on the basis of success rate in terms of candidates trained and ventures established under ACABC scheme with a total sample size of 60 respondents to ascertain the status of agri-enterprises established by the agripreneurs. The study reveals that majority (66.67%) of the agripreneurs were 'satisfied' whereas 23.33% of the agripreneurs were 'highly satisfied' in running their enterprise.

**Keywords:** Agri-clinics, Agri-business Centres, Agri-preneurship, Agri-venture, Skill Development, employment generation etc.

## INTRODUCTION

Unemployment is one of the major problems of rural people, which affect family and per capita income. Indian population comprises large number of qualified unemployed youths dispersed in different regions of the country. There is a huge scope to explore the potential of rural youths and identify the skill gaps for building their capacities for agri-entrepreneurship through skill development. Several efforts are being made by GOI to bring rural youth in the mainstream of agriculture and rural development.

The present unemployment situation in the country calls for massive efforts for generating employment avenues. In the present era where population is increasing at an alarming rate, a pragmatic approach is much in need to get self-employed and entrepreneurship is the straight forward solution. Agri-

entrepreneurship is a purposeful activity in initiating, promoting, and maintaining economic activities for the production and distribution of wealth (Shamshad, 2005).

In the prevailing scenario, the public extension system is facing lot of constraints in technology dissemination to the farmers, due to inadequate technical work force at district, block and village level. The ratio of farmer to extension worker worked out to be 1000:1 (Global Agri System, 2010). It has resulted in widening the gap between research and extension system. There is a need for revitalization of extension system to address these issues, providing value added extension services to the farmer through additional qualified work force and adequate infrastructure (Shekara *et al.*, 2011). It is, therefore, inevitable to have a pluralistic extension set-up to deliver the diverse and

urgent technological needs of farmers. Complimenting and supplementing the efforts of public extension system through active involvement of para-extension workers across the country is a viable option in this direction.

The GOI constituted a Steering Committee on agriculture and allied sectors under the chair of Prof. M.S. Swaminathan and suggested creation of agri-clinics and agri-business centres managed by agri-graduates, to provide consultancy services to the farming community in rural areas (Karjagi *et al.*, 2006). The centres provide a wide range of services, depending on the interests of the graduates, and can include, but are not limited to, soil, water quality, and input testing laboratory; plant protection services; vermin composting units; horticulture; veterinary clinic; and agro service centres for farm machinery and primary processing (NABARD, 2010).

The Central Sector Scheme “Establishment of Agri-clinic and Agri-business Centres (ACABC)” was launched by Government of India in April, 2002 with an objective to supplement the efforts of public extension for agricultural development and to create gainful self employment opportunities to unemployed agricultural youths. Through this intervention, various efforts are being made to impart training to unemployed youths who possess qualification in agriculture and allied subjects to facilitate them to establish their own agri-ventures. The scheme is implemented throughout the country. Cumulative progress of the scheme indicates that out of 47,884 candidates trained under the scheme, 20,684 of them could establish agri-ventures up to April 2016. Table 1 shows the year-wise number of candidates trained under the scheme till April 2016:

The trained agricultural graduates have positive and favorable attitude towards self-employment and starting of agri-business in rural areas (Parimaladevi *et al.*, 2006). The agri-ventures provide advisory and extension services to the farmers and facilitate the agri-entrepreneurs to generate their income through self-employment and promote employment opportunities for other rural youth in their region. More than 20,684 agri-preneurs have taken the benefit of the ACABC scheme across the country till April, 2016 (Source: <http://www.agriclinics.net>). In this backdrop, a study

**Table 1: Year-wise progress of ACABC scheme**

Year	Candidates trained	Ventures established	Success rate (%)
2002-03	3058	416	13.60
2004-05	2977	783	26.30
2006-07	3149	1081	34.33
2008-09	2503	824	32.92
2009-10	2564	1111	43.33
2011-12	4015	2139	53.28
2012-13	4439	2250	50.69
2013-14	4451	2320	52.12
2014-15	5437	2546	43.15
2015-16	5244	2775	52.91
<b>Total</b>	<b>47,815</b>	<b>20,448</b>	<b>42.76</b>

was undertaken to ascertain the role and status of agri-enterprises in terms of investment, annual growth rate in business turnover, profits and reinvestment.

## MATERIALS AND METHODS

The research study was conducted in Uttar Pradesh and Madhya Pradesh, which were purposively selected on the basis of success rate in terms of candidates trained and ventures established under ACABC scheme. Varanasi and Azamgarh districts of Uttar Pradesh and Sehore and Hoshangabad districts of Madhya Pradesh were in turn considered for further sampling of fifteen agri-preneurs per District (list available at <http://www.agriclinics.net>) with a total sample size of 60 respondents to ascertain the status of agri-enterprises established by the agri-preneurs

The data collected through interview schedule was analysed on the master sheet to describe personal, social, and economic characteristics of the respondents. Frequencies were marked and percentages were calculated. The statistics analysis was done through arithmetic mean, correlation coefficients etc for interpretation of the data.

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$$

The status of agri-enterprises was measured in terms of total investment made (Rs. in lakh), extent of net income gained per annum (Rs.), extent of profit reinvested in the enterprise and annual growth rate in sales.

## RESULT AND DISCUSSION

**Personal profile:** Data in Table 2 reveals that majority (60%) agripreneurs were of less than 35 years of age category, followed by 40% in the age group category of 36-55 years. Overall, 56.67% of the agri-preneurs were graduates in Agriculture, followed by 40% post graduates in agriculture and allied subjects. About 37% were having experience of 6 to 10 years in U.P whereas, 76.66 % of the agri-preneurs were having the experience up to five years in M.P. Agri-preneurs, in majority were of Joint Family (90%) and having Family Size of above 9 members category (21.66%).

It is evident that agri-preneurs trained under ACABC scheme had good educational qualification, experience and capabilities to gain the confidence of farmers.

**Investment for setting up of Agri-venture:** Almost 53.33% agri-preneurs had invested less than Rs. 5.0 lakh followed by 36.66% and 10% in the category of between Rs. 5 to 10 lakh and more than Rs.10 lakh of investment, respectively for setting up of agri-venture (Table 3).

**Net Income Gained:** Figures given in the Table 4 revealed that 65% of the agri-preneurs had earned the net income in the category of of Rs.1,20,001 and above, whereas only 6.67% of agri-preneurs were found to be in the category of Rs. 80,001 to Rs.1,00,000/- per annum from their agri-venture. Further, it was also seen that in the above said category of Rs.1,20,001 and above, 73.33 % of agri-preneurs in Uttar Pradesh and 56.67% of agri-preneurs in Madhya Pradesh were found respectively. Thus, it can be concluded that the Agri Clinic entrepreneurs were successful in their enterprises up to very high level.

**Profit Reinvested:** A look at the data in Table 5 reveals skewness towards the higher end of reinvestment of profits. About 43.33 per cent of respondents had achieved a moderate degree of success with reinvestment of profits being between 11 to 20 per cent of their gross returns, while about 10 per cent of them could get higher degree of success (with reinvestment of profits being more than 51 per cent). Thus, it may be concluded that the Agri Clinic entrepreneurs were successful in their enterprises up to a very high degree.

**Table 2: Personal profile of agri-entrepreneurs**

Characteristics	Category	Uttar Pradesh		Madhya Pradesh		Overall (N=60)	
		No.	%	No.	%	No.	%
Age	Less the 35 years	19	66.33	17	56.67	36	60.00
	36 to 55 years	11	36.67	13	43.33	24	40.00
Education	Diploma (Agri)	01	3.33	01	3.33	02	3.33
	BSc (Agri)	18	60.00	16	53.34	34	56.67
	M.Sc (Agri)	11	36.67	13	43.33	24	40.00
Experience	Up to 5 years	16	53.33	23	76.67	39	65.00
	6 to 10 years	11	36.67	05	16.66	16	26.67
	Above 10 years	03	10.00	02	6.67	05	8.33
Family Size	Up to 3 members	02	6.67	01	3.33	03	5.00
	4 to 6 members	11	36.66	11	36.67	22	36.67
	7 to 9 members	12	40.00	10	33.33	22	36.67
	Above 9 members	05	16.67	08	26.67	13	21.66
Family Type	Nuclear	02	6.67	04	13.33	06	10.00
	Joint	28	93.33	26	86.67	54	90.00

**Table 3: Investment made by agri-entrepreneurs for setting up of agri-venture**

Investment (Rs in Lakh)	Uttar Pradesh (n= 30)		Madhya Pradesh (n= 30)		Overall (N = 60)	
	No.	Per cent	No.	Per cent	No.	Per cent
Less than 5	14	46.67	18	60.00	32	53.33
Between 5 – 10	12	40.00	10	33.33	22	36.67
More than 10	04	13.33	02	6.67	06	20.00
<b>Total</b>	<b>30</b>	<b>100.00</b>	<b>30</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>

**Table 4: Extent of net income gained per annum by agri-entrepreneurs**

Income gained per annum (Rs.)	Uttar Pradesh (n= 30)		Madhya Pradesh (n= 30)		Overall (N = 60)	
	No.	Per cent	No.	Per cent	No.	Per cent
60,001- 80,000	02	06.67	04	13.33	06	10.00
80,001- 1,00,000	02	06.67	02	06.67	04	6.67
1,00,001-1,20,000	04	13.33	07	23.33	11	18.33
1,20,001 & above	22	73.33	17	56.67	39	65.00
<b>Total</b>	<b>30</b>	<b>100.00</b>	<b>30</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>

**Table 5: Extent of profit reinvested by agri-entrepreneurs**

Profits reinvested per annum (%)	Uttar Pradesh (n= 30)		Madhya Pradesh (n= 30)		Overall (N = 60)	
	No.	Per cent	No.	Per cent	No.	Per cent
No reinvestment	00	00	02	06.67	02	3.33
Up to 10	07	23.33	09	30.00	16	26.67
11 - 20	14	46.67	12	40.00	26	43.33
21 - 30	02	06.67	02	06.66	04	6.67
31 - 40	00	00	00	00	00	00
41 - 50	04	13.33	02	06.67	06	10.00
51 & above	03	10.00	03	10.00	06	10.00
<b>Total</b>	<b>30</b>	<b>100.00</b>	<b>30</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>

It is evident from Table 6 that majority of the agri-entrepreneurs (50%) were generating the annual growth rate of 15 to 20% of sales through their agri-ventures. It further revealed that 13.33% agri-preneurs were successfully involved in agri-preneurship with a growth rate of sales of more than 25% per annum.

It may be because of the fact that majority of the agri-preneurs are able to reap higher income from the enterprises they are engaged in. It justifies that the enterprises selected by them were economically feasible and appropriately managed by the entrepreneurs due to their technical competence.

The data in Table 7 reveals that most of the agri-preneurs (73.33%) adapted very well to the demand of the day while 20% of the agri-preneurs adapted well to some situations only, whereas only 6.67 % could found surviving barely and were now adjusting themselves. It

might be due to the fact the entrepreneurs had undergone experience to adjust themselves with the demand-supply analysis of their products and services and able to encash the opportunities and make preparedness to overcome the constraints in establishing and running the enterprise.

It can be observed in Table 8 that majority (66.67%) of the agri-preneurs were 'satisfied' whereas 23.33% of the agri-preneurs were 'highly satisfied' in running their enterprise. Majority of the agri-preneurs being in the category of 'satisfied' to 'highly satisfied' which might be due to the fact that they are earning profits out of their agri-venture through providing need based advisory and extension services to the farmers for improving their socio-economic status.

The results in Table 9 revealed a positive correlation between status of agri-ventures with experience in agri-

**Table 6: Annual growth rate in Sales of agri-enterprise**

Annual growth rate of sales (%)	Uttar Pradesh (n= 30)		Madhya Pradesh (n= 30)		Overall (N = 60)	
	No.	Per cent	No.	Per cent	No.	Per cent
Upto 5	01	3.34	05	16.67	06	10.00
10	07	23.33	09	30.00	16	26.67
15	07	23.33	05	16.66	12	20.00
20	10	33.33	08	26.67	18	30.00
25 & above	5	16.67	03	10.00	08	13.33
<b>Total</b>	<b>30</b>	<b>100.00</b>	<b>30</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>



**Table 7: Extent of adaptability to the business environment**

Status of adaptability	Uttar Pradesh (n=30)		Madhya Pradesh (n=30)		Average (N =60)	
	No.	Per cent	No.	Per cent	No.	Per cent
Adapted very well to the demands of the day	20	66.66	24	80.00	44	73.33
Adapted well to some situations only	08	26.66	04	13.33	12	20.00
Could survive barely and now adjusting	02	6.66	02	6.66	04	6.67
Could not foresee the impending crisis and unable to adjust well	00	0.00	00	0.00	00	0.00
Could not adjust at all and thinking of quitting or changing	00	0.00	00	0.00	00	0.00
<b>Total</b>	<b>30</b>	<b>100.00</b>	<b>30</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>

**Table 8 Extent of satisfaction in running the Agri-enterprise**

Extent of satisfaction	Uttar Pradesh (n= 30)		Madhya Pradesh (n= 30)		Overall (N = 60)	
	No.	Per cent	No.	Per cent	No.	Per cent
Highly satisfied	09	30.00	05	16.67	14	23.33
Satisfied	17	56.66	23	76.67	40	66.67
Somewhat satisfied	04	13.33	02	6.66	06	10.00
Dissatisfied	00	0.00	00	0.00	00	00.00
<b>Total</b>	<b>30</b>	<b>100.00</b>	<b>30</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>

clinics in case of agri- entrepreneurs running these ventures at 0.01 level of probability.

**Table 9: Relationship between personal profile of Agri-preneurs with the Status of their Agri-enterprises**

Profile variables	Correlation coefficient ('r' value)
Age	0.1274
Education	0.1022
Experience in agri-clinic	0.3680 **
Size of family	-0.0359
Type of Family	0.0812

### CONCLUSION

The Agri Clinics and Agri-business Centres were set up by agricultural graduates in majority followed by post-graduates and diploma holders in agriculture and allied subjects with active support from the MANAGE and Nodal Training Institutes. The key to their success was their technical competence to provide advisory and extension services to the farmers in terms of quality inputs and consultancy on various technologies including soil health, cropping practices, plant protection and improved animal husbandry practices.

It can be concluded from the results and discussion that the agricultural graduates were provided with adequate training on improved farm practices, business management and entrepreneurship development, which motivated them towards self employment with profitable business options. Both economic and social indicators were the crucial factors while assessing the success of Agri Clinics and Agri Business centres in the study area. The results of the study showed that ACABC scheme has immense potential to motivate the rural youth towards agri-entrepreneurship and self-employment, which would in turn significantly contribute to enhance their per capita income and socio-economic status.

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# Analysis of Constraints in Adoption of Biogas Technology

Dharminder Singh<sup>1</sup> and K.B. Singh<sup>2</sup>

<sup>1</sup>Department of Extension Education, <sup>2</sup>Department of Soil and Water Engineering, Punjab Agricultural University, Ludhiana-141004, Punjab

## ABSTRACT

Traditional fuels like fuel wood, agricultural waste and cow dung cakes are commonly burnt for meeting cooking and general heating purposes in rural areas. Biogas can be a clean and efficient fuel alternative in rural areas. The present study was conducted in eleven villages of Moga district of Punjab to analyse the various constraints faced in adoption of biogas technology. Data were collected from randomly selected 80 respondents with the help of semi structured interview schedule. It was found that reduction of gas supply in pipe during winter season and slow gas availability were the major operational constraints faced respondents with mean percent score of 85.0 and 73.8, respectively. The social unacceptability for use of human faeces in biogas plants and unhygienic conditions in the surrounding of house were considered the most serious socio-psychological hindrances. High cost of construction of biogas plant and less amount of government subsidy were the major financial constraints. Study reveals that the financial constraints were most important constraints followed by socio psychological and operational constraints. Efforts should be made to overcome these constraints to facilitate adoption of biogas technology in rural areas.

**Keywords:** Biogas technology, Biogas plants, Constraints, Adoption, Punjab

## INTRODUCTION

Biomass is an important source to meet the cooking energy needs of most rural households and half of the urban households (Shukla, 1996). Despite significant penetration of commercial energy in India during last few decades, biomass based traditional fuels continues to dominate energy supply in rural and traditional sectors. Biomass energy constitutes wood fuels (including charcoal, wood waste wood), crop residues (such as bagasse, rice husk and crop stalks) and animal dung (including biogas). Wood fuels contribute 56 percent of total biomass energy in India (Sinha *et al*, 1994). It is an inefficient source of energy and releases large amount of pollutants, which leads to chronic health problems in rural masses. On the contrary, biogas provides a clean and important renewable energy source for rural areas. Bio-slurry, its by product has better quality manurial properties than farm yard manure.

Biogas is a combustible gaseous mixture, produced in the process of anaerobic fermentation of organic material like cattle dung or other digestible biomass.

Although India has large livestock population and animal dung is available in abundant quantity, but the biogas technology has not find adoption with many farmers in the rural areas. Against the estimated potential of about 12 million family type biogas plants based on availability of cattle dung in the country, a total of 4.31 million family type biogas plants have been setup in the country (Anonymous, 2014). In Punjab, a total of 1.16 lakh biogas plants have been installed up to the year 2011, against the estimated potential of 4.5 lakh plants (Anonymous, 2014a). Two technology designs, the floating dome and fixed dome, are being used in biogas plants. India has one of the largest biogas programme in the world. Failures discontinued use and below standard operation of the biogas technology are widely reported. Despite having the potential to provide good alternate to the traditional fuel sources, there could be several hindrances which users face during operation and maintenance of the biogas plants. Thus, the present study was conducted to analyse the various constraints faced by the farmers in adoption of biogas technology in Punjab.

## MATERIALS AND METHODS

The present study was conducted under the operational area of Krishi Vigyan Kendra, Moga. Punjab Energy Development Agency (PEDA) and Khadi and Village Industries Commission (KVIC) were operating in the Moga district of Punjab for installation of biogas plants. For the present study, eleven villages of the district having maximum number of biogas plants were selected. Data were collected from 80 randomly selected respondents from these villages. Data were collected through survey method with the help of semi structured interview schedule. In the present study, constraint was operationalized as irresistible force that acts as hindrance in adoption of biogas technology. A list of major constraints was prepared in consultation with extension scientists, available literature, field functionaries and biogas users from non-sample area. Further, the major constraints were categorized into suitable sub-heads viz. operational, socio-psychological and financial constraints. Mean percent score (MPS) was calculated for each of the constraint on the basis of their degree of magnitude and ranked in order of their importance as suggested by Tanwar (2011).

## RESULTS AND DISCUSSION

**Operational constraints:** The data revealed that reduction of gas supply in pipe during winter season and poor gas supply were the major operational constraints faced by the majority of the respondents with the mean percent score of 85.0 and 73.8, respectively (Table 1). Clogging of inlet and outlet pipeline (47.5%) was the third major operational problem realized by the respondents. Non-availability of labour (43.8%) and technician for minor repair (37.5%) were 4<sup>th</sup> and 5<sup>th</sup> ranked constraints perceived by the respondents, respectively. Problems like disposal of slurry in rainy season (36.3%) and inadequate cow dung (28.8%) were also faced by respondents. However, constraints like choking of burners, frequent cleaning of digester tank and accumulation of water in gas pipeline were faced by lesser number of respondents and ranked 9<sup>th</sup>, 10<sup>th</sup> and 11<sup>th</sup>, respectively. Vinothini and Natchimuthu (2011) emphasized the role of women in care and management of livestock at the household level and necessitates training of women workers to overcome these operational constraints.

**Table 1: Operational constraints faced by the respondents**

Constraint	M.P.S.	Rank
Reduction of gas during winter season	85.0	I
Poor and irregular gas supply	73.8	II
Clogging of inlet and outlet pipeline	47.5	III
Non-availability of labour	43.8	IV
Non-availability of technician for minor repair	37.5	V
Disposal of slurry in rainy season	36.3	VI
Inadequate cow dung	28.8	VII
Leakage of gas pipeline	26.3	VIII
Choking of burners	21.3	IX
Frequent cleaning of digester tank	16.3	X
Accumulation of water in gas pipeline	13.8	XI
<b>Overall</b>	<b>39.1</b>	

**Socio-psychological constraints:** Amongst the socio-psychological constraints, social unacceptability for use of human faeces in biogas plants (83.8%) was the most serious socio-psychological constraint perceived by the respondents (Table 2). Although the government emphasizes on the use of human faeces in biogas plants and also extends additional subsidy to those who adopt this practice, but as evident from the study the socio-psychological beliefs prevalent in rural areas were posing hindrances in adoption of this practice. Another major socio-psychological constraints perceived by the respondents were found to be unhygienic condition in the surroundings of house (61.3%) followed by foul smell emanating from mixing cow dung in water (42%) and neighbours' criticism (34%). Problems like increase in cooking time and bad smell of gas were also faced by some of the respondents and ranked 5<sup>th</sup> and 6<sup>th</sup> in the order. The results of present study were in conformity with those reported by Kabir *et al.* (2013).

**Table 2: Socio-psychological constraints faced by the respondents**

Constraint	M.P.S.	Rank
Social unacceptability for use of human faeces	83.8	I
Unhygienic conditions in the surroundings of house	61.3	II
Foul smell while mixing cow dung in water	42.0	III
Neighbours' criticism	34.0	IV
Increase in cooking time	27.5	V
Bad smell of biogas	16.3	VI
<b>Overall</b>	<b>44.1</b>	

**Financial constraints:** Study revealed that high cost of construction of biogas plant (95%) was the most serious financial constraint perceived by the majority of the respondents (Table 3) and it was ranked first by them. Insufficient amount of government subsidy (92.5%) was the second major financial constraint as perceived by the respondents. With the increase in cost of construction material like bricks, cement, and labour in recent years, the expenses on installation of biogas plant has increased manifolds. Government should enhance the amount of subsidy for installation of biogas plants to ensure cleaner fuel in rural areas. It will also help to curtail the Government expenses on subsidized LPG cylinders. Respondents also felt difficulty in getting the subsidy (72.5%). Data further revealed that high cost of maintenance (53.8%) and labour (36.3%) were ranked 4<sup>th</sup> and 5<sup>th</sup> in various financial constraints faced by the respondents. Other financial constraints faced by respondent included difficulty in availing loan (30%) and high rate of interest (25%) and these were ranked 6<sup>th</sup> and 7<sup>th</sup> by the respondents.

**Table 3: Financial constraints faced by the respondents**

Constraint	M.P.S.	Rank
High cost of construction	95.0	I
Less amount of Govt subsidy	92.5	II
Difficulty in getting subsidy	72.5	III
High cost of maintenance	53.8	IV
High Labour expenditure	36.3	V
Difficulty in getting loan	30.0	VI
High rate of interest on loan	25.0	VII
<b>Overall</b>	<b>57.9</b>	

**Category-wise constraints as perceived by the respondents:** In order to find out the relationship between the ranks accorded by the respondents to different category of constraints, rank order correlation was calculated (Table 4). It is clear that the category of financial constraints was the top ranked as perceived by the respondents in adoption of biogas technology. It was followed by socio-psychological constraints (44.1%) and operational constraints (39.1%), which were ranked 2<sup>th</sup> and 3<sup>th</sup> by the respondents.

## CONCLUSION

There is large quantity of biomass available in India. The biogas offers a clean and efficient fuel alternative to the rural masses and can easily be used for cooking in rural

**Table 4: Category-wise ranking of constraints faced by the respondents**

Category	M.P.S.	Rank
Financial constraints	57.9	I
Socio-psychological constraints	44.1	II
Operational constraints	39.1	III

households. However the present study reported that there are several hindrances which users face during operation and maintenance of their biogas plants. On comparison of all these three types of constraints faced by the respondents, it can be inferred that financial constraints were the most serious constraints faced by the respondents followed by socio-psychological and operational constraints. Thus, Government should advance more financial incentives to compensate the installation cost of biogas plant. Farmers should be educated through trainings and other extension activities to remove socio-psychological and operational hindrances. Efforts should be made to overcome these constraints for facilitate adoption of biogas technology in rural areas of the country. The future prospects of biogas technologies depend considerably on removing these barriers.

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# Extent and Scope of Agriculture Diversification in Baghpat District of Uttar Pradesh

**Surendar Kumar, G. Pal and Sarita Joshi**

KVK, Baghpat, Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh

## ABSTRACT

The study was conducted in Baghpat district of Uttar Pradesh. Baghpat represents the agro-eco-socio situation of western Uttar Pradesh. 300 respondents were selected for the study. The major problem in diversification perceived and expressed by the farmers were supporting price, technical guidance, transportation of produce, non availability and adulteration in inputs and lack of developed marketing infrastructure. Animal husbandry & dairy, vegetable production, floriculture were the main choices of the farmers for diversification, however spices, medicinal plants and pulse were also focused by the sufficient number of farmers for diversification. Farmers suggested that relatively more trainings are required in field of medicinal plants, flowers, vegetables and spices with special reference to plant protection measures, marketing intelligence and post harvest management. Some of the farmers were also suggested requirement of regular training on veterinary aspects in animal and poultry.

**Keywords:** Diversification, Backyard poultry, Crop intensification and Market-led extension

## INTRODUCTION

Diversification in agriculture is generally seen as increasing the alternative farm production pattern so that it can provide stability in farm income, regularity in employment generation and minimizing the risk factor. Commercially, the decision of the farmers to grow a particular crop or go for particular farm enterprises depends on the price, yields, infrastructure and availability of marketing opportunity. Thus, cropping pattern prevailing at a point of time is a reflection of farmers' decision as directed by facilities, technology and market. The problem faced by the farmers towards diversification confined on assessment of the profitability, possibilities and practicality of diversified component. Farmers have different views about diversification on crop level as well as enterprises level like dairy, poultry and other. But they have a common view that diversification can play a vital role in increase the productivity per unit area with employment generation, it was also stated by Biswarup Sasha *et al.* (2012) and suggested that farmers household with diversified source of income have higher

agriculture productivity, input management and human capital like education, communication and awareness which influence for more participation in non farm activities. Diversification is not only important for increase in income and employment generation but it is highly relevant to sustainability of our agriculture production system and environment, it was also noticed by Gill *et al.* (2009) and suggested that Integrated Farming System aims is to increased productivity, profitability along with sustainability, balanced food, generating family income and employment generation round the year, recycling of farm wastes ,clean environment, solving of energy, fuel and fodder crises, increasing in input use efficiency and enhanced oppourinity for agriculture

## MATERIAL AND METHOD

The study was conducted in Baghpat district of Uttar Pradesh, all 6 blocks were selected to get the wider representation. From each block 50 farmers were selected and totaling 300 farmers. The total cultivated land of respondents for the study was 780 hectare.

Opinions of the farmers were calculated on the base of choice of farmers expressed by them. A well structured schedule was designed to collect the information and opinion of farmers. The trend of diversification was operationalised according to deviation from the base year 1992-93 for measuring the trend and direction of diversification, the data between 1992-93 to 2002-03 and 2002-03 to 2012-13 were compared and draw the conclusion. The choice of diversification of farmers was operationalised as an expression about selected diversified component by them like dairy, vegetable, floriculture etc. It was measured in terms of change in area and percentage. Internal diversification towards existing cropping pattern was also quantified. Crop wise area was calculated to measure the trend and extent of diversification with in cropping pattern, same methodology was used by Yadav *et al.* (2000) to quantify the trend and extent of diversification through changing area in different cropping system.

## RESULT AND DISCUSSION

The cropping pattern of Baghpat district by and large is sugarcane based followed by wheat and foeder, all the three crops occupies three fourth of total cultivable area. The area under sugarcane increased 76000 to 78500 ha and in wheat 22000 to 22230. However in case of foeder area was slightly decreased 16500 to 16230 between 1992-93 to 2012-13 (Sankhayakhi Patrika of Baghpat district) other crops like jawar, bajara, pulses and millets to have lost their relevance in the cropping pattern. The study reveled that farmers are not interested to shift towards orchard even in some of the case they are cutting of their established orchard for cultivation purpose due to management problem and low return from orchard resulting area under orchard decreased upto 7.55% and 24.86% during 1992-93 to 2002-03 and 2002-03 to 2012-13 respectively. However they are shifting towards vegetable followed by floriculture. Spices and medicinal plant are the new emerging areas where farmers are focusing due to suitability of these crops in existing cropping system and ruminative price. The data presented in Table 1 and Table 2 reveals that the farmers tried to diversify towards vegetable and flower during the last two decade. The area under these crops increased up to significant extent. Area under spices and medicinal

plants is increasing slowly, however there is slightly increase in agro forestry while area under orchard especially mango orchard decreased drastically. Table 3 and Table 4 reveals that area under sugarcane and wheat are almost constant during last two decades but significance increase were noticed in area of rice because of popularization of basmati varieties with charming market price. Area under jawar, bajra and other millets decreased drastically while area under potato and other

**Table 1: Area and percentage under different direction of diversification between 1992-93 to 2002-03**

Crop/ diversification	Total cultivated area (ha) 1992-93	Total cultivated area (ha) 2002-03	% increase
Vegetable	3.36	9.04	188.09
Fruits	15.84	14.64	-7.57
Flower	0.16	1.04	550.00
Medicinal plants	0.04	0.12	200.00
Spices	0.04	0.2	400.00

**Table 2: Area and percentage increased under different direction of diversification between 2002-03 to 2012-13**

Crop/ diversification	Total cultivated area (ha) 2002-03	Total cultivated area (ha) 2012-13	% increase
Vegetable	9.04	26.40	192.03
Fruits	14.64	11.00	-24.86
Flower	1.04	1.95	87.50
Medicinal plants	0.12	0.14	16.66
Spices	0.20	0.52	160.00

**Table 3: Area and percentage increased under different crop through diversification/intensification between 1992-93 to 2002-03**

Crop/ diversification	Total cultivated area (ha) 1992-93	Total cultivated area (ha) 2002-03	% increase
Sugarcane	52.20	51.50	-1.3
Wheat	21.00	21.75	3.5
Rice	08.20	09.50	15.85
Fooder	19.80	17.25	-13.28
Potato	3.25	4.20	29.23
Mustard	4.50	4.35	-3.33
Pulses	6.32	6.85	8.38
Any other crop	11.20	14.55	29.91

**Table 4: Area and percentage increased under different crop through diversification/intensification between 2002-03 to 2012-13**

Crop/ diversification	Total cultivated area (ha) 2002-03	Total cultivated area (ha) 2012-13	% increase
Sugarcane	51.50	54.20	5.24
Wheat	21.75	19.42	-10.71
Rice	09.50	17.50	84.21
Fooder	17.25	14.35	-16.81
Potato	4.20	4.50	7.14
Mustard	4.35	5.50	26.43
Pulses	6.85	6.25	-8.75
Any other crop	14.55	21.55	48.11

vegetable crops increased up to significant level. In case of oilseed and pulses it is almost constant. Some of the farmers successfully adopted more than one component at a time many of them put their view as requirement of multiple choice for diversification, so that they can choose better option as per their resources, interest and availability of market. Importance of multi-option diversification was also suggested by Singh *et al.* (2010) and highlighted that Integrated Farming system model is a basket of option and farmers can choose appropriate combination of enterprises as per their resources and family need. He was also highlighted that marginal and small farmers can integrate less land required enterprises as mushroom, backyard poultry and other like bee keeping in their farming system

**Farmers' choice for diversification:** The study revealed that farmers are mostly interested in dairy diversification followed by vegetable, floriculture and poultry. Cultivation of spices and medicinal plants is the other choice for diversification. Among pulses, farmers

growing green gram and black gram as a catch crop between the main crop of kharif and Rabi season. Farmers are very much interested to grow medicinal plant and spices but in lack of knowledge, procurement facility and assured market they are not doing so. During last two decades some farmers show the interest in agro-forestry as popular plantation with their existing cropping system. Choice of farmers is very for diversification as per their resources and availability of market. Most of them have preference for dairy and animal husbandry being a traditional occupation. Vegetable cultivation and floriculture are another preferred area for diversification. Landless farmers show keen interest in occupation like backyard poultry. Importance of backyard poultry for land less farmers was also reported by Aahirer *et al.* (2015) and suggested that diversification in agriculture with component like backyard poultry can help in enhance the family income, employment generation with insured the enrich diet for family member & promote the gender equity (Table 5).

**Status of livestock:** Diversification and mechanization in agriculture directly and indirectly effecting in number of livestock. In last four decades the population of buffaloes almost same as before. But the population of cattle declined from 1913 to 312 the population of poultry and pig is just increased. The reason behind decreasing the number of cattle is mechanization in agriculture; due to mechanization farmers are frequently replacing the bullock power by tractor. Numbers of buffalos are all most constant because of their utility in draw the bullock cart and high yielding milk capacity as compare of cattle (Table 6).

**Diversification with in crop production:** Diversification with in crop production is a continuous process runs with crop cultivation. Farmers are using

**Table 5: Trend of crop diversification through various agronomic mechanism between 1992-93 to 2002-03 and 2002-03 to 2012-13**

Crop/diversification	Total diversified area (ha) 1992-93 to 2002-03	% share in diversification	Total diversified area (ha) 2002-03 to 2012	% share in diversification
Complete diversification	72.50	9.93	86.00	11.02
Through intensification	5.00	0.64	22.00	2.82
Through intercropping	4.80	0.61	9.75	1.25
Through agro forestry	1.25	0.16	1.80	0.23
Through multicropping	2.80	0.35	4.80	0.61
Total diversified area	86.35	11.59	124.35	14.93

Total area-780 hectare



**Table 6: Position of livestock**

Livestock	Year				
	1972	1982	1992	2002	2012
Cattle	1913	1705	1228	504	312
Buffalo	1404	1509	1603	1511	1573
Piggery	38	42	37	28	13
Goat	106	96	88	90	73
Sheep	36	48	43	41	33
Poultry	54	64	72	108	218

much way to do so as Complete Diversification, Intensification, Intercropping and Multicropping pattern. Among those agronomic techniques Complete Diversification covered maximum Diversified area that is 9.93% during 1992-93 to 2002-03 and 11.02 during 2002-03 to 2012-13. But now Intensification and Intercropping of high ruminative crops with main crop are being popularize. Because of this practice farmers are getting additional return with the same cost of cultivation. Same thing was noticed by Kumar *et al.* (2015) and concluded that intercropping of onion with autom planting sugarcane provided more than one lack additional monetary gain without any extra cost of cultivation (Table 7).

**Training needs assessment:** It is revealed in Table 8 that farmers indicated relatively more need of training in vegetable crops, floriculture, medicinal plants, spices and post harvest technology. They required relatively more emphasis on the aspect of plant protection, input management and marketing inelegancy especially in case

**Table 7: Choice of farmers for diversification (N=300)**

Kind of diversification	Frequency	Percentage	Ranking
Vegetable	162	21.95	II
Fruit	18	2.43	VII
Mushroom	12	1.62	X
Flower	86	11.65	III
Spice	56	7.58	V
Medicinal plants	42	5.69	VI
Pulses	76	10.29	IV
Dairy	202	27.37	I
Fisheries	16	2.16	VIII
Beekeeping	12	1.62	X
Piggery	14	1.89	IX
Poultry	42	5.69	VI
Sericulture	-	-	-
<b>Total</b>	<b>738</b>	<b>100</b>	

**Table 8: Training needs of farmers in different diversified area (N=300)**

Kind of diversification	Freq- uency	Perce- ntage	Ran- king
Vegetable and Fruit	126	17.16	I
Dairy and animal husbandry	74	10.08	V
Crop based technology	85	11.58	III
Flower and ornamental plants	78	10.62	IV
Spice and medicinal plants	54	7.35	VII
Poultry and Fisheries	26	3.54	XI
Marketing Intelligence	52	7.08	VIII
Procurement and post harvest management of produced	103	14.03	II
Integrations of various component in a single farming system	39	5.31	IX
Vaxination in animals and birds	34	4.63	X
Mechanization part of agriculture	63	8.58	VI
<b>Total</b>	<b>734</b>	<b>100</b>	

of flower, vegetable, spices and medicinal plants. Farmers who are associated with animal husbandry and poultry are highly interested for training on veterinary aspect and vaccination. Kumar *et al.* (2013) draw the conclusion that every component of farming system has necessity of specific training so that diversified component can take place as an economically viable and sustainable enterprise. Quality training not only required for farmers but also has to be arranged for extension personal so that they can equip them self with new advancement for further transfer of gained knowledge. The importance of training for extension workers was highlighted by Sodengi *et al.* (1991) and suggested it must be future thrust for extension system.

**Constraint in diversification:** Majority of the farmers is convinced by advantage of diversification but they are not in action mode because of constraints facing by them. Lack of financial and marketing support is the major hurdle in diversification (Table 9). However lack of sufficient knowledge about desirable diversified area and extension support were also identified by most of the farmers as another serious problem. It was also noticed by Udai *et al.* (2012) and Kumar *et al.* (2010).

**Farmers' perception:** Majority of the farmers are convinced about necessity of the diversification in present challenging scenario. Most of them feel that diversification is only way to increase the productivity per unit area with oppurnity of employment generation.

**Table 9: Constraint facing by farmers in diversification (N=300)**

Kind of Constraint	Frequency	Percentage	Ranking
Financial	216	20.70	I
Technical	162	15.53	III
Extension	105	10.06	IV
Transportation	42	4.02	IX
Marketing	192	18.40	II
Storage	76	7.28	VI
Grading and packaging	35	3.35	X
Input Management	28	2.68	XI
Wild Animal	49	4.69	VIII
Initiation	84	8.05	V
Theft and any other kind of damage	54	5.17	VII
<b>Total</b>	<b>1043</b>	<b>100</b>	

Most of the farmers think that being a part of NCR they have good opportunity for diversification same time they feel that they are not utilizing that opportunity.

**Suggestion for diversification:** Following suggestion can be made for promote the diversification as given below-

1. Establishing marketing hub in rural area.
2. To open the chain of cold storage and go down in near by production zone.
3. Strengthen of specific and commodity based extension service.
4. Frequent need based skill oriented training.
5. Ensured availability of credit.
6. Networking of transport and communication facilities.
7. Risk covers policy like crop and animal insurance.
8. Promote the post harvest technology.
9. Promote the market-led extension instead production based extension.

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# Yield Gap Analysis of Potato Through Front Line Demonstration

**Om Singh\*, R.P. Singh, Richa Singh and Dinesh Singh**

Department of Post Harvest Management, College of Horticulture, R.V.S. Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh

## ABSTRACT

Potato is a very popular and important cash crop in district Ghazipur but due to improper adoption of improved technology its productivity is far below the average productivity of the state. Through survey, farmers meeting, group discussions with the farmers and field diagnostic visit the yield gap was brought out due to unavailability of HYVs quality potato tubers and imbalanced use of N:P:K fertilizers, particularly lower dose of potassium (40-50 kg/ha) and nitrogen (100-120 kg/ha) and higher dose (100-120 kg/ha) of phosphorus, was considered. Existing farmers practice was taken as a control for comparison and recommended packages includes use of new released HYVs of potato Kufri Chipsona-02 & 03 along with balance application of N:P:K fertilizer. The yield performance of both control and demonstration plot were recorded, and their yield gap, technology gap, extension gap and technology index were analyzed. Considering the scope of improvement in productivity through the recommended technologies, 32 front line demonstrations were conducted by Krishi Vigyan Kendra, Ghazipur, Uttar Pradesh during 2008-13 in three different villages at farmer's field. The average five years data revealed that an average yield of demonstration plot was 339 q/ha over local check 268.7 q/ha and 26.3 percent increase over control. The results showed that an average technology gap was recorded 10.9 q/ha. Average extension gap was recorded 70.36 q/ha and average technology index was recorded 3.0%. The yield gap analysis emphasizes the need to educate the farmers through various extension means for adoption of improved agricultural technologies to revert the trend of wide extension gap.

**Keyword:** Potato, Front line demonstration, Extension gap, Technological gap, Technological index

## INTRODUCTION

Vegetable cultivation has become highly commercialized. But still there is a wide gap between current production and potential productivity. India is the second largest annual producer of potato after China in the world. Potato is a very popular and important cash crop in India and it produced 45.34 million tones from 1.99 million hectares with average productivity of 22.80 tones/ha during 2012-13 (NHB, 2013). Uttar Pradesh is the largest potato producing state in the country and accounts for 32% of total production. The state produces 14.43 million tones of potato from an area of 0.60 million hectares with productivity of 23.9 tones/ha during 2012-2013 (NHB 2013). This rapid growth under production (10.63 million tones in 2008-09 to 14.43 million tones in 2012-2013) of potato in Uttar Pradesh was possible through

dissemination of the latest technology under real farming conditions. The country's urgent requirement is to enhance the production of nutritious food in a sustainable manner and improve the farm family income in order to ensure household food security, nutritional security and economic security. Current share of potato to agricultural GDP is 2.86% from 1.32% cultivable area. On the contrary, the two principal food crops, rice and wheat, contribute 18.25% and 8.22% of agricultural GDP, respectively from 31.19 and 20.56% cultivable area, respectively (FAOSTAT). It indicated that contribution of potato in agricultural GDP from unit area of cultivable land is about 3.7 times higher than rice and 5.4 times higher than wheat. Potato cultivation has become highly commercialized in Uttar Pradesh, but still there is a wide gap between current production and potential productivity.

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\*Corresponding author email id: omsingh1921@gmail.com

Potato is a predominant Rabi crop of Ghazipur district of Uttar Pradesh. But the fact that the average productivity of potato in Ghazipur district (207.2 q/ha) is substantially lower in comparison to other district i.e. Mathura (301.81 q/ha), Manipur (271.37 q/ha), Agra (263.77 q/ha), Farrukhabad (262.97 q/ha) and Etawah (235.49 q/ha) in 2010-11 (Source: State Horticulture Mission, Government of Uttar Pradesh). There is ample scope for further improvement of production and productivity of potato for raising the income level of the farming community of the district.

The yield gap analysis is a potent research technique that has been introduced in the 1970s. Developed by the International Rice Research Institute (IRRI), it is extensively used to measure and analyze determinants of the yield gaps. It is also observed that, even though the production level has increased to a great extent in the recent past; still there exists a wide gap between the actual yield obtained by the growers and the production level actually possible with the existing modern technology. In the present investigation, Yield loss is due to unavailability of HYVs quality potato tubers and imbalanced use of N:P:K fertilizers have been assessed under real farming condition. To combat the causes of yield erosion and lower economic returns, dissemination of recommended technology through front line demonstration was successfully attempted.

## MATERIALS AND METHODS

Thirty two Front line demonstrations on Potato were conducted at farmers' field in district Ghazipur (Uttar Pradesh) to assess its performance during Rabi seasons of the year 2008-09, 2009-10, 2010-11, 2011-12 and 2012-13. FLD on potato was purposively conducted in Karanda and Sadar blocks of Ghazipur district in Uttar Pradesh. Two villages were selected randomly from each block. The soil of the district is generally sandy loam in texture. The area under each demonstration was 0.2 ha. Regular visits by KVK scientists to FLD plots were made so as to ensure timely application of critical inputs and to solve other crop related problems. The extension activities like field days and *Kisan goshtis* were also organized at the demonstration sites as to provide opportunities for other farmers of the area.

Through survey, farmers meeting, group discussions with the farmers and field diagnostic visit

during the cropping period, low yield of potato was conceived due to unavailability of HYVs quality potato tubers and imbalanced use of N:P:K fertilizers, particularly lower dose of potassium (40-50 kg/ha) and nitrogen (100-120 kg/ha) and higher dose (100-120 kg/ha) of phosphorus. To manage assessed problem, improved and recommended technologies were followed as intervention during the course of front line demonstrations programme. In case of recommended practice, use of new released HYVs of potato Kufri Chipsona-02 & 03 along with balanced use of fertilizer i.e. N:P:K:: 180:80:110 kg/ha. To ensure the benefits of recommended technologies, feedbacks from the farmers were collected so that further research and extension activities were improved.

Yield gap refers to the difference between the potential yield and actual farm yield. Potential yield refers to that which is obtained in the experiment station. The yield is considered to be the absolute maximum production of the crop possible in the given environment, which is attained by the best available methods and with the maximum inputs in trials on the experiment station in a given season. Demonstration yield is the yield obtained on the demonstration plots on the farmers' fields in the study area. The conditions on demonstration plots closely approximate the conditions on the cultivators' fields with respect to infrastructural facilities and environmental conditions. Actual yield refers to the yield realized by the farmers on their farms under their management practices. The data output were collected both in FLDs as well as control plots and finally the extension gap, technology gap, technology index (%) were worked out (Samui *et al.*, 2000) as given below:

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - Farmers yield

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

## RESULTS AND DISCUSSION

**Performance of FLD Potato:** The performance of high yielding varieties of potato for the year 2008-13 in during *rabi* season was analyzed (Table 1). Data revealed that under demonstration plots, potato yield was found substantially higher than that under farmer's

**Table 1: Productivity, technology gap, extension gap and technology index (%) in potato crop**

Year	Area under demo. (in ha)	Variety	No. of demo.	Average yield (q/ha)		% increase over check	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
				Demo	FP				
2008-09	1.0	Kufri Chipsona-02	10	335	265	26.41	15	70	4.2
2009-10	1.0	Kufri Chipsona-02	10	345	285	21.05	5	60	1.4
2010-11	0.5	Kufri Chipsona-03	02	324	260	24.61	26	64	7.2
2011-12	1.0	Kufri Chipsona-03	05	345	272	26.80	5	73	1.4
2012-13	1.0	Kufri Chipsona-03	05	346.5	261.7	32.40	3.5	84.8	1.0
<b>Mean</b>	-	-	<b>32</b>	<b>339</b>	<b>268.7</b>	<b>26.3</b>	<b>10.9</b>	<b>70.36</b>	<b>3.04</b>

*Demo: Demonstration plot with recommended practice; FP: Farmers practice*

practice during all the year. Under different locations, the potato yield in demonstration plots ranged between 324 to 346.5 q/ha, which was 21 to 32.4 percent higher over farmers practice (local check). On an overall basis, 26.3 percent increase in yield was recorded. These results are in conformity with the findings of Tomar *et al.* (2003), Jethi (2008) and Mishra *et al.* (2009) in Front Line Demonstrations on potato and Dayanand *et al.* (2012) in other crop.

**Analysis of Yield gap:** The technology gap, the difference between potential yield and yield of demonstration plots, were 15, 5, 26, 5 and 3.5 q/ha during 2008-09, 2009-10, 2010-11, 2011-12 and 2012-13, respectively. On an average technology gap under 5 years FLD programme was 10.9 q/ha. The technology gap observed may be attributed to dissimilarity in the soil fertility status, agriculture practices and local climatic situation. Extension gap of 70, 60, 64, 73 and 84.8 q/ha was observed during 2008-09, 2009-10, 2010-11, 2011-12 and 2012-13, respectively. Average extension gap was observed 70.36q/ha, which emphasized the need to educate the farmers through various extension means like FLD, for adoption of improved agricultural technologies, to revert the trend of wide extension gap. The technology index showed the feasibility of the evolved technology at the farmers' fields. The lower the value of technology index, the more is feasibility of technology. Fluctuation in technology index (ranging between 1.0-7.2%) during the study period may be attributed to the dissimilarity in soil fertility status, weather conditions, insect-pests and diseases reported by Mishra *et al.* (2007), Saini *et al.* (2013) and Singh *et al.* (2013). On an average technology index was observed 3.04 percent during the 5 years of FLD, which

shows the efficacy good performance of technical interventions. There are adoption gaps in the demonstrated plots vs. farmers' practice and with the very clear results in front of the farmers between these plots, they automatically leads toward adoption of the technology.

## CONCLUSION

Front line demonstration program was effective in changing attitude, skill and knowledge of improved recommended practices of potato cultivation including adoption. This also improved the relationship between farmers and scientists and built confidence between them. The study of yield gap analysis of potato through Front Line Demonstration revealed that the losses made in terms of yield q/ha could be increased by 21 to 32.40 percent. The technology gap which shows the gap in the demonstration yield over potential yield were ranged between 3.5 to 26 q/ha and can be attributed to dissimilarity of the soil fertility and local climatic situation. Extension gap ranged between 60 and 84.8 q/ha, which emphasized the need to educate the farmers through various means like training, FLDs etc. Technology index show the feasibility of the technology demonstrated which show the good performance of intervention point made to reduce the yield gap in potato.

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## Performance of Front Line Demonstration of Musard (*Brassica juncea*) in Rural Delhi

Y.P. Singh<sup>1\*</sup>, Jitender Kumar<sup>2</sup> and D.K. Rana<sup>3</sup>

<sup>1</sup>Subject Matter Specialist (Extension), KVK Ujwa, Delhi; <sup>2</sup>Asstt. Scientist (Agronomy) CCSHAU, RRS, Karnal

<sup>3</sup>Subject Matter Specialist (Plant Protection), KVK Ujwa, Delhi

### ABSTRACT

Krishi Vigyan Kendra, Delhi had conducted Front Line Demonstration (FLD) at farmers' field in the villages of South-West district of Delhi during 2009-10, 2010-11 and 2011-12. Fifty farmers were selected randomly from the villages in each year. The study was conducted to observe the performance of the Mustard variety Pusa Vijay (NPJ-93) against the existing local variety 'Jadia'. During 1<sup>st</sup> year (2009-10) the variety performed very well with an average yields of 22.58 which was 29.02 % higher than the local check variety (17.5 q/ha). On the basis of 1<sup>st</sup> year result the demonstration was continued during 2010-11 and 2011-12. The three year average data reveals that grain yield of Pusa Vijay variety increased by 5.08 q/ha (2009-10), 3.00 q/ha (2010-11) and 2.75 q/ha (2011-12) over the yield obtained under farmers' practice. The results revealed that increase in yield ranged between 15.94 % (2011-12) and 29.02 % (2009-10) and farmers got between Rs. 6775 and Rs. 9187 additional return from demonstration fields over farmers' practice. This increase was with an extra expenditure of approximately Rs. 1100 per ha which is very less and even small and marginal farmers could also afford. An extension gap ranging from 275-508 kg per hectare was found between FLD demonstration and farmers practices during the different time line

**Keywords:** Front line demonstration, Gap analysis, Mustard

### INTRODUCTION

In India many species of rapeseed mustard are grown for edible oil purpose like Toria, Yellow & Brawn Sarson, Raya (Indian Mustard) and Taramira. Indian mustard (*Brassica juncea*) is one of the major edible oilseed crops after soyabean and accounts for about 75-80 % of the 6.8 m ha rapeseed mustard crops. Indian mustard is mainly grown in Rajashtan, Uttar Pradesh, Punjab, Haryana and rural area of NCT Delhi. Rajasthan ranks 1<sup>st</sup> in area, production and productivity of mustard, followed by U.P. and Haryana. The productivity is quite low due to sub-optimal application of fertilizers, lack of high yielding varieties and cultivation on marginal lands under rainfed conditions. In 1986 the government of India started Oilseed Technology Mission for Research and Development of oilseed crops and the area increased from 3.98 Mha to 6.79 Mha and the productivity increased from 650 kg/ha to 1094 kg/ha in the year 2006-07.

The increase in area and productivity is mainly due to development of high yielding varieties and adoption of improved agronomic practices. In spite of this the average production of India is 1.17 t/ha. Which is very lesser than the world average (1.85 t/ha). Mustard is grown mainly in conserved soil moisture or the area of having less irrigation facilities as a result of which the crop has to face the drought during the different stages of growth. In other side during January there is a prolonged cool temperature and high relative humidity also effect the growth and development of crop. To demonstrate the need specific technologies such as better varieties and cultural practices of mustard Front Line Demonstrations (FLD's) should be laid out at farmer's field. During the year 2008 ICAR-IARI, New Delhi released a new High Yielding Variety (HYV) Pusa Vijay (NPJ-93) having the average yield of 24.5q/ha with yield potential of 32.22 q/ha and recommended for NCR in irrigated conditions. The variety was

\*Corresponding author email id: dyps\_17@yahoo.com

selected for demonstration at farmers' field under the ICAR programme of Integrated Scheme of Oilseed and Pulses with the aim to study the effect of improved varieties on production and productivity per unit area in NCT, Delhi. The basic objective of FLDs is to demonstrate the proven technology at farmer's field through KVKs.

Keeping the importance of FLDs, the KVK Delhi had planned FLD's on Mustard variety "Pusa Vijay" on farmers' field under irrigated situations during *rabi* season of 2009-10, 2010-11, and 2011-12 with following specific objectives.

- To demonstrate the performance of recommended Mustard variety compared with farmers practiced variety; and
- To analyze the economics of FLDs of Mustard variety.

## MATERIALS AND METHODS

Krishi Vigyan Kendra, Ujwa, Delhi had conducted FLDs at the farmers' field in the villages of South-West district of Delhi during 2009-10, 2010-11 and 2011-12 (Table 1). Fifty farmers were selected randomly from the villages in each year and the area under each demonstration was 0.40 ha. The farming situation of demonstration fields was irrigated, low in nitrogen, medium in phosphorus and potash and the soil was sandy loam. The crop rotation was pearl millet-mustard or fellow-mustard. The study was conducted to observe the performance of variety Pusa Vijay (NPJ-93) against the existing local variety 'Jadia'. The crop was grown with recommended package and practices. The critical input i.e. Sulphur was applied to demonstration field through two sprays at 25 and 50 days after sowing @ 500 g/acre in 200 liter of water. The demonstrations on farmers' fields were regularly monitored from sowing till harvesting by scientists of Krishi Vigyan Kendra, Ujwa, Delhi. To spread the technology in large area, the outcomes of demonstration were depicted to nearby farmers through field days, Kisan goshies and trainings.

The results in terms of productivity and profitability per unit area realized by the farmers in FLD and farmers' practice fields were observed and economics was analyzed.

Different parameters as suggested by Yadav *et al.* (2004) and Dayanand *et al.* (2012) were also used for calculating gap analysis. The analytical tools used for assessing the performance of the FLD are as follows:

- Extension gap = Demonstration yield – Farmers' practice yield
- Technology gap = Potential yield – Demonstration yield
- Technology index = (Potential yield – Demonstration yield) x 100/Potential yield

## RESULTS AND DISCUSSION

The improved variety was used for demonstrations as it has some special characters as given below:

- It is tolerant to abiotic stresses *viz.* high temperature at seedling stage and salinity up to 12dS/m.
- It has erect, medium tall plant with profuse secondary branches (12-15 per plant) and waxy stem.
- Low incidence of white rust, sclerotinia stem rot, downy mildew and powdery mildew.
- Main shoot is long (80 cm) bearing approximate 48 siliqua on it.
- Tolerant to lodging and shattering
- High oil content upto 41%
- High average yield i.e. 24.5 q/ha.

**Grain yield:** The results of all FLD plots over different periods are given in Table 2. The variety Pusa Vijay performs better and provided good yield in comparison with to local check in different years. The grain yield of mustard increased by 5.08 q/ha (2009-10), 3.00 q/ha (2010-11) and 2.75 q/ha (2011-12) over the yield obtained under farmers' practice (Table 2). These results

**Table 1: Year -wise crop detail demonstrated fields**

Year	Sowing date	Harvesting date	Seasonal Rainfall	No. of rainy days
2009-10	08.10.2009- 12.10.2009	2.03.2010 -16.03.2010	14.2 mm	1
2010-11	07.10.2010- 12.10.2010	5.03.2011 -12.03.2011	50.0 mm	7
2011-12	28.09.2011- 20.10.2011	4.03.2012 -25.03.2012	14.0 mm	1



**Table 2: Yield analysis of front line demonstrations of mustard on farmers' field**

Year	No. of demonstrations	Technology demonstrated	Demonstration yield (q/ha)	Farmers practice yield (q/ha)	Percent increase
2009-10	50	High Yielding Variety (HYV) 'Pusa Vijay'	22.58	17.50	29.02
2010-11	50	HYV 'Pusa Vijay'	20.25	17.25	17.39
2011-12	50	HYV 'Pusa Vijay'	20.00	17.25	15.94

clearly indicates that due to knowledge and adoption of appropriate technology i.e. Pusa Vijay, use of balanced dose of fertilizer, etc., the yield of mustard could be increased between 15.94 and 29.02 per cent over the yield obtained under farmers' practice. The present results are in close conformity with the findings of Singh *et al.* (2013).

**Economic analysis:** Economic returns were observed to be a function of grain yield and Minimum Support Price (MSP) or sale price which varied with the year. Different variables like seed, fertilizers, herbicides and pesticides were considered as cash inputs for the FLD demonstrations, as well as, for farmers practice. The additional return of demonstrated plots under HYV Pusa Vijay ranged between Rs. 6775 and 9175 per ha during different years in comparison with farmers practices. This increase was with an extra expenditure of approximately Rs.1100 per ha which is very less and even small and marginal farmers could also afford. The highest average net return (Rs. 38550) was observed during the year 2011-12 than the other years. This might be due to difference in sale price of produce. The benefit-cost ratio was observed higher under HYV variety than the farmers' practice during all the years

(Table 3). The results are in conformity with the findings of Lathwal (2010), Dayanand *et al.* (2012) and Verma *et al.* (2014) and Venkattakumar *et al.* (2012).

The kisan goshthies, trainings, field days and regular monitoring of the fields by the KVK scientists were used to change the attitude, skill and knowledge of farmers towards improved/recommended practices of wheat cultivation.

**Gap analysis:** An extension gap ranging from 275-508 kg per hectare was found between FLD demonstration and farmers practices during the different time line. The extension gap was higher under HYV Pusa Vijay in the year 2009-10 than rest two years 2010-11 and 2011-12 (Table 4). Such gap might be attributed to adoption of improved technology in demonstrations which resulted in higher grain yield than that in the farmers' practices. Wide technology gap were observed during these years and this was lowest (9.64) during 2009-10 and was highest (37.92) during 2012-13 (Table 4). The difference in gap during different years could be due to differential climatic conditions during different years. Similarly, the technology index for all the demonstrations during different years were in accordance with technology gap.

**Table 3: Economic analysis of front line demonstrations of mustard on farmers' field**

Year	Cost of cash input (Rs./ha)		Total returns (Rs./ha)		Net return over variable cost		Additional return over farmers' practice	BC Ratio (Gross Return/Cross cost)	
	Demonstration	Farmers' practice	Demonstration	Farmers' practice	Demonstration	Farmers' practice		Demonstration	Farmers' practice
2009-10	12303	11250	41312	32025	29008	20775	9187	3.35	2.85
2010-11	10800	9700	40500	34500	29699	24800	5900	3.74	3.55
2011-12	11450	10700	50000	43125	38550	32425	6775	4.36	3.77

**Table 4: Gap analysis of front line demonstrations of mustard on farmers' field**

Year	Technology demonstrated	Potential yield (q/ha)	Demonstration yield (q/ha)	Farmers' practice yield (q/ha)	Extension gap	Technology gap	Technology index
2009-10	HYV 'Pusa Vijay'	32.22	22.58	17.50	5.08	9.64	29.92
2010-11	HYV 'Pusa Vijay'	32.22	20.25	17.25	3.00	11.97	37.15
2011-12	HYV 'Pusa Vijay'	32.22	20.00	17.25	2.75	12.22	37.92

Higher technology index reflected the inadequacy of technology and or insufficient extension services for transfer of technology. The results are in conformity with the findings of Singh and Kumar (2012).

### CONCLUSION

The increase in yield of mustard is sufficiently high to motivate the farmers to adopt the technology. FLD program coupled with kisan goshies/trainings/field days and regular monitoring the fields by scientists could be used to change the attitude, skill and knowledge of farmers towards improved/recommended practices of mustard cultivation. The FLD at farmers' field acted as primary source of information about the improved practices of mustard cultivation. The concept of FLD may be applied to all farmer categories including progressive farmers for speedy and wider dissemination of the recommended practices to other members of the farming community and helps in improving the productivity and profitability of the farmers. This will help in the removal of the cross-sectional barriers among farming community. Hence, the farmers were motivated to adopt new high yielding variety *viz.* Pusa Vijay through transfer of technology center like Krishi Vigyan Kendra and line department of state government.

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## What Hinders the Elected Women Village Panchayat Members in their Role Performance?

Anuradha Ranjan Kumari<sup>1</sup>, S.K. Dubey<sup>2</sup> and U.S. Gautam

<sup>1</sup>Krishi Vigyan Kendra (ICAR-IIVR) Malhana Deoria, Uttar Pradesh

<sup>2</sup>ICAR-ATARI, Kanpur, Uttar Pradesh

### ABSTRACT

Women have been an integral part of social structure not only because their importance in the perpetuation of human race but also by virtue of their significant contribution in socio-economic progress. Despite this time and again they have been subjected to discrimination due to gender bias and have been denied equality of status and opportunities in social economic and political spheres of life. The present study was an effort to know the profile of elected women Village Panchayat members and Constraints faced by elected women Panchayat members in role performance. Total Seventy Five women representatives randomly selected from Pusa and Kalyanpur block of Samastipur district in Bihar. The study reveals that majority of the women members of the gram Panchayat were within 35 years of age (73.33%), 46.66 percent of respondents were from forward caste, a large majority (98.66 % and 97.33%) of EWVPMs were married and were housewives only, respectively, personally possessed low (up to 8<sup>th</sup> standard) level of Education (40.0%) and also had high family Education (29.33%). They by and large enjoyed a nuclear family (64.00%) but the majority had 3-5 members (42.66%) these respondents owned land up to 2.5 acre (58.66%) and lived with low material possession (84.0%). The family income of more than half of the members (64.0%) of respondents had low income group below 20,000 annually, having as many as (42.66%) of the members had mixed house (76.0%) of respondents had not membership of any social institution. Out of 11 constraints of role performance by EWVPMs, 8 viewed as most serious were lack of resources for development work (90.66%), lack of fund on time for carrying out the work of the projects (88.00%), lack of knowledge to the members (82.66%), non-availability of persons well versed with the rural projects (80.0%), lack of interest in Mukhiya for developmental works (80.0%), carelessness among villagers for development works (74.66%) lack of education among panchayat members (69.33%) and bribery and misappropriation of funds (54.66%). The maximum number of EWVPMs considered economical constraints to be acting as the greatest hindrance in the way of their role performance (93.33%).

**Keywords:** Constraints, Elected women village panchayat members, Panchayati raj institutions

### INTRODUCTION

Women represent almost half of the human resources of half the potential in all the societies, India being no exception, naturally, therefore the employment and autonomy of women and improvement of women's social achievement of sustainable development on all areas of life. Empowerment is a process, not an event, which challenges traditional power equations and relations. Abolition of gender-based discrimination in all institutions and structures of the society and

participation of women in policy and decision making process at domestic and public levels are few dimensions of women empowerment.

But contrary to this wisdom, India women continues to languish in our patriarchal society and colossal percentage of them are forced to enjoy low social status the scenario being the worst in Bihar state. The female literacy rate of India stood at 54.16 percent in 2001. This is 33.5 percent only in case of Bihar. The work participation rate of women has steadily risen

from 14.22 percent in 1971 to 19.6 percent in 1981 and was steeper further from 37.81 lakhs in 1991 to only 47.74 lakhs in 1998. Further, only a meager 14.1 percent of women are employed in organized sector, but the majority find jobs in the informal unorganized private sector, mainly in the low paid household activities.

The 73<sup>rd</sup> constitutional amendment mandated a minimum of one third reservation for women in the membership as well as in the position of chairpersons of Panchayat at all three levels, namely the village, district and intermediate levels. All the states without exception have adopted this reservation policy since then. The present study was undertaken with the specific objectives to delineate the profile of elected women Village Panchayat members of Panchayati Raj System as well as to identify the constraints faced by the women Village Panchayat members in their role performance.

## MATERIALS AND METHODS

The study was undertaken in purposively selected Samastipur district of Bihar state for case in data collection. Out of twenty blocks of Samastipur district two blocks namely Pusa and Kalyanpur were selected to represent the whole district. Forty villages in the total were drawn randomly from the two selected blocks (20 villages from each block). For selection of respondent's multistage sampling procedure was used. 75 women representatives were randomly selected from all the gram panchayats of these two blocks. The data were collected by personally interviewing the respondents with the help of structured interview schedule. Appropriate statistical tools were used for analysis of data.

## RESULTS AND DISCUSSION

***Socio-economic and Psychological profile of elected women village Panchayat members (EWVPMs) (Third-tier of PRI):*** A perusal of table 1 reveals that the majority of the elected women village Panchayat members were within 35 years of age (73.33%) the majority belonged to forward (46.66%) caste and majority of the elected women village Panchayat members had married (98.66%) followed by only 1.34 percent had windowed. Majority the women members personally possessed low (up to 8<sup>th</sup> standard) level of education (48.0%) and also had high family

education (29.33%). They by and large enjoyed a nuclear family (64.0%). But the majority had 3.5 members (42.66%). Further most of these respondents enjoyed in household work (97.33%), these respondents owned land up to 2.5 acre (58.66%) and lived with low material possession (84.00%). Maximum 64.00 percent of respondent had low income group below 20000 annually. The majority of the members were endowed with either mixed (42.66%) or kutcha house (37.33%). Majority of respondents had not membership of any social institution.

As is evident from the data, the representatives appeared to possess certain Characteristics which were comparatively less expressed in the beneficiaries (rural women). The EWVPMs were relatively younger in age, possessed at least some education, the family members of many of them being highly educated, had several sources of earning and so were well to do and naturally therefore, several of them had got constructed Mixed houses with wealth comes the contact and so was the case with many respondents who were found to be having active linkage with certain socio-political organizations. Sarkar and Adhikari (1998) also reported that most of the Panchayat women belonged to low socio-economic groups.

Such being the Socio-economic and Psychological background of the elected women members, what degree of preparedness did these representative have to turn this basic institution in to a key player in accelerating the socio-economic development in the country side while there may be numerous indicators to this effect, a knowledge of the sources of motivation for the women to fight a for the rules and regulations of Gram Panchayats and awareness to the developmental programmes under the Panchayati Raj was considered important towards effective role playing by the elected women members.

***Constraints faced by elected women Village Panchayat members in role performance:*** An investigation into the possible impediments become inevitable against the backdrop of low level of performance by the elected members in respect of various designated roles of gram Panchayats, an investigation into the possible impediments becomes inevitable with this point in view the elected women members of the gram Panchayats under study were

**Table 1: Socio-economic and psychological profile of elected women village Panchayat members (N=75)**

S.No.	Variables	Categories	F	%
1.	Age	Young (up to 35 years)	55	73.33
		Middle (35 – 50 years)	20	26.66
		Old (> 50 years)	-	-
2.	Caste	Forward	35	46.66
		Back ward	18	24.00
		SC	22	29.33
3.	Marital status	Unmarried	-	-
		Married	74	98.66
		Widowed	1	1.34
		Divorces	-	-
4.	Personal education	Illiterate (No formal Education)	14	18.66
		Low (up to 8 <sup>th</sup> Standard )	36	48.00
		Medium (Matric and intermediate)	22	29.33
		High (Graduate & above )	3	4.00
5.	Family Education Index	Illiterate (No formal Education)	10	13.33
		Low (up to 8 <sup>th</sup> Standard )	25	33.33
		Medium (Matric and intermediate)	18	24.00
		High (Graduate & above )	22	29.33
6.	a) Family type	Nuclear	48	64.00
		Joint	27	36.00
6.	b) Family size	Up to 3 members	15	20.00
		3 – 5 members	32	42.66
		> 5 members	28	37.33
7.	Occupation	Household work	73	97.33
		Caste occupation	-	-
		Small scale industries	-	-
		Independent profession	-	-
		Construction work	-	-
		Business	-	-
		Farming	2	2.66
8.	Land holding	Landlers (No. Land)	4	5.33
		Marginal (up to 2.5 acre)	44	58.66
		Small (2.5 to 5 acre)	25	33.33
		Medium (5.1 to 10 acre)	2	2.66
9.	Family Income	LIG (up to Rs. 20,000)	48	64.00
		MIG (Rs. 20000 – Rs. 35000)	12	16.00
		HIG ( >Rs. 35000)	15	20.00
10.	Material Possession	Low (up to MPS)	63	84.00
		Medium (MPS 4-6)	2	2.66
		High (MPS > 6 )	10	13.33
11.	Type of house	Kutchha	28	37.33
		Mixed	32	42.66
		Pucca	15	20.00
12.	Social linkage	No. Membership	57	76.00
		Membership of one organization	18	24.00
		Membership of more than one organization	-	-

L.I.G.=Low Income Group; H.I.G.=High income Group; M.I.G.=Medium Income Group; M.P.S.=Material Possession Score  
 Note - Figures in Parentheses indicate Percentages, N = Elected women village Panchayat members

interviewed to reveal various constraints in their role performance. An effort was also made to delineate the degree of the problem that these constraints posed to defeat the purpose of wisdom behind the constitution of the Panchayati Raj System. The observations recorded in the course of inquiry into these aspects are posted in Table 2.

The observations in Table 2 revealed as many as 11 important constraints which affected the role performance by elected women members in gram Panchayat adversely. Some of these constraints were judged highly problematic by some members while others related different constraints to be moderately problematic or little problematic. The constraints which were considered highly problematic by more than 50.0 percent of the EWVPMs interviewed were lack of resources for development works (90.66%), lack of fund on time for carrying out the work of the programme/projects (88.0%), lack of knowledge of the members about the developmental projects (82.66%), Non-availability of persons well versed with the rural projects (80.0%), lack of interest in Mukhiya for development works (74.66%), lack of education among elected Panchayat members (69.33%) and bribery and misappropriation of fund (54.66%).

Thus, out of a total of 11 serious constraints of role performance by women members in Gram Panchayats, these 8 were felt to be highly problematic. The lack of unity among the villagers was considered highly problematic (46.66%) and moderately problematic

(40.0%). Incidentally, Caste based Cooperation and conflicts in the villages were considered moderately problematic by the large number of women. The conflict in the villages, however, was considered to be the factor to be highly problematic (33.33%) and moderately problematic (50.66%). As against (18.66%) EWVPMs indicated that caste cooperation in the villages was highly problematic, other 53.33 percent believed it to be moderately problematic and the rest of 21.33 percent considered it of a little problem only.

The caste based cooperation and conflicts in the villages were considered little problematic by the large number of women (21.33 %) and (16.0%) respectively. This indicated that the democracy at grass root level is matured enough and people could put aside their personal problems in matters of development works launched by the gram Panchayat for up-liftment and betterment of the villagers.

The 11 constraints were further classified into three categories viz-Social constraints, Economic constraints and Psychological constraints. The data in terms of number of elected women village Panchayat members and their percentage are summarized in Table 3.

It can be observed in Table 3 that the maximum number of EWVPMs considered economical constraints to be acting as the greatest hindrance in the way of their role performance (93.33%). In comparison 82.66 percent respondents considered the Psychological constraints to be highly problematic by (45.33%) of the

**Table 2: Degree of constraints as perceived elected women village Panchayat members in role performance**

Statement	Highly problematic		Moderately problematic		Little problematic	
	F	%	F	%	F	%
Lack of unity among the villagers	35	46.66	30	40.00	10	13.33
Caste based co-operation in the village	14	18.66	40	53.33	16	21.33
Conflicts in the village	25	33.33	38	50.66	12	16.00
Lack of education among Panchayat members	52	69.33	16	21.33	7	9.33
Lack of resources for development works	68	90.66	4	5.33	3	4.00
Lack of knowledge of the members about the development project	62	82.66	8	10.66	5	6.66
Lack of interest in Mukhiya for development works	60	80.0	5	6.66	10	13.33
Carelessness among villagers for development works	56	74.66	15	20.00	4	5.33
Lack of fund in time	66	88.00	5	6.66	4	5.33
Bribery and misappropriation of fund	41	54.66	27	36.0	7	9.33
Non-availability of persons well versed with the rural projects	60	80.00	7	9.33	8	10.66

(Note: F= Frequency, Figures in Parentheses indicate Percentage)

**Table 3: Socio-economic and Psychological constraints of role performance by the elected women village Panchayat members**

Nature of constraints	Highly problematic		Moderately problematic		Little problematic	
	F	%	F	%	F	%
Social constraints	34	45.33	26	34.06	15	20.0
Economical constraints	70	93.33	2	2.66	3	4.0
Psychological constraints	62	82.66	4	5.33	9	12.0

EWVPMs. However more number of respondents (34.66%) commented that the social constraints were moderately problematic number of such members who considered these three types of constraints to be of little problem in their role performance in gram Panchayats were small. However, among the Socio-economic and Psychological constraints the social constraints were considered less problematic by (20.0%) percent members followed by Psychological (12.0%) and economical constraints (4.0%). Jayalakshmi (1997) also reported that women members were facing some practical problems in managing the affairs of Panchayats.

### CONCLUSION

In Indian Constitution, there are provisions for equal rights for all citizens irrespective of their social and economic status. It was only role performance by the elected women members that was not directly influenced substantially by caste or personal education or family size or family type or house type or even empowerment. The EWVPMs were younger in age, possessed at least some education, the family members of many of them being highly educated had several sources of earning and so were well to do and naturally therefore, several of them had got constructed mixed house with wealth comes the contact and so was the case with many respondents who were found to be having active linkage with certain Socio-political organizations. Elected women possessed better knowledge about Panchyati Raj System. In fact it was the degree of participation which acted as deciding

factor in performance by the elected women members in gram Panchayat.

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# Innovation Management in Indian Research and Development Organizations: An Intellectual Property Right Perspective

Vikram Singh<sup>1</sup>, J.P. Sharma<sup>2</sup> and M.S. Nain

<sup>1</sup>Scientist, IP and TM Unit, <sup>2</sup>Joint Director (Extension), <sup>3</sup>Senior Scientist, Division of Agricultural Extension, ICAR-Indian Agricultural Research Institute, New Delhi-110012

## ABSTRACT

Innovation generates intellectual assets, where man, money and material are considered as vital inputs. In the emerging trend of managing the innovations, Intellectual Property tools in general and patent tools in specific are important. In India, science is regarded as one of the most powerful instrumentalities for propelling innovation. To strengthen this innovation culture in the country different R&D organizations are working in the field of S & T. The present study is mainly focused on leading Indian R&D organisations, which have subject specific research laboratories/units. This paper is the outcome of assessment of patent filing related data taken from different public and paid search engines. The objective of this study was to understand the patent filing behaviour of Indian R&D organizations and their legal status. Results of the present study revealed that patent filing in the Indian Patent Office is growing, an astonishing 272.50% increase, during the last ten years (2005-2014) as compared to previous 10 years. The Indian R&D assignees except CSIR are showing a comparable upward trend in filing as increase in filing by DRDO (285%), ICAR (209%) and DST (187%), respectively. CSIR is an exception to this as it is showing a declining trend of -53% in 2006-2015 in comparison with 1996-2004. Most of the organizations filed their patent applications at IPO, where CSIR is leading with 7104 applications; followed by IITs (1674); and ICAR (511). It was found that IPC classes viz. A, B, C, D, G, and H were preferred by most of the institutions for their patent filing subject domain. Study shows that CSIR possess the highest number of granted patents i.e. 7780<sup>1</sup>, followed by IITs (488), DST (227), IISc (170), DRDO (146), DBT (123), ICAR (70), and ICMR (26). The implications of result displayed by this study will be useful in the augmenting India's new National IPR Policy 2016.

**Keywords:** Innovation, IPC, Legal status, Patent, Public funded organizations, R&D organizations, WIPO

## INTRODUCTION

Innovation is the pivotal for Research and Development (R&D) organizations, where intellectual assets/properties are the core resources and their application in field situation is the output (Bloom *et al.*, 2005). Creativity and Innovation are the forces which drive growth, development and progress in the knowledge economy ([www.dipp.nic.in](http://www.dipp.nic.in)). Innovation management helps to an organization in grasping the opportunities and its use in creation of new ideas, processes, or products industriously (Kelly and Kranzburg, 1978). If we consider innovation as process,

invention and imitation are two sequential steps in the process leading to innovation (Godin, 2008). In other words, innovation generates intellectual assets, where  $tm^3$  i.e., time, man, money and material are the input resources. Creation of these assets starts from its need assessment from field level to development in research labs and subsequent transfer to the business chain for its multiplication and social development (Singh *et al.*, 2015 and Kumar *et al.*, 2015).

Managing these innovations is an emerging trend where, different Intellectual Property (IP) tools like,

<sup>1</sup>Including patents filed outside IPO

\*Corresponding author email id: [kmmvsg@gmail.com](mailto:kmmvsg@gmail.com)



patent, copyrights, designs, trade secrets etc. are available to protect and promote for generation of employment, business and secondary resources for the development of agrarian society (Ravishankar and Archak, 2000, Sharma and Daipuria, 2013). IP tools are important not only because India as a member of World Trade Organization (WTO), but also because they offer possible mechanisms for stimulating research, enabling access to technology and promoting enterprise growth, all for the ultimate benefit of the society (Singh and Singh, 2015). In today's context it has become necessary to do so, for unprotected research results in the public domain can lead to unacknowledged use/exploitation of such research for commercial gains by other agencies both within the country and abroad. Moreover, protection of IP creates incentive for more knowledge and technology generation as scientists/ innovators are recognized and rewarded (ICAR, 2006).

In India, science is regarded as one of the most powerful instrumentalities for propelling growth and development, especially in the emerging scenario of competitive global economy ([www.dst.gov.in](http://www.dst.gov.in)). This is not surprising as India is one of those countries where science was always an integral part its collective consciousness. To carry on this baton of scientific voyage in the country, diverse R&D organizations/institutes are working in various fields of science and technology viz. Council of Scientific & Industrial Research (CSIR), Department of Biotechnology (DBT), Defence Research & Development Organisation (DRDO), Department of Science and Technology (DST), Indian Council of Agricultural Research (ICAR), Indian Council of Medical Research (ICMR), Indian Institute of Technologies (IITs), and Indian Institute of Science (IISc), Bangalore. Together these R & D organisations made India one of the frontline countries in the field of basic and applied research. As the country has already announced its new IPR Policy 2016 for protection of innovations, so it is pertinent to know the innovations and their management and protection status of Indian R&D organizations/institutes, which will be a source for policy makers, researchers and different business stakeholders.

## MATERIALS AND METHODS

This paper is the outcome of assessments of research related patent data from websites of CSIR'S Unit for Research and Development of Information Products (URDIP), European Patent Office (EPO), Indian Patent Office (IPO), Japan Patent Office (JPO), State Intellectual Property Office of People's Republic of China (SIPO), United States Patent and Trademark Office (USPTO), World Intellectual Property Organization (WIPO), and Orbit's Questel software for IP data search. The objective of this study is to know the innovations of Indian R&D organizations, secured by filing of patents at different countries and their legal status.

The present study was mainly focused on leading Indian R&D organisations, which are having their subject specific research laboratories/institutes/stations in different parts of the country (except IISc, Bangalore, which included due to its uniqueness in basic science research in the country). Eight such organizations were purposively selected for this study viz. CSIR (37), DBT (18), DRDO (48), DST (20), ICAR (105), ICMR (32), IITs (16) and IISc, Bangalore<sup>2</sup>.

The collected information was analysed and added with different available database of other research organizations and presented in the form of patent filing trends in priority years (1996 to 2015); priority countries for national patent filing; classification of the innovations as per International Patent Classification (IPC) of WIPO; and their present legal status.

## RESULTS AND DISCUSSIONS

**Legal aspect of Patent:** Patent gives inventors a monopolistic right to their creations for a limited time in a specific geographical area. It is a form of ownership right, negative in nature, which gives the right-holder the power to exclude others from using the subject matter of the patent without the permission of the owner. The main reason for the evolution of the patent protection system is to encourage economic development. This conception appears to be based on two postulates viz. innovation is the prime driver of human prosperity and economic development (Douglass C. North and Robert

<sup>2</sup>Number of Laboratories/Institutes/Stations/Units are in the parenthesis

Paul 1973); and patent stimulates innovation and encourages progress<sup>3</sup>. It is, therefore, patent results in human prosperity and economic development.

**Worldwide Patent Filing Trends:** Patent filing is a continuous process at different Patent Filing Offices (PFOs), and is one of the indicator of the development and growth of innovations and their management by using different IP tools. The WIPO has published a database of worldwide patent filing in various PFOs. For the purpose of this study, to emphasize on IPO's activities in relation to other top-4 PFOs of the world, a dataset of last 20 years in two equal Divisions, namely 1995-2004 and 2005-2014 was prepared from the aforesaid database & presented in brief in the Table 1.

The results of this analysis revealed that JPO is the leading PFO as 77.27 lakh patent applications were filed from 1995 to 2014; followed by USPTO (76.91 lakh); SIPO (51.52 lakh); EPO (23.54 lakh) and IPO (4.71 lakh). However, the trend is different when analyzed in the split of two sets, viz. 1995-2004 and 2005-2014. During the study period spanning between 1995 to 2004 the JPO was found to be the leading PFO with 40.71 lakh patent applications; followed by USPTO (28.19 lakh); EPO (9.26 lakh); SIPO (5.94 lakh); and IPO (0.99 lakh), in descending order. However, the patent filing data of the subsequent decade (2005 to 2014) showed that USPTO has been in the leading position (48.72 Lakh).

This trend was recorded as different when percentage of growth between these two decades was compared. It was found that, among the PFO, SIPO was leading with an increase of 665.97% (45.57 lakh as compared to 5.94 lakh of 1995-2004); followed by IPO (272%); USPTO (72.81%); and EPO (54.22).

Notably, it is very important to know that patent filing trend at JPO was in a declining trend recorded at -10.20%. These findings of JPO have been supported by the information retrieved from the website quoting as, the number of patent applications filed with the JPO has been gradually decreasing since 2006 (318,721 in 2015), while the ratio of patent registration by filing year has been increasing. This shows that applicants tend to file patent applications in a more carefully selective way (www.jpo.go.jp).

These results also showed the growing awareness of the benefits of patent by various stakeholders of Indian R & D machinery, which in turn, supported one of the objectives of newly launched National Intellectual Property Rights Policy 2016 quoted as, to create public awareness about the economic, social and cultural benefits of IP among all sections of society for accelerating development, promoting entrepreneurship, enhancing employment and increasing competitiveness (<http://dipp.nic.in>).

**Patent Filing Trends at Indian R&D Organizations:** As mentioned in Table 1, the patent filing at IPO increased by 272.50 % during the last decade (2005-2014). The resemblance of this growth is also reflected in the patent filing trend of Indian leading R&D organizations (Figure 1).

It is of note that DRDO achieved highest decennial growth by registering 285% increase in patent applications (420 in 2006-2014 as compared to 109 in 1995-2004). The second in growth was ICAR, which filed 380 applications from 2006-2015 (209% increase as compared to the previous decade). The same trend was shown by DST (187%); IITs (167%); ICMR (117%); IISc (74%) and DBT (36%); although the

**Table 1: Patent filing trends at leading PFOs of the world**

Patent Filing Office (PFOs)	Patent application filed		Total applications	Growth (%)
	1995-2004	2005-2014		
SIPO	594944	4557110	5152054	665.97
EPO	926211	1428400	2354611	54.22
IPO	99737	371520	471257	272.50
JPO	4071445	3656070	7727515	-10.20
USPTO	2819521	4872317	7691838	72.81

Source: WIPO statistics database. Last updated: December 2015

<sup>3</sup>Graham v. John Deere Co., 383 U.S. 1 (1966)

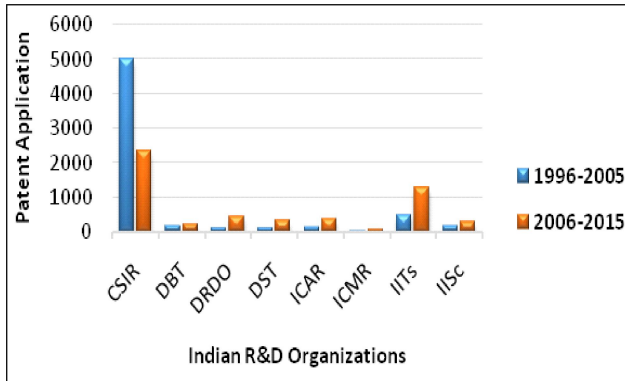


Figure 1: Year wise patent filing trends at Indian R&D organizations

patent filing trend at CSIR displayed a declining trend with -53% in 2006-2015 in comparison with 1996-2004. The experts of CSIR claimed selective patenting, seeking only those patents, which would have potential commercial value or preemptive nature as the reason for decrease in patent filing trend (Burhan and Jain, 2015). However, that does not *ispo facto* means that other R&D organizations are patent trigger happy as a comparative analysis is not made.

**Priority Patent Offices for Patent Filing:** Most of the R&D organizations filed their patent applications at IPO, with CSIR being the leading among others (7104 applications); followed by IITs (1674); ICAR (511); DRDO (496); IISc (349); DBT (260); DST (116), and ICMR (105), in descending order. Unlike other R&D organisations, CSIR had a history of filing patents in foreign countries. However, this trend has been changed by multitude of factors like in-house capacity development, globalisation, and awareness of the importance of patenting and implementation of new IPR regime. This change resulted in many other R&D organizations started filing of patent applications at USPTO and WIPO through Patent Cooperation Treaty (PCT). Figure 2 showed that CSIR is leading with 1201 applications at USPTO directly and indirectly (through PCT); followed by IITs (148); DBT (71); IISc (76); DRDO (40); DST (17); ICAR (9) and ICMR (4).

This trend of PCT filing is an indication of changing presumption of innovators and a resultant

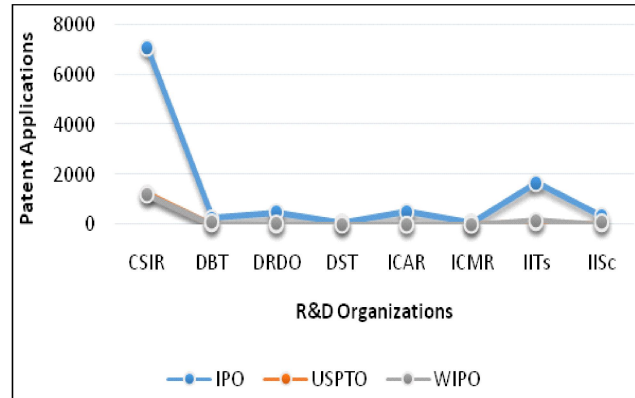


Figure 2: Priority Countries for Patent Filing

paradigm shift in the strategy of R&D Organisation for global competency.

**Subject Domain of Patent Applications:** The subject domains of these applications were classified according to International Patent Classification (IPC), where all subjects are classified in its eight Sections (A to H)<sup>4</sup>. The top ten preferred IPC sub-classes were selected for all the Indian R&D organizations in Table 2.

It was found that the most of the applications were in six major sections viz., Section A-Human Necessities; Section B-Performing Operations, transporting; Section C-Chemistry, Metallurgy; Section D- Textiles; Paper; Section G- Physics; and Section H- Electricity. In the next step of analysis (Table 2) of sub-classes in this classification was found that in the Section- A (A01 and A61); Section- C (C07 and C12); and in Section- G (G01) were the most preferred subject area for patent filing.

If the filing trends of sub-sectional preferences of individual organizations were analysed, it can be found that the preferred sub-sections in Section- B have been B05, B28 and B82. Likewise that of Section- C were C01, C02, C04, and C27; Section- D was D06; Section- G were G06 and G08; and for Section- H have been H01 and H04. This selective preference of IPC subject domain was based on research mandates of the individual organizations, for instance, DBT and DST filed their most of the applications under the sub-class

<sup>4</sup>IPC is an outcome of the Strasbourg Agreement of 1971, entered into force on 7<sup>th</sup> October 1975, accommodates for a common classification for patents invention including published patent applications, inventors' certificates, utility models and utility certificates we re used to know the expansion of subject area as well as diversity of inventions ( source www.wipo.in)

**Table 2: Subject Specific Preferences of Indian R&D Organizations**

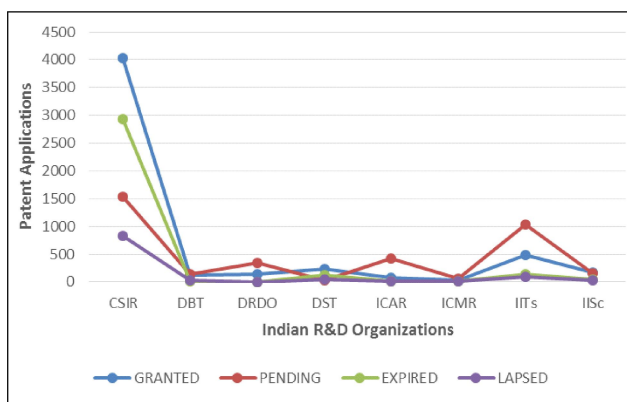
S.No.	IPC Symbol		International Patent Classification (IPC) & Description	R&D Organizations
	Class	Sub class		
1	A	A01	Agriculture; Forestry; Animal Husbandry; Hunting; Trapping; Fishing	CSIR, DBT, DRDO, DST, ICAR and ICMR
2		A23	Foods or Foodstuffs	DBT and DST
3		A61	Medical or Veterinary Science; Hygiene	CSIR, DBT, DRDO, DST, ICAR, ICMR, IITs, and IISc
4	B	B05	Spraying or Atomising in General; Applying Liquids or other Fluent Materials to Surfaces, in general	DRDO
5		B28	Working Cement, Clay, or Stone	DRDO
6		B82	Nano-Technology	ICMR
7	C	C01	Inorganic Chemistry	ICMR
8		C02	Treatment of Water, Waste Water, Sewage, or Sludge	ICMR
9		C04	Cements; Concrete; Artificial Stone; Ceramics; Refractories	ICMR
10		C07	Organic Chemistry	CSIR, DBT, DST and IISc
11		C12	Biochemistry; Beer; Spirits; Wine; Vinegar; Microbiology; Enzymology; Mutation or Genetic Engineering	CSIR, DBT, ICAR, ICMR and IISc
12		C22	Metallurgy	IISc
13	D	D06	Treatment of Textiles or the Like; Laundering; Flexible Materials not otherwise Provided	ICAR
14	G	G01	Measuring	DBT, DRDO, ICMR, IITs and IISc
15		G06	Computing; Calculating; Counting	ICMR
16		G08	Signalling	DST
17	H	H01	Basic Electric Elements	DRDO
18		H04	Electric Communication Technique	DST and IISc

A23 and G08; specially DRDO filed under sub-class B05, B28 and H01; ICMR filed under sub-class B82, C01, C02, C04, and G06; and ICAR under the sub-class D06.

**Legal Status of IP Portfolio:** Legal status of any IP tool is an important component of IP portfolio for any organization. In case of patents, such information has been used to determine whether, examination of a patent application is still pending; the application has been withdrawn or rejected; a patent has been granted and is still valid; or a granted patent has expired, lapsed or been revoked. This information plays a vital role in technology transfer and further development of the subject matter of that patent, since they answer the question as to which technology is still protected, and where, or whether it will soon become freely available to the public. Though the legal status of patents is linked to legal events or actions, which changes over time and therefore poses particular problems to the availability and reliability of up-to-date information (<http://www.wipo.int>).

Each country follows its own predefined procedure of receiving patent applications, examining the applications and granting patents or rejecting patent grants. Based on the procedure followed by a patent office, the time required to have a patent granted to a particular invention can vary. IPO also follows a predefined procedure ([www.invntree.com](http://www.invntree.com)). To know the legal status of filing of patent and subsequent grant of patent if any, of any Indian R&D organization, the data have been compiled under different heads viz. *Granted* (patent applications granted to an applicant on his request and by completing the grant process); *Pending* (patent application which is in process of grant which includes complete filing, Filing Examination Request (FER), Second Examination Request (SER), under examination or under hearing or Decision of Controller may be pending etc.); *Expired* (the time limit of patent grant has been completed from its date of filing i.e. 20 years and such patents are free for public use); and *Lapsed* (lapsed patents are patents that expired because the maintenance fee was not paid in due time).

The overview of Figure 3 shows that CSIR possess highest number of patents i.e. 7780<sup>5</sup> followed by IITs (488), DST (227), IISc (170), DRDO (146), DBT (123), ICAR (70), and ICMR (26), in descending order. The data revealed that DST had the highest applications granted (54.18%) in comparison to its total filing i.e. 419; followed by CSIR (43.23%); and DBT (41.14%). Of note that CSIR recorded highest number of patent applications in pending status, followed by IITs, ICAR, DRDO, ICRM, DBT, and DST.



**Figure 3: Legal Status of IP Portfolio of Indian R&D Organizations**

This indicates that the trend of patent application filing increased in these organizations due to the IP awareness programmes and implementation of new IPR guidelines, but due to unavailability of techno-legal expertise in their research and scientific staff, these applications remained as pending in different stages of patent granting process. Some of the granted patents of these organizations were expired for completing their time limit i.e. 20 years in India, and in most of the WIPO member countries. It was also observed that few patents were lapsed due to non-payment of renewal fee. The reasons for non-payment of renewal fee are varying according to the competence of the technology (because patent grant process takes average 4 to 6 years at IPO, till that time some new modifications may compete) in market, its feasibility and cost of production, demand and supply ratio, government policies etc.

### CONCLUSION

Innovation management helps an organization in seizing the opportunities and potentials if new processes

or products or a combination of both for the economic benefit of the organisations and the nation, above all. Creation of these assets includes idea generation, need assessment, execution in research labs and transfer to the business chain. Managing these innovations with the help of various IP tools and particularly patent is an emerging trend worldwide. The patent filing is essential for Indian R&D organizations, not only because India is a member of WTO and signatory of The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), but also because in today’s context it has become necessary as unprotected research results in the public domain and can lead to unacknowledged use/exploitation. To continue this innovation culture in the country new IPR Policy 2016 for protection of innovations has been announced. This study mainly focused on the frontline innovations, their management and protection status of the eight leading Indian R&D organisations, which will be a important guideline for policy makers, researchers and different business stakeholders.

The patent filing growth during the last decade (2005 to 2014) showed SIPO at the leading position, with its robust growth, followed by IPO, USPTO, and EPO; although the same at JPO was recorded as declining. The highest decennial growth (2006-2014) in the patent filing is by DRDO followed by ICAR, whereas, CSIR had shown a declining trend. CISR possesses highest number of granted patents, followed by IITs and other organizations. This apparently indicated that the trend of patent application filing increased in these organizations due to the IP awareness programmes and implementation of new IPR guidelines, but due to the unavailability of techno-legal competencies in their research and scientific staff, these pendency’s are lying in different steps of patent grant process. Most of the organizations filed their patent applications at IPO, but this is slowly changing as greater number of R&D organisations are instrumental in filing patent application abroad. This trend of increasing PCT filing is an indication of realisation of globalisation of world economy and consequent paradigm shift in the strategy of R&D organisations to achieve global presence. The implications of this study may be useful in the line of country’s new IPR Policy, where IPR awareness, generations of IPRs, legal and

<sup>5</sup>Based on [www.urdip.res.in](http://www.urdip.res.in)

legislative framework, commercialization of IPR and enforcement and adjudication need to be dealt as the key objectives.

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# Socio-economic Constraints Perceived by Fruit Growers in Sirsa District of Haryana

Sumit Yadav\*, S.K. Mehta and A.K. Godara

Department of Extension Education, CCS Haryana Agricultural University, Hisar-125004, Haryana, India

## ABSTRACT

Present study aimed to find out the critical constraints in production, advisory services, input and marketing of fruits in Sirsa district of Haryana. Most arising constraint among all faced by majority of the respondents was slow dissemination of improved high yielding cultivars/hybrids among other major constraints related to the production and marketing faced by the farmers, unfavorable climatic conditions, lack of guidance for controlling physiological disorder, diseases and application of fungicide and instability of price with no support price mechanism were prominent.

**Keywords:** Constraints, Fruit growers, Fruit production technology

## INTRODUCTION

India is second largest producer of fruits in the world next to China and accounts for 8 per cent of the total world fruit production (NHB, 2014-2015). The cultivation of fruits has become a key driver for economic development in many of the states in the country. Among fruits citrus fruits occupy a prominent place in international market. The area and production of fruit crops in India is 6.1 million hectare and 8.6 m T., respectively, In Haryana, the total area under kinnow cultivation is 19500 hac with the production of 3 Lakh m T. The productivity of Sirsa district is higher than other districts of Haryana but lower than other states of India. Guava fruits are commercially grown throughout the country. Production of guava in Haryana is 1.03 Lakh m T and area 10840 hac (NHB, 2014-2015). In Haryana, production of guava is 0.053 m T with an area coverage of 0.007 m hectares. Although the area and production of both major crops is significant still the farmers face a lot of problem in production to marketing which need attention of the researchers, extension professionals as well as policy planner. The study aim to enumerate the various constraints faced in production process of two important fruit crops (guava and kinnow) in south west zone of Haryana state. No such study which accounts

for constraints faced by fruit growers and them had been conducted in southwest region. It was because of the familiarity of researcher with the local conditions, convenience and easy accessibility.

## MATERIAL AND METHODS

The study was conducted in purposively selected Sirsa district from south-west of Haryana state as this district has higher number of kinnow as well as guava growers and the maximum area under kinnow and guava production. The functional head of the farming families, who have developed kinnow and guava orchards on their farms, were taken as respondents of the study. A total number of 80 farmers constituted the sample for the purpose of the study out of them 40 were kinnow growers and 40 were guava growers. Constraint can be described as any condition or situation which impede, restrict any activity to find out the probable constraints which hinder the adoption of improved practices of fruits, an inventory of constraints was prepared on the basis of available literature, personal experience, discussion with experts and farmers growing fruits. The constraints for the study purpose were divided into, related to production, marketing, input and advisory services the respondents were asked to rank the constraints according to their importance and

\*Corresponding author email id: sumit33yadav@gmail.com

magnitude. The primary data was treated with mean, frequency and weighted mean scores for presentation of result.

## RESULTS AND DISCUSSION

**Constraints related to inputs:** On the basis of weighted cumulative frequency scores, all the eight constraints related to inputs faced by the farmers were ranked in the descending order. Table 1 revealed that among various constraints related to input ‘slow dissemination of improved high yielding cultivars/hybrids’ was observed as the most serious constraint and it was ranked first with a mean score of 2.68. The ‘inadequate availability of disease free, planting material’ was ranked second with a mean score of 2.53. While other constraints like ‘inadequate credit facilities for the purchase of inputs’, ‘high cost of inputs’, ‘non-availability of inputs on proper time at village level’, ‘Non availability of micro propagated seedlings’, ‘high labour charges’ and ‘maintaining field/gardening is not an easy task followed, respectively. These findings are in consonance with the findings of Gill (2009) and Devi and Manoharan (1998).

**Constraints related to production:** The results presented in Table 2 highlights that the ‘unfavourable climatic conditions’ was observed as the most serious constraint in order mean score of 2.09 followed by ‘high cost of production due to labour intensive technology’

(2.01). These findings are in consonance with the findings of Shashikant *et al.* (2011). Farmers were very much affected by ‘unfavourable climatic conditions, soil type and difficult to maintain the proper moisture in soil’, ‘high cost of production due to labour intensive technology’, ‘lack of proper knowledge about balanced fertilizers application’, ‘use of seed without treatment’, ‘inadequate training, pruning, and grading’, ‘lack of irrigation facilities and farmers lacking the skill in fruit cultivation followed, respectively.

**Constraints related to marketing:** Table 3 revealed various constraints faced by the farmers related to marketing of their product. Among these ‘instability of price, with no support price mechanism’ was ranked 1<sup>st</sup> with highest mean score of 2.1 followed by ‘lack of storage facilities’ with mean score of 2.01. The ‘immediate or forced sale of perishable commodity’ was rated as a serious constraint by 40 out of 80 i.e. fifty per cent of farmers. The results are in consonance with Daset *et al.* (2014). ‘Lack of co-operative organization for marketing of produce’, ‘poor marketing practices and infrastructure’, ‘low price of produce ‘lack of grading system’ and ‘lack of marketing knowledge’ followed, respectively according to the mean scores.

**Constraints related to advisory services:** The most serious constraint related to technical guidance was ‘lack of guidance for controlling physiological disorder,

**Table 1: Constraints related to inputs (N=80)**

Constraint	VS	S	NSS	Mean score	Rank order
Slow dissemination of improved high yielding cultivars/hybrids	58	19	3	<b>2.68</b>	<b>I</b>
Inadequate availability of disease free, planting material	46	31	3	<b>2.53</b>	<b>II</b>
Inadequate credit facilities for the purchase of inputs	24	54	2	<b>2.28</b>	<b>III</b>
High cost of inputs	13	56	11	<b>2.02</b>	<b>IV</b>
Non-availability of inputs on proper time at village level	15	44	21	<b>1.92</b>	<b>V</b>
Non availability of micro propagated seedlings	16	38	26	<b>1.87</b>	<b>VI</b>
High labour charges	12	38	30	<b>1.77</b>	<b>VII</b>
Maintaining field/gardening is not an easy task	<b>11</b>	18	51	<b>1.5</b>	<b>VIII</b>

**Table 2: Constraints related to production (N=80)**

Constraint	VS	S	NSS	Mean Score	Rank Order
Unfavourable climatic conditions	26	33	21	2.06	<b>I</b>
High cost of production due to labour intensive technology	31	19	30	2.01	<b>II</b>
Lack of proper knowledge about balanced fertilizers application	23	20	37	1.82	<b>III</b>
Use of seedling without treatment	16	15	49	1.58	<b>IV</b>
Inadequate training, pruning and grading	11	17	52	1.48	<b>V</b>
Lack of irrigation facilities	6	19	55	1.38	<b>VI</b>
Farmers and labours are not skilled in fruit cultivation	4	21	55	1.36	<b>VII</b>



**Table 3: Constraints related to marketing (N=80)**

Constraint	VS	S	NSS	Mean Score	Rank Order
Instability of price with nosupport price mechanism	28	32	20	2.1	I
Lack of storage facilities	24	33	23	2.01	II
Immediate sale being perishable commodity	23	18	40	1.95	III
Lack of cooperative organization for marketing of produce	20	33	27	1.91	IV
Poor marketing practices and infrastructure	15	41	24	1.88	V
Low price of produce	20	23	32	1.85	VI
Lack of grading system	17	27	36	1.76	VII
Lack of marketing knowledge	6	17	57	1.36	VIII

**Table 4: Constraints related to advisory services (N=80)**

Constraint	VS	S	NSS	Mean Score	Rank Order
Lack of guidance for controlling physiological disorder, diseases and application of fungicide	37	35	8	2.28	I
Lack of technology to manage problems like wilt in guava and decline incitrus	33	31	16	2.21	II
Lack of diseases and pests out break forecast service	31	33	16	2.19	III
Lack of knowledge about proper nutrient management	16	41	23	1.91	IV
Lack of knowledge of post harvest technology	17	23	40	1.71	V
Lack of knowledge of fertilizer application	11	22	47	1.55	VI

diseases and application of fungicide' and with a mean score of 2.28 (Table 4). The problem of 'lack of technology to manage problems like wilt in guava and decline in citrus' was ranked 2<sup>nd</sup> in order of importance. These findings are in consonance with the findings of Mallareddy and Kumar (1990). The table further revealed that 'lack of diseases and pests outbreak forecast service', 'lack of knowledge about proper nutrient management', 'lack of knowledge of post-harvest technology' and 'lack of knowledge of fertilizer application' were the major constraints faced by the farmers in order of seriousness.

### CONCLUSION

The findings, therefore, conclude that non-availability of recommended cultivars might have also contributed towards low production and adoption level of kinnow cultivation in the area under study. This may possibly be due to the reason that major inputs were not available in the local market and if available it was only in the city markets which were far away from the villages. Therefore, the timely availability of inputs was not assured. The farmers were not aware about the benefits of seedling treatment as well as pruning and training of the plants and they might have considered these practices as merely to increase the cost of production and thus avoiding them. This requires that

extension personnel's arrange for the farmers visit to the research farms for showing them demonstrations on profitability. The fruits being a perishable commodity, the farmers were not able to retain it for a longer period in view of lack proper of cold storages etc.

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# Production and Economics of Tomato Cultivation in Agra District

Gopichand Singh, Gyanendra Singh and Dilip Ranjan Das\*

KVK RBS College, Bichpuri, Agra-283105, Uttar Pradesh

\*Department of Science and Technology, Government of India

## ABSTRACT

Among vegetable crops, tomato is one of the largest cultivated crops globally. The increasing demand of tomato and its low productivity is major cause of concern in Agra. There is huge potential in tapping the exploitable productivity levels at farmers' field by bridging the gap between the tomato productivity at FLD and farmer practice through conduct of need based frontline demonstration. The production share of India in tomato production is 11.5% and in India, Uttar Pradesh contributes 14.7% of total tomato production. Keeping this in view, front line demonstrations (FLD) were conducted on improved cultivation practices of tomato crop in scientific manner at farmer's field during 2008-09 and 2009-10 in winter season. The recommended dose of fertilizer (RDF) was 188 kg DAP + 75 kg CAN + 150 kg M.O.P. and 30 kg ZnSO<sub>4</sub>/ha. Beside this, 200-300q FYM/ha were applied before last ploughing and thoroughly mixed in the soil. The demonstration of improved cultivation practices resulted into increase adoption of the improved tomato cultivation technology in the region. The yield in tomato increases by 23.25% and 21.95 % under FLD compared to local practices over the two years. The benefit cost ratio (5.83 in 1<sup>st</sup> year and 5.45 in 2<sup>nd</sup> year) was comparatively higher in demonstration than the control plot (4.14 in 1<sup>st</sup> year and 4.04 in 2<sup>nd</sup> year).

**Keywords:** Demonstration, Economics, Pusa Rohini, Improved practices, Productivity

## INTRODUCTION

Tomato is the world's largest cultivated vegetable crop and known as protective food both because of its special nutritive value and also because of its wide spread production. Smallholder agriculture is essential to livelihoods of many rural households in developing and transition economies. In addition, opportunities for profitable commercial agriculture were observed in growing demand, emerging food preferences and intensive farming. In addition fruit and vegetables are an important component of a healthy diet (Medhin and Teklehaimanot, 2013). So, Farmers have to put so many efforts to fulfil the need of the country. For this, farmer should be aware so that they can utilize the inputs wisely viz. seed, fertilizer, insecticides etc. without any economic losses (Saini *et al.*, 2013). So, it is necessary to front line demonstration which was conducted under the supervision of scientist of the Krishi Vigyan Kendra Bichpuri, R.B.S. College, Agra. The estimated area and

production of Tomato for India are about 0.35 mha and 0.53 mt, respectively. The production share of India in tomato production is 11.5% and in India, Uttar Pradesh contributes 14.7% of total tomato production. The trend in area, production and productivity of tomato in India and its share in total vegetable cultivation have been depicted in Table 1. The average productivity of tomato in our country is merely 158 q/ha while its productivity in U.S.A in 588 q/ha. As it is short duration crop and gives high yield, it is important from economic point of view and hence area under its cultivation is increasing. Tomato is rich in vitamin A and C and fiber and cholesterol free. Tomato statistics in our country also depicts its increasing importance in human diet. The achievable yield of tomato is very important to meet the production demand at the country keeping the increasing number of populace in mind. The demonstrations of advanced improved tomato production technologies at village level can fill the gap in the productivity. Keeping in view the

**Table 1: All India area, production and productivity of tomato**

Year	Area (In "000" ha)	% of total vegetable area	Production (in 000"mt)	Percentage of total vegetable production	Productivity (in mt/ha)
1991-92	289.10	5.20	4243.40	7.20	14.70
2001-02	458.10	7.40	7462.30	8.00	16.30
2002-03	478.80	7.90	7616.70	9.00	15.90
2003-04	502.80	8.00	8125.60	8.70	16.20
2004-05	505.00	7.50	8825.40	8.70	17.50
2005-06	546.10	7.60	9820.40	8.90	18.00
2006-07	596.00	7.90	10055.00	8.70	16.90
2007-08	566.00	7.20	10303.00	8.00	18.20
2008-09	599.00	7.50	11149.00	8.60	18.60
2009-10	634.40	7.90	12433.20	9.30	19.60
2010-11	865.00	10.20	16826.00	11.50	19.50

importance of tomato crop in Agra, KVK Agra conducted FLD on improved agricultural technologies of tomato crop at farmer's field during 2009 and 2010.

### MATERIALS AND METHODS

The front line demonstration was conducted by the Krishi Vigyan Kendra Bichpuri, R.B.S. College, Agra at adopted village of KVK as per guide line set up by Zonal coordinator at zone IV. The FLD under tomato crop were laid out in two adopted villages- Dawali and Nagala Khandia in Akola Block at Agra district. The knowledge of the farmers in these two villages was also estimated by taking random sample of 8 farmers from

two villages. The difference between the demonstration and existing farmer's practice are mentioned in Table 2. In demonstration plots, use of quality seed of improved varieties, raised bed transplanting, timely weeding and as well as balance fertilizers were emphasized. Improved agro techniques including the high yielding variety- Pusa Rohini was used in FLD. A comparative note has been given in Table 2 about the improved practices followed under demonstration and status of practices followed locally.

The farmers were provided well in advanced technical knowledge-how about sustainable cultivation of tomato under guidance of KVK scientists by making

**Table 2: Comparison between demonstration package and existing farmers' practices**

Particulars	Package and practices under demonstration	Farmers practices
Farming situation	Irrigated	Irrigated
Variety	Pusa Rohini	Himsona
Time of nursery sowing	20-25 September	15-20 September
Soil treatment	Trycoderma Powder	Nil
Time of transplanting	18 <sup>th</sup> Oct	20 <sup>th</sup> Oct
Method of transplanting	Raised bed	Flat bed
Seed rate	300-400 g/ha	450-500 g/ha
Fertilizer dose	190 kg DAP + 75 kg CAN + 160 kg MOP + 30 kg ZnSO <sub>4</sub> + 20 kg Sulphur	100 kg DAP+60 kg Urea
Seeding	Before transplanting seedling root dip in captan/trycoderma Powder 2 g/lite	Nil
Weed management	Pendimethaline (Stom) 1 kg/ha as per-emergence followed by one hand weeding about 40-45 days of transplanting	Hand weeding one time
Plant protection	Need based use of pesticides as insecticide, fungicide etc.	Heavy amount of insecticides and Fungi side
Plant hormones	Flowering and fruit setting use of N.A. A dose of 20-40 ppm in two spray	Nil

**Table 3: Yield of tomato fruit under front line demonstration at Diwali and Nagla Khandia**

Croptomato	Name of technology	No. of farmers	Area (ha)	Yield (q/ha) demonstration	Local check	Percent increase
2008-09	Pusa Rohini	8.0	1.6	530	430	23.25
2009-10	Pusa Rohini	8.0	1.6	500	410	21.95

**Table 4: Economics of tomato under front line demonstration at Dawali and Nagar Khandia**

Year	Economics of improved practices under FLD				Economics of local check			
	Gross cost	Gross return Rs/ha	Net return Rs/ha	BCR	Gross cost	Gross return	Net return	BCR
2008-09	62000	4,24000	362000	5.83:1	65000	3,44000	2,79000	4.14:1
2009-10	62000	400000	338000	5.45:1	65000	3,28000	2,63000	4.04:1

regular visit to the demonstration field and these visits were also utilized for collection of feedback of the farmers. Field day and group meeting were also organized at the demonstration plots to disseminate the message at large. The yield and economic data were collected from control (local check) and demonstration plot. The cost of cultivation, net return and benefit cost ratio (BCR) were computed. The BCR formulas was calculated as given below:

$$\text{BCR} = \text{Gross return} / \text{Gross cost}$$

## RESULT AND DISCUSSION

The progress of FLD on tomato crop during winter season 2009 and 2010 on improved variety of tomato Pusa Rohini was found to be substantially higher than that local check/control plot at Dawali and Nagala Khandia. During the year 2008-09 and 2009-10, the productivity of tomato was increased under front line demonstration by 23.25% and 21.95% over local check. The yield level in local check was 430 q/ha and 410 q/ha, while it was 530 q/ha and 500 q/ha during 2008-09 and 2009-10 respectively (Table 2). Tiwari and Sexena (2001) and Mishra *et al.* (2009) also reported similar findings.

**Economics of fruit production of tomato:** The economic indicator such as cost at cultivation, gross return, and benefit cost ratio of FLP on Tomato crop was estimated. The data clearly (Table 3) revealed that net return from FLD were substantially higher than local check during year 2009 and 2010. The net return from tomato FLD was Rs. 362000 per hectare in comparison to local check (Rs. 279000/ha). The high net income was due to the technological intervention

provided in demonstration over the period of two years (Table 2). Economics analysis of the field performance revealed the high BCR of demonstration plot than control plot/lock check.

**Other extension activity of FLD:** The following extension activities were organized on FLD of Tomato. Total 70 farmers were trained in six courses, 4 scientist visits were made in demonstration site in which 50 farmers were benefited. Two field days on Tomato also organized in Villages- Dawali and Nagal Khandia of Akole Block at Agra district in which 140 farmers were participated. Seedlings of Tomato were also provided to 8 farmers for demonstration. Fifteen farmers were also registered in KVK SMS (Horticulture) to get solution for their problems related to Tomato cultivation.

**Table 4: Other extension activities under FLD**

Extension activities	No. of extension activities	Participant
Training	6	70
Providian seedling of farmers	8	8
Scientist visit to demonstration site	4	50
Field day	2	140
Farmers visit to KVK	4 group	50
Farmers consulting	20	20

## CONCLUSION

The improved technologies (Pusa Rohini) demonstrated increased the yield of tomato and found economically remunerative with high B:C ratio. Good quality planting material supplied by the KVK and regular advisory support helped in exploiting potential of the improved

variety in the study area. It may be concluded that suitable extension interventions may be designed to get benefit from improved technologies.

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# Weed Management Strategies in Wheat Adopted by Farmers in Punjab

Randhir Singh\*, Anuj Kumar, Ramesh Chand, Satyavir Singh, R. Sendhil and Indu Sharma

Directorate of Wheat Research, Karnal-132001, Haryana

## ABSTRACT

India has achieved a record wheat production of 93.9 mt during 2011-12. Punjab is one of the leading states in wheat production (17.94 mt) with second highest productivity of 5.10 t/ha and contribute significantly to the central grain pool. The wheat front line demonstrations conducted during 2011-12 have indicated a yield gap of 5.3 q/ha in Punjab and weed problem is considered to be one of the important reasons for not attaining the desired yield. Not only weeds cause 25 to 30 percent yield loss in wheat crop but increases cost of cultivation, interfere with agricultural operations, impair quality, and acts as an alternate host for several insect pests, diseases, and nematodes. Weeds also account for about one third of total losses caused by the pests of wheat. A survey was conducted during 2011-12 in randomly selected districts of Punjab viz., Patiala, Sangrur, Jalandhar and Mansa representing rice-wheat, rice-potato-wheat, rice-maize-wheat and cotton-wheat rotations. The results of the survey indicated that respondents were aware of crop rotation strategy to manage weeds and more than 43 percent of them had adopted it. All the sample farmers applied herbicides to control weeds, some of them did use herbicide twice in the same year. To achieve higher production, there should be timely sowing (last week of October to 20 November), adopt zero tillage technique, grow latest recommended varieties, seed treatment, maximum usage of certified/quality seeds, nutrient usage as per soil testing, timely control of weeds with uniform spray using flat fan nozzle and rotation of herbicides and crop rotations as effective strategies to control weeds.

**Keywords:** Farmers, Weed management, Wheat, Punjab

## INTRODUCTION

India has achieved an all-time record wheat production of 93.90 mt during 2011-12, however, concerted efforts need to be made to meet the food requirement of ever increasing population. Under the wheat front line demonstration programme, it has been observed that there is a yield gap of 0.52 t/ha in Punjab and weed problem is one of the important reasons for reducing the potential yield (Yaduraju *et al.*, 2006). Weeds also account for about one third of total losses caused by the pests of wheat (Ladha *et al.*, 2000; Timsina and Connor, 2001). The yield losses due to weeds can be as high as 65 percent depending on the crop, degree of weed infestation, weed species and management practices (Yaduraju *et al.*, 2006). The intensified cultivation under rice-wheat system results more weed

infestation and thereby causing significant regional productivity loss every year (Harrington *et al.*, 1992). Herbicides are widely accepted in wheat and majority of the farmers apply herbicides to control weeds (Singh, 2007). Beneficial effect was observed on growth and yield attributes of wheat due to the integrated weed management treatment viz., pendimethalin pre emergence @ 1.0 kg/ha + hand weeding (Patil and Dhonde, 2009). Regular use of the same herbicide year after year has led to herbicide resistance. There is possibility that resistance will extend to alternate herbicides too. There are also greater chances of weed flora shift. Not only weeds cause 31.6 percent yield loss in wheat crop but increases cost of cultivation, interfere with agricultural operations, impair quality, act as alternate hosts for several insect pests, diseases and nematodes (Varshney, 2010). Identification of farmers'

\*Corresponding author email id: rsposwal@yahoo.com

perceptions influencing weed and farm management decisions provide an opportunity to formulate extension strategies. A number of studies on weeds have been conducted, the contribution of many such studies to improved planning of extension has often been disappointing (Llewellyn *et al.*, 2005). An attempt has been made to explore the weed management options adopted by farmers across different crop rotations in Punjab.

## MATERIALS AND METHODS

The study was conducted during 2011-12 in randomly selected districts of Punjab in the North Western India namely Sangrur, Patiala, Jalandhar and Mansa. From each district, four villages and from each village 10 farmers were randomly selected, making the sample size 160. Rice-wheat, potato-wheat-maize, rice-potato-wheat, and cotton-wheat were the main cropping system prevailing in the study area. The sample farmers were randomly distributed in the above said cropping systems. Conventional analytical tools like simple percentage and tabular analysis were done to give meaningful inferences.

## RESULTS AND DISCUSSIONS

**Socio-personal profile of respondents:** Majority (66.25%) of the farmers were middle aged followed by old (30%) and a few young (3.75%). The average age of the farmers was 46 years. It was observed in Punjab that the young generation was interested to get settled abroad than having agriculture as their profession.

Majority of the farmers were literate (81.87%). The analysis has indicated that 22.5 percent of the farmers were educated up to matric followed by higher secondary (21.25%), illiterate (18.13%), middle (15.63%) and primary (14.37%). There were only 7.5 percent graduate and negligible farmers who got education to post graduate level (0.63%).

About one third of the farmers (30%) had more than 11-20 years experience in agriculture. It is a matter of concern that only 28.75 percent of the farmers had less than 10 years of experience in agriculture indicating that the young generation is not very keen to adopt agriculture as their main profession. The average experience was 20.9 years. Agriculture requires physical fitness which is more suited for young generation

**Table 1: Socio-economic profile of the respondents**

Variables	Category	Freq.	Percent
Age (years)	Young (upto 25)	3	3.75
	Middle ( 25-50)	53	66.25
	Old (>50)	24	30.0
Education	PG	1	0.63
	Graduate	12	7.5
	10+2	34	21.25
	Matric	36	22.5
	Middle	25	15.63
	Primary	23	14.38
	Illiterate	29	18.13
Experience	<10	46	28.75
	11-20	48	30
	20-30	41	25.63
	31-40	18	11.25
	41-50	7	4.38
Family type	Nuclear	44	27.5
	Joint	116	72.5
Family members (No.)	1 to 4	37	23.125
	5 to 6	39	24.375
	7 to 8	46	28.75
	9 to 10	26	16.25
	>11	12	7.5
Member of organization	Member	115	71.88
	Not member	45	28.13
Occupation	Agriculture	160	100
	Subsidiary occupation	31	19.38
Source of income	<60000	20	12.5
	61000-120000	19	11.875
	121000-180000	20	12.5
	181000-240000	13	8.125
	241000-300000	18	11.25
>300000	70	43.75	

however; the job has been entrusted to the older generation.

Majority of respondents lived in a joint family system (72.5%) followed by nuclear families (27.5%). On an average, the respondent's family comprised of seven members. About 28.75 percent of the farmers had 7-8 family members. Almost an equal percent (24) had 1-4, 5-6 and more than 8 family members.

About 72 percent of the respondents registered their membership in cooperative societies and other organizations. A sizeable percentage (28) was not member of any organization. It indicates that these farmers were independent and were not getting any help or benefits from the cooperative societies. All the

farmers were dependent on agriculture for their livelihood. Similar findings have been reported by Singh *et al.* (2007). Only about one fifth of the farmers had other sources of income in addition to agriculture.

All the sample farmers depend on agriculture for their basic livelihood. However, about one fifth of the respondents had other sources of income in addition to agriculture. Majority of the farmers (43.45%) earn more than three lakhs per annum. There were only 12.5 percent having annual income less than 60000 INR followed by 11.87 per cent in the category of 61000-120000 INR/annum.

The farmers do not rely on a single source of agriculture related information. Most of them consult their fellow farmers irrespective of their level of education. Those who had higher education consulted specialists from institutes, state agricultural universities. Newspapers radio and TV were found as important sources of information for the farmers. Magazine was found to be a source of information for those who had higher education (Table 2). Sagwal and Malik (2001) also reported friends and neighbours as the main sources of information.

About 38 percent of the sample farmers had large holdings followed by small (24.38%), marginal (21.88%) and medium (16.25%) (Table 3). Due to joint family system, there were more large farmers. Also some of the family members were living abroad and they had leased out their land to the family members or other farmers of the village.

Across all the crop rotations, majority of the farmers (78%) had cultivated wheat crop in 76-100 percent of the total land area. About one tenth had cultivated wheat in 51-75 percent of the total land and an equal percent of them cultivated wheat in less than half of the area.

**Table 3: Particulars of land holding (acres)**

Land holding (acres)	Frequency (%)
Marginal (Upto 2.5)	35 (21.88)
Small (2.5 to 5.0)	39 (24.38)
Medium (5.0 to 10.0)	26 (16.25)
Large (>10)	60 (37.50)

**Table 4. Sources of seed**

Source of seed	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
	Variety	Variety	Variety	Variety
Self	63(39.37)	28(17.50)	04(02.25)	1(0.62)
Other farmers	07(04.37)	03(01.87)	01(00.62)	0(0.00)
Private	78(48.75)	56(35.0)	16(10.00)	2(1.25)
Government	12(07.50)	10(06.25)	04(02.25)	1(0.62)

Seed is a major component to enhance wheat production and source of seed makes a lot of difference in tackling a number of issues such as weed infestation, disease control, etc. It was interesting to note that more than half of the farmers purchased seed either from private (48.75%) or government (7.50%) agencies (Table 4). About 39.37 percent of them used their own seed in case of the major wheat varieties sown. Some of the farmers purchased seed from other farmers (4.37%) and the extension agencies look for such a horizontal seed distribution system. The seed policy of the government has motivated the farmers to purchase seed from outside and replace the old seed and varieties.

Majority of the farmers in the study area purchased the seed from market or private firm which was either treated or have pouch of powder of medicine used for treatment. About 45 per cent of the sample farmers had not treated the seed before sowing. Though majority of the farmers irrespective of holding size, treated wheat seed, the large farmers (90%) were way ahead of the marginal (69.5%).

**Table 2: Sources of information (%) according to education**

Education	Magazine	Other farmer	State Agri. Institute Officer	SAU	Newspaper	Radio	TV	Input Dealer	
Illiterate	0	18.13	1.88	0.63	3.13	0.00	1.88	3.13	0.00
primary	0	14.38	2.50	1.25	2.50	2.50	3.75	2.50	0.00
Middle	0	15.63	3.13	1.25	1.25	3.13	0.63	3.13	0.63
Matric	0.63	22.50	5.00	2.50	2.50	4.38	0.63	3.75	0.00
Intermediate	1.88	21.25	2.50	2.50	3.13	5.63	0.63	3.75	0.00
Graduate & above	2.50	08.13	2.50	1.88	1.88	5.63	1.25	3.13	2.50



**Table 5: Varietal diversification of wheat**

No. of varieties grown	Frequency (%)
One	63 (39.38)
Two	48 (30.00)
Three	25 (15.63)
More than three	04 (03.13)

About 39.38% of the respondents had sown single variety viz, PBW 343, PBW 502, 550, HD 2851, HD 2967 and DBW 17 (Table 5). Almost one third (30%) of the farmers had sown two varieties and 15.63 percent had sown three varieties. The scientists as well as extension officers have always advised the farmers to grow more than one variety to minimize any risks particularly due to insects and diseases, weather fluctuations, terminal heat, etc. so that farmers should not face any economic loss.

**Table 6: Average yield (q/ha) with date of sowing**

Date of sowing	% farmers	Average yield (q/ha)
22 October	00.63	55.00
1-15 November	48.13	55.88
16-30 November	15.00	51.58
1-19 December	16.88	48.60
20-30 December	13.75	46.13
1-8 January	05.63	40.28

It is clear that the highest average wheat yield (55.88 q/ha) was obtained when the crop was sown during 1-15 Nov closely followed by last week of October (55 q/ha). The declining yield trend was observed when sowing delayed. The average yield was 51.58 q/ha for sowing period 16-30 Nov, 48.60 q/ha for 1-19 Dec, 46.13 q/ha for 20-30 Dec and 40.28 q/ha for 1-8 January (Table 6). The sampled farmers in majority (82.5%) used drill sowing as a method of crop establishment followed by broadcasting (14.37%).

**Table 7: Irrigation management**

Number of irrigations	Frequency (%)
Two	02 (01.25)
Three	13 (08.12)
Four	59 (36.87)
Five	65 (40.62)
Six	20 (12.5)
Seven	01 (00.62)

The farmers in majority (77.49%) had applied four to five irrigations in wheat. The canal and tube well were

the main sources of irrigation (Table 7). Flood irrigation method is generally used in Punjab in all the crops.

**Table 8: Average yield (q/acre) of major wheat varieties, range and percent adoption**

Variety	Percentage farmers	Average yield (q/acre)	Yield range
Barbat	5.88	22.29	18-27
DBW 17	7.56	21.11	17-27
DPW 621-50	3.37	22.50	22-25
HD 2687	0.84	25.00	25
HD 2733	07.56	24.22	18-28
HD 2851	00.80	15.00	15
HD 2894	06.72	20.63	18-24
HD 2932	17.65	20.81	15-25
HD 2967	10.08	22.58	18-28
PBW 343	29.41	20.23	10 - 28
PBW 502	02.52	21.67	20-25
PBW 550	04.20	19.20	18-30
Super 172	00.62	26.00	26
WH 711	01.68	20.00	15-25
WH 542	00.84	20.00	20-24
PBW 373	02.50	12.50	10-15

Table 8 reveals that PBW 343 (29.41%) is still the ruling variety in the study area followed by HD 2932 (17.65%), HD 2967 (10.08%), HD 2733 (7.56%). There were other varieties also like DBW 17, DBW 550, DBW 621-50, Barbat, HD 2894, WH 711, Super 172, and PBW 373. A major point of concern was that the varieties like HD 2733 and HD 2932 which were recommended for the North Eastern and Central India were cultivated in Punjab also. Yellow rust not being a major disease of these area, even varieties with 60S were also recommended making these varieties more vulnerable to this disease in the north western India. The extension agencies find it difficult to dissuade the farmers from cultivating such varieties. Either we need to educate the farmers about possible threat of growing such varieties or the breeders should screen varieties for north east India with the similar standards as in the North West India.

**Table 9: Methods of wheat harvesting**

Category	Frequency	Percentage
Combine	153	95.63
Manual	5	03.12
Both	2	01.25

Majority of the farmers (96.63%) used combine harvester (Table 9). There were only 3.12 per cent who harvested their crop manually. This indicated that mechanization is increasing in wheat harvesting. Labour scarcity is one of the main reasons for mechanization in Punjab.

Majority of the sample farmers (83.13%) did not burn wheat residues. Only 16.88 percent farmers burnt the residue of wheat stubbles to avoid hindering while sowing. This indicated that there was awareness among the farmers about residue management after harvesting. The law enforcement by Govt. of Punjab to stop burning has also played major role in this direction. The state department of agriculture is working hard to educate the farmers about ill effects of residue burning on soil, living beings and environment.

**Weed Control:** All the farmers had applied herbicides to control weeds in wheat crop. Singh and Kumar (2007) also reported that majority of the farmers had applied herbicides to control weeds in wheat crop.

**Table 10: Farmers' perception about yield loss by weeds**

Category	Frequency (%)
Unaware about yield loss	64 (40.00)
< 5%	06 (03.75)
5- 10% loss	36 (22.50)
11- 15% loss	16 (10.00)
16-20% Loss	18 (11.25)
>20%	20 (14.38)

Forty percent of the farmers could not respond about percent yield loss to wheat crop caused by the weeds (Table 10). There were 22.5 per cent who reported 5-10 per cent yield loss. Only 14.38 percent of the farmers reported more than 20 per cent yield loss due to weeds.

**Table 11: Do you think weeds were controlled properly?**

Response	Frequency (%)
Yes	95 (59.38)
No	65 (40.63)

About 60 per cent of the sample farmers perceived that they controlled weeds properly (Table 11). More than 40 per cent farmers were not satisfied with weed control. The possible reasons (Table 12) were substandard chemical (24.15%), spray not uniform (20.5%), foggy weather during spray (20.18%) and use

of same herbicide over years (15.22%). The farmers suggested that (Table 13) weeds can be controlled by timely and uniform spray of herbicides (87.15%), using standard herbicides (78.15%), crop rotation (69.38%), sowing weed free seed (45.50%), usage of new chemicals (45.32%) and rotate herbicide (32.12%).

**Table 12: Possible reasons of poor weed control**

Reasons	Percent
Foggy weather during spray	20.18
Use of same herbicide over years	15.22
Substandard chemical	24.15
Spray not uniform	20.50

**Table 13: Suggestion by the farmers to improve weed control**

Suggestions	Percent
Weed free seed	45.50
Crop rotation	69.38
Purchase standard herbicides	78.15
Timely and uniform spray	87.15
Rotate herbicides	32.12
Usage of new chemicals	45.32
Retain residue	32.50

**Table 14: Ranking of major weeds across crop rotations**

Crop Rotation	Ranking of weeds		
	I	II	III
Rice-wheat	<i>Phalaris minor</i>	Bathua	Jangali Palak
Rice-potato-wheat	<i>Phalaris minor</i>	Bathua	Poa ghas
Cotton-wheat	<i>Phalaris minor</i>	Jangali Palak	Bathua
Rice-maize-wheat	<i>Phalaris minor</i>	Bathua	Jangali Palak

The findings clearly indicate that *Phalaris minor*, *Rumex retroflex* L. (Jangali Palak), and bathua (*Chenopodium album*) were the top ranked weeds across the rice-wheat, rice-potato-wheat, rice-maize-wheat and cotton-wheat crop rotations (Table 14). Ahmad *et al.* (1987) reported that *Avena fatua*, *Phalaris minor*, *Chenopodium album*, *Convolvulus arvensis*, *Asphodelus tenuifolius*, *Carthamus oxyacantha*, *Melilotus alba*, *Fumaria indica*, *Medicago denticulata* and *Senebiera didyma* were the most common weeds found in wheat cultivation.

In cotton-wheat system, 11.88 percent of the sample farmers used metsulfuron plus clodinafop (Algrip plus Topik) in combination to avoid the losses caused by both broad and narrow leaves weeds (Table 15). Almost one tenth of farmers used clodinafop

**Table 15: Type of herbicides used by farmers (%) according to crop rotation**

Herbicides	Cotton-Wheat	Potato-Wheat-Maize	Rice-Potato-Wheat	Rice-Wheat	Total
Algrip	1.88		0.63		02.50
Agrip; Leader			1.25		01.25
Algrip; Topik	11.88		0.63	07.50	20.00
Topik	10.00	2.5	2.50	28.75	41.25
Topik; Metsulfuron			1.25		01.25
Topik; 2,4-D	01.25		1.88	01.88	05.00
Leader		2.5	8.13	04.37	12.50
Leader; Topik			1.25	08.75	10.00
Total			2.50	00.62	03.13
Leader; 2,4-D				00.63	00.63
Axial				02.50	02.50

(Topik) in this system for the control of narrow leaf weeds such as *Phalaris minor* (Mandusi), *Avena ludoviciana* (jangli jai) and *Poa annua* L. (Poa ghas) etc. In potato-wheat maize cropping system in Punjab sulphosulfuron (Leader) and clodinofof (Topik) were used almost at par (2.5%) by the farmers. Different herbicides were used in rice-potato-wheat cropping system, 8.13% used sulphosulfuron (leader) to avoid the losses caused by the both types of weeds. In rice-wheat system majority (28.75%) used clodinofof (topik) as major herbicide followed by Algrip + Topik (7.5%) in combination. Overall in the area, majority (41.25%) used clodinofof for the control of narrow leaf weeds followed by metsulphuron + clodinofof (Algrip + Topik) in combination.

**Table 16: Farmers' level of knowledge and adoption of weed control technologies**

Method	Knowledge (%)	Adoption (%)
Advance sowing	52(32.50)	10(06.25)
Zero tillage reduces <i>Phalaris minor</i>	22(13.75)	04(02.25)
Retention of crop residue	52(32.50)	24(15.00)
Crop rotation	111(69.38)	70(43.75)
Increased seed rate	62(38.75)	26(16.25)

Knowledge of respondents about different weed control strategies was poor (Table 15). Farmers were aware that crop rotation (69.38%), increased seed rate (38.75%), retention of crop residue on soil surface (32.5%) and advance sowing (32.5%) helps in weed control. Under the agronomic management practices, crop rotation (43.75%), increased seed rate (16.25%) and crop residue retention (15%) were adopted by the farmers to control weeds. A few farmers were aware

of zero tillage to control *Phalaris minor* and crop residue (15%) (Table 16). Mahal *et al.* (2009) have also mentioned that zero tillage helps in controlling *Phalaris minor*.

Across the crop rotations, most of the farmers used knapsack sprayers (Table 17). Some of the farmers used power sprayer in cotton-wheat (7.5%) and rice-potato-wheat (8.75%) rotations. Flat fan nozzle was used by only 5.63 percent of the farmers in rice-wheat crop rotation. Boom nozzle was also used by the farmers in rice-wheat (13.13%), cotton wheat (13.75%) and rice-potato-wheat (6.25%) rotations. Rest of the farmers used cut nozzle which was more prominent across the rotations. Most of the farmers sprayed herbicide themselves due to scarcity of labour. All the farmers replied that they did not increase the dose of herbicide to control weeds. About 78.8 percent of the farmers replied that they had applied the same herbicide this year as in the preceding year. About half (53.13%) of the farmers across the crop rotations have mentioned that they had to apply herbicide twice in the crop season due to poor weed control. About 38.13 percent of the farmers used the same herbicide even second time in the same season, whereas, 15 percent of the farmers had applied the other herbicide.

## CONCLUSION

Weeds cause significant losses to wheat crop which can be minimized by adopting appropriate weed management strategies. *Phalaris minor*, *Rumex retroflex* L. (Jangali palak), *Poa ghas* and bathua were the top ranked weeds across wheat based crop rotations. Herbicide rotation, use of flat fan nozzle or bloom nozzle,

**Table 17: Weed management in different crop rotations**

Operations	Sprayer used	Rice-Wheat	Cotton-wheat	Potato-Wheat -Maize	Rice-Potato -Wheat	Total
Sprayer used (%)	Knapsack	50.00	17.5	5.00	11.25	83.75
	Power	0	07.50	0	08.75	16.25
Nozzle used (%)	Flat fan	05.63	00.00	0	0	5.63
	Cut	31.25	11.25	5	13.75	61.25
	Boom	13.13	13.75	0	06.25	33.13
Sprayed by (%)	Self	25.63	11.88	2.50	01.88	41.89
	Labour	13.75	06.25	2.50	15.63	38.13
	Both	10.63	06.88	0	02.50	20.01
Increased dose over last year (%)	No	50.00	25.00	5.00	20.00	100
Used same herbicide as last year (%)	Yes	31.25	20.00	3.75	16.88	71.88
	No	18.75	05.00	0	03.13	26.88
	No response	0	00.00	1.25	0	1.25
Herbicide used second time (%)	Same	13.13	06.25	2.50	16.25	38.13
	Other	06.25	03.75	1.25	03.75	15

application of herbicides at appropriate time (30-35 days after sowing) helps in controlling weeds. Some of the farmers were aware of crop rotation, higher seed rate, retention of crop residue on soil surface, zero tillage technology of wheat sowing as weed management strategies. Adoption of these strategies has to be stepped up to enhance wheat production.

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# Attitude of Farmers and Extension Personnel towards Sustainable Groundnut Production in Semi-arid Eastern Plains of Rajasthan

J.P. Singh<sup>1\*</sup>, G.S. Bangarva<sup>2</sup> and Vikram Singh<sup>3</sup>

<sup>1</sup>Agriculture Officer, Agriculture Department, Government of Rajasthan

<sup>2</sup>Professor, SKN Agricultural University, Jobner, Rajasthan; <sup>3</sup>Scientist, IP&TM Unit, ICAR, New Delhi

## ABSTRACT

The issue of sustainability have become increasingly important to policy makers, farmers and the public. The present study, especially focuses on the sustainability of groundnut production in Semi-Arid Eastern Plains of Rajasthan, where 200 groundnut producing farmers and 50 extension personnel were identified by combination of simple random and proportionate sampling methods. The outcomes of the study shows that, most of the farmers (80.50 per cent) belonged to the neutral attitude level category. It is further noted that 9 per cent of the respondents fell under favourable attitude level category. 46 per cent of extension personnel were having favourable attitude towards sustainable groundnut production. It is further noted that 44 per cent of the respondents fell under natural attitude. Attitude of farmers towards sustainable groundnut production showed positive and significant association with land holding, socio-economic status, education, social participation, family education, economic motivation, sources of information utilized and change proneness. It will pertinent to make efforts to educate the farmers through mass media for making their attitude favourable.

**Keywords:** Attitude, Extension personnel, Favourable, Groundnut

## INTRODUCTION

The high input technology driven model was instrumental in increasing crop yields globally, after early agriculture development efforts become focused on changing the local socio-economic environments to suit technology through subsidies and incentives (Pretty, 1996). Though this approach succeeded in meeting many ambitious production targets, the benefits were distributed in favour of resource rich farmers. Moreover, followed by the single motive of high production, technological innovations favored an over exploitation of biological resources and weakening of the traditional approaches causing total marginalization of poor, small and marginal farmers.

The disillusionment over this conventional approach in agriculture was on the rise since the early years of 1980's. Jackson (1980), Dover and Talbot (1987) and Conway and Barbier (1990) were some of the front runners who called for a qualitative shift in

priorities and practices favouring resource conserving technologies in agriculture. It was the Bruntland Commission report in mid-1980's that directed the attention of the international community to the resource regenerating model of sustainable agriculture. In fact, sustainable agriculture developed in response to concerns about impacts of modern agriculture such as depletion of non-renewable resources, soil degradation, health and environmental effects of agricultural chemicals, inequity, declining rural communities, loss of traditional values, food quality, farm workers and safety decline in self-sufficiency and decreasing number and increasing size of farms (Dahlberg, 1986).

Indian economy is greatly influenced by the oilseed group of crops. Oilseeds, the raw materials for vegetable oils, occupy a significant place in India's national economy, next only to food grain accounting for about 13 per cent of cultivated area and 5 per cent of the gross national product and 10 per cent of the value of all

\*Corresponding author email id: pratap.jwala@gmail.com

agricultural products. In India 85 per cent vegetable oils are obtained from nine cultivated crops viz. groundnut, rapeseed-mustard, sesamum, linseed, safflower, castor, sunflower, niger and coconut. India is the leading groundnut producing country since it account for about 34.5% world groundnut area and about 27.3% production (second to China). However, India ranks tenth in productivity of world groundnut average productivity hover around 1187 kg/ha. In Rajasthan also groundnut is grown over vast area. The area and production of groundnut in last one decade remained varied which can be due to a number of reasons which like degradation/depletion of soil fertility, increased epidemic of insect, pest and disease, infestation of weeds, decline in water table etc. In addition of above physical and technical constraints the farmers have experienced a continuous escalation in cost of production, resulting in decrease in income.

Keeping in view the depletion of natural resources, environmental pollution and limitation of sustainable agriculture, it becomes essential to know the attitude of farmers and extension workers and its association towards sustainable groundnut production. In the present study, the psychological objects is sustainable groundnut production practices against which farmers' agreement or disagreement was recorded.

## MATERIALS AND METHODS

The study was conducted in agro-climatic zone IIIa (Semi-Arid Eastern Plains) of Rajasthan state, which is having highest area (109896 ha) and production (148423 tonnes) of groundnut. Zone IIIa having geographical area of 2.96 million ha spread over Ajmer, Jaipur, Dausa and Tonk districts of Rajasthan. Out of these four districts two Jaipur and Dausa were selected due to their highest area and production under groundnut. Based on maximum acreage under groundnut cultivation five tehsils viz. Jaipur, Chomu, Amber and Phagi in Jaipur district and Sikrai in Dausa district were selected. Two Gram Panchayats from each Tehsil and two villages from each Gram Panchayat were selected randomly. A sample of 200 groundnut growers (Farmers cultivating groundnut for last 5 years on a minimum land size of ½ acre) was selected by using proportion probability sampling technique. A total of 50 extension personnel associated with groundnut ToT were selected randomly for the purpose of study.

Attitude Scale: Attitude is a very important component of behavior as it plays significant role in forming the overt and covert behavior of a farmer. The concept of attitude described by Thrustone (1946), Skinner (1977), and Supe (1993) as psychological process associated with perceptions. To measure the attitude of farmers and extension personnel towards sustainable groundnut production an attitude scale was developed by using Likerts (1932) technique. The construction and standardization of scale was completed by collection of 58 statements concerning the attitude of farmers towards sustainable groundnut production on the basis of recommendations of by the National Research Centre for Groundnut (NRCG), Junagadh, Gujarat; Swami Keshwan and Rajasthan Agricultural University (SKRAU), Bikaner; and State Department of Agriculture (SDA), Rajasthan. Further the subject matter areas were selected by discussing with a number of extension specialists of SKRAU, SDA, and consulting farmers of various categories.

The statements were carefully edited in the light of 14 criteria suggested by Edwards (1969). These items were sent to 77 judges for their relevancy test on four point continuum viz., most relevant, relevant, least relevant and not relevant with the score of 4, 3, 2 and 1 respectively. The relevancy of these judge's response were analyzed and considered only those statements which had more than 75.00 Relevancy Percentage, 0.75 Relevancy Weightage and 3.00 Mean Relevancy Scores, respectively. By this process 26 items were isolated for item analysis, where a questionnaire was used to collect the responses from 40 farmers, by personal interview. Finally, the attitude score of a respondent was obtained by summing the scores of all items. The 't' value was worked out to measure the extent to which a given statement differentiates between the high and low groups. Hence, the statements with 't' value of equal or greater than 1.75 were selected as attitude items. Finally, on the basis of their 't' values, 16 statements, were selected for inclusion in the attitude scale. The 't' value for each statement was worked out by using the following formula :

$$t = \frac{X_H - X_L}{\sqrt{\frac{\sum(X_H - X_H) + \sum(X_L - X_L)}{n(n-1)}}$$

Where, X= The mean score on a given statement of the high group

XL = The mean score on a given statement of the low group

n = The number of subject in each group

$$\Sigma(XH - XL)^2 = \frac{\Sigma XH^2 - \frac{(\Sigma XH)^2}{n}}{n} - \frac{(\Sigma XL)^2}{n}$$

$$\Sigma(XL - XL)^2 = \frac{\Sigma XL^2 - \frac{(\Sigma XL)^2}{n}}{n}$$

The split half method for testing reliability was employed. The Pearson Product Moment Correlation Coefficient analysis was employed to determine the degree of relationship between the two scores. It was found to be 0.76 which was significant with ‘t’ value 4.96. The reliability coefficient thus obtained indicated high internal consistency of attitude scale constructed for the study. While selecting attitude statements due care was taken for obtaining a fair degree of content validity. The calculated ‘t’ value being significant for all the finalized statements of the score indicated that the attitude statements of the scale had discriminating values.

Method of scoring: Each attitude item was provided with a five-point continuum. Hence, the response categories were strongly agree, agree, undecided, disagree and strongly disagree. An item, which was favourable to the object, considered and scored as 5, 4, 3, 2 and 1 respectively. For items that were negative to the object, the scoring procedure was reversed. The cumulative score of each respondent for all the statements was considered as attitude score. The maximum possible score could be 80 whereas the minimum score possible would be 16 to each individual. The attitude of the farmers towards sustainable groundnut production was measured with the help of attitude scale specially prepared for the purpose of the study.

On the basis mean and standard deviation of the attitude score, the attitude level of extension personnel were classified in to three categories viz., unfavourable, natural and favourable. To know the association between farmers and extension workers attitude towards sustainable groundnut production and selected

independent variables was analyzed by applying zero order correlation (r) and multiple regression. Distribution of farmers according to their attitude towards sustainable groundnut production was summarized by using mean (X), Standard Deviation (S.D.) and the Coefficient of Variation (CV).

### RESUTLS AND DISCUSSION

Farmers attitude towards sustainable groundnut production: Attitude of farmers towards sustainable groundnut production has profound implication in integrating the goal of environmental conservation with production. The data in Table 1 shows that attitude score of farmers ranged from 20 to 75 having mean attitude score of 52.32 against maximum possible attitude score of 80. It reveals that the farmers on an average had neutral attitude level towards sustainable groundnut production. The perusal of this data shows that most of the farmers (80.50 per cent) belonged to the neutral attitude level category. It is further noted that 9 per cent of the respondents fell under favourable attitude level category. However, only 10.50 per cent of the respondents were under unfavourable attitude level category. Thus it is obvious that more than 89 per cent of the farmers had neutral to favourable attitude level towards sustainable groundnut production. The attitude of farmers was found neutral due to their medium knowledge level towards sustainable groundnut production. This could be attributed to general misconception that sustainable groundnut production resulted in lower production and economic returns.

**Table 1: Distribution of farmers according to their attitude towards sustainable groundnut production (N=200)**

Attitude level	Frequency	Percent
Unfavourable (upto 42.33 score)	21	10.50
Neutral (from 42.34 to 62.31 score)	161	80.50
Favourable (above 62.31 score)	18	9.00

X = 52.32; S.D. = 9.99; CV = 19.10

It was also disclosed in the findings that, farmers attitude was more favourable in relation to these items which were related to ‘natural resources conservation’ component, it was lowest level of agreement in relation to those items which were related to ‘high input use and related problems component, same was the case for ‘profitability’ and ‘farming efficiency’ components.



On the items related to 'natural resource conservation' majority of farmers had an attitudinal disposition in favor of sustainable groundnut production. In fact these dimensions had direct impact on their lives and surrounding and they were experiencing the hazards of environmental degradation. As such they favoured sustainable groundnut production on these dimensions as an alternative to conventional agriculture. In case of 'high input use and related problems', it seemed that the majority of the farmers were not convinced about the potential of substitutes of high inputs use in actual farming situations. For instance the non-availability of organic manures in required quantities might be the major reason for the farmers to take this pragmatic attitudinal position on few items of scale.

The results of farmers attitude towards sustainable groundnut production were in similarity with the results of Krishnakutty (1995), Rahaman and Mikuni (1999), Shivrain (2002), Singh and Roy (1993), Aye and Chamjai (2009), James and Helen (2014), Suman (2014), Gour *et al.* (2014), and Bhat *et al.* (2014).

**Response of farmers on different components of attitude scale:** An attempt was made to analyze the response of farmers on different components of attitude scale. As seen from Table 2 in case of 'natural resource conservation' component majority of farmers (62 per cent) fall in 'agree' category whereas in case of 'farming efficiency' and 'profitability' component about half of farmers (50 per cent and 52 per cent respectively) lie in agree category, but only 46 per cent farmers lie in 'agree' category in case of 'high input use and related problems'.

**Table 2: Farmers response on different components of attitude towards sustainable groundnut production (N = 200)**

Components	Level of agreement in per cent		
	Agree	Undecided	Disagree
Natural resources conservation	62	8	30
High input use and related problems	46	7	47
Farming efficiency	50	12	38
Profitability	52	11	37
<b>Overall</b>	<b>52.5</b>	<b>9.5</b>	<b>38</b>

**Extension personnel attitude towards sustainable groundnut production:** Extension personnel play a key role in influencing the attitude of farmers towards the concept of sustainable groundnut production. So, it is important to know how they themselves view this concept.

**Table 3: Distribution of extension workers according to their attitude towards sustainable groundnut production (N=50)**

Attitude level	Frequency	Percent
Unfavourable (upto 54.23 score)	5	10
Neutral (from 54.24 to 73.97 score)	22	44
Favourable (above 73.97 score)	23	46

X = 64.10; S.D. = 9.87; CV = 15.39

Table 3 shows the distribution of extension personnel on attitude towards sustainable groundnut production. Majority of extension personnel (46 per cent) were having favourable attitude towards sustainable groundnut production. It is further noted that 44 per cent of the respondents fell under natural attitude towards sustainable groundnut production. However, only 10 per cent of the respondents were under unfavourable attitude towards sustainable groundnut production.

**Response of extension personnel on different components of attitude scale:** To have a better insight into the divergence of extension personnel on various components of attitude scale, the component wise analysis has been presented in Table 4. In case of 'high input use and related problems' component majority of extension personnel (80.00 per cent) falls in agree category, whereas in case of 'natural resources conservation' and 'farming efficiency' component about 72 and 58 per cent extension personnel falls in 'agree' category, but only 50 per cent farmers lie in 'agree' category in case of 'profitability'.

It was disclosed in above findings that, majority of extension personnel fetching them favourable attitude towards sustainable groundnut production. The results also indicate a trend in favour of sustainable groundnut production on three components, namely, 'high input use and related problems', 'natural resources conservation' and 'farming efficiency'. Through in case of 'profitability' component it was moderate. It remained obvious that their professional curriculum

**Table 4: Extension personnel response on different components of attitude towards sustainable groundnut production (N = 50)**

Components	Level of agreement in per cent		
	Agree	Undecided	Disagree
Natural resources conservation	72	14	14
High input use and related problems	80	4	16
Farming efficiency	58	12	30
Profitability	50	8	42
<b>Overall</b>	<b>65.00</b>	<b>9.5</b>	<b>25.5</b>

training spurred them to develop such an attitude on these profitability related items. Similar results were obtained by Krishnakutty (1995), Shivrain (2002), Aye and Chamjai (2009), James and Helen (2014), Suman (2014), Gour *et al.* (2014), and Bhat *et al.* (2014).

Association between farmers attitude towards sustainable groundnut production and selected independent variables: The relationship between the selected independent variables and attitude of farmers towards sustainable groundnut production was calculated by applying zero order correlation ( $r$ ). The Table 5 shows that land holding, socio-economic status, education, family education, source of information utilized and change proneness were found positively and significantly associated with attitude towards sustainable groundnut production at one per cent level of significance. Whereas social participation and economic motivation were positively and significantly related with attitude of farmers towards sustainable groundnut production at five per cent level of probability.

It means that these variables were contributing towards the attitude of farmers in positive terms. This does not supported the hypotheses of this study i.e. “there was no correlation between land holding, socio-economic status, education, social participation, family education, economic motivation, source of information utilized, changes proneness and attitude of farmer towards sustainable groundnut production” hence these were rejected.

Further the findings revealed that independent variables namely risk orientation and age was non-significantly related with the attitude of farmers towards sustainable groundnut production. Hence it supported

**Table 5: Relationship between independent variables and attitude of farmers towards sustainable groundnut production (N=200)**

Independent variables	Co- coefficient of correlation 'r' value
Age	-0.074
Land holding	0.255**
Socio-economic status	0.284**
Education	0.367**
Social participation	0.139*
Family education	0.274**
Risk orientation	0.041
Economic motivation	0.176*
Source of information utilized	0.299**
Change proneness	0.314**

\* = Significant at 0.05 level of probability; \*\* = Significant at 0.01 level of probability

the hypotheses that “there was no correlation between age, risk orientation and attitude of farmers about sustainable groundnut production”. Hence the hypothesis were accepted.

Multiple regression equation with ten independent variables related to the attitude of farmers towards sustainable groundnut production: Multiple regression technique was applied to know the influence of each

**Table 6: Coefficient of multiple determination and partial regression of independent variables on attitude of farmers towards sustainable groundnut production (N= 200)**

Independent	b-value (Reg. Cof.)	s-error of b	t-value variables
Age	0.047784	0.034214	1.397
Land holding	0.334288	0.193382	1.729
Socio-economic status	0.179563	0.071490	2.512*
Education	0.952616	0.298187	3.195**
Social participation	0.890471	0.565665	1.574
Family education	0.138039	0.128795	1.072
Risk orientation	-0.025227	0.071290	-0.354
Economic motivation	0.130134	0.230688	0.564
Source of information utilized	0.090649	0.282910	3.204**
Change proneness	0.746008	0.231043	3.229**

Determination coefficient  $R^2 = 0.81826$

Multiple correlation  $R = 0.90457$

F-calculated = 8.85326 d.f. 10, 189

\*Significant at 0.05 level of significant; \*\*Significant at 0.01 level of significant

of the ten selected independent variables individually and combined on the attitude in sustainable groundnut production (Y). All the ten selected independent variables along with the dependent variable (i.e. attitude) were put in the multiple regression equation. The results have been presented in Table 6.

Data in Table 6 elucidated that all the ten independent variables taken together explained to the extent of 81.82 per cent of the variation for the attitude in the recommended practices in sustainable groundnut production of farmers. The respective 'F' value was 8.85326 at 10, 189 degree of freedom which was significant at 0.01 level of probability. Thus the results implied that all the ten variable had accounted for a significant amount of variation for the attitude in sustainable groundnut production.

Further, it was also observed that 't' test of significance expressed coefficient of regression 'b' value were positively significant for education (X4), source of information utilized (X9), and change proneness (X10) at one per cent of probability similarly, socio-economic status (X3) was positively significant at 0.05 level of probability. On the contrary, coefficient of regression (b-value) were non-significant for age (X1), land holding (x2), social participation (x5), family education (X6), risk orientation (X7) and economic motivation (X8).

The results of the analysis were indicative of the fact that education, source of information utilized, change proneness and socio-economic status of the farmers were the most important predictors of the attitude in sustainable groundnut production.

### IMPLICATIONS

The attitude of farmers was found at neutral level towards sustainable groundnut production. Efforts should be made to educate the farmers through mass media viz., newspapers, farm magazines etc. and short duration training programmes in the villages as per the convenience of the farmers. Study tours to successful farm sites should also be arranged to increase their knowledge as well as change their attitude. Extension agencies, themselves should modify their approach and attitudes to gender issues and methods by which to reach farmers. Front line research philosophy should change to become farmer oriented and field based. The attitude of extension personal was found favourable

only to a moderate extent. The refresher courses for extension personnel should be organized by the authorities. Group discussions should be conducted during such courses to remove their doubts and misgivings which would help in formulating more favourable attitude towards sustainable practice.

The level of extension contact of the farmers was not satisfactory in the study area. This is a very serious problem since it is not feasible for the Govt. to increase the number of extension workers, the extension activities of the University and the state department of agriculture need to be regularized and closely monitored to have an effective contact with more number of farmers. Simultaneously, some motivating strategy should also be developed in the form of incentives for the extension workers to encourage them to have more and more field visits.

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# Integrated Farming Systems Approach for Income Enhancement and Employment Generation in North-West India

**Ravinder Singh and T.S. Riar**

Department of Extension Education, Punjab Agricultural University, Ludhiana, Punjab

## ABSTRACT

A study was conducted during 2011-12 on the Punjab farmers to find out the productivity, profitability and employment generation of integrated farming system as compared to conventional cropping system. The study comprised of two integrated farming systems viz., crop + dairy and crop + forestry. Both these integrated farming systems were productive and profitable than that of sole cropping system. The net returns increased in the tune of 18.82 per cent and 2.61 per hectare with inclusion of dairy and forestry enterprises, respectively over sole cropping system. The study also indicated that crop + dairy farming system generated 27.04 mandays/hectare/annum/farm employment for family, 34.42 mandays/hectare/annum/farm for hired labour and 61.46 mandays/hectare/annum/farm total labour. In case of crop + forestry, it was observed that employment generated through crop + forestry farming system for family labour was 26.27 mandays/hectare/annum/farm, for hired labour was 38.70 mandays/hectare/annum/farm and for total labour was 64.97 mandays/hectare/annum/farm.

**Keywords:** Enhancement, Employment, Generation, Farming system, Integrated, India

## INTRODUCTION

In India Punjab is one of leading state of Indian agriculture. The progressive personality of state is passing through complex problems such as soil degradation, declining water table, appearance of multi-nutrient deficiencies which is further coupled with effects of climate changes. The modern agricultural practices which are heavily dependent on the use of chemical pesticides, inorganic fertilizers and growth regulators has raised the agricultural production manifold but at the cost of resource depletion, environmental deterioration and loss of crop diversity. The major reason for these problems is the continuous cultivation of wheat-paddy, excessive use of insecticides, pesticides, weedicides etc. and other wrong farming patterns. To overcome the problems and to make the agriculture profitable, there is dire to shift paddy pattern to alternative crops like cotton, maize, pulses, oil seeds, fruits, and vegetables etc. There is also need to encourage other enterprises like beekeeping, dairy, mushroom cultivation, forestry, vegetable, and livestock

production etc. for additional income generation. Therefore the present concern is to ensure the livelihood security, which can very safely accrued by following the farming system approach. Farming system approach is adequate combination of different enterprises which interact with environment and agriculture inputs without dislocating the ecology on one hand and meeting the national goal on other hand.

It is pre-requisite in farming system to ensure the efficient recycling of resources particularly crop residues, because 80-90% of the micronutrients remains in the biomass (Gill *et al.*, 2011). Integrated farming system represents a complicated interwoven mesh of soil, plant, livestock, workers, farm inputs and environmental influences (Shekinah and Sankaran, 2007). Among the different system variables, some of these are necessary to manipulate as per need of the area as well as system approach for making it more productive according to their preferences and aspirations. The integration of crop and animals enables synergistic interaction, which has a greater total contribution than the sum of their

individual effects (Edwards *et al.*, 1988). Various farming systems approaches are being practiced by the farmers of Punjab which fulfill their needs by maintaining balance of ecology. They manage farm enterprises like crops, dairying, poultry, fishery, sericulture, piggery, tree crops etc. in such a way that they could get more profit from all the enterprises and field. The present study was planned to assess the profitability and employment generation in different integrated farming systems.

### MATERIALS AND METHODS

The compressive study was conducted during 2011-12. The Punjab Agricultural University awards prizes to progressive farmers at farmers fair for the adoption of latest technologies and this concept which was started in 1997 in memory of a progressive farmer, Sardar Dalip Singh Dhaliwal. The first award was started by the family of Sardar Dalip Singh Dhaliwal in 1997 by donating the funds for this purpose. Other awards namely 'Chief Minister Award (agriculture), Chief Minister Award (horticulture), Parwasi Bharti Award, Ujagar Singh Dhaliwal Award and Surjit Singh Dhillon Award, Sardarni Jagbir Kaur Memorial Awards were instituted by Punjab Agricultural University later on. A fool proof system of selecting the farmers for awards has been developed by the university. Since 1997, forty-nine farmers have been awarded for their excellent performance in agricultural activities. All these awardee farmers till 2011 by Punjab Agricultural University Ludhiana, Punjab were selected as respondents. A list of respondents was taken from Directorate of Extension Education, Punjab Agricultural University, Ludhiana, and all of them were respondents for study. It comprises of 60 awardee farmers by Punjab Agricultural University, Ludhiana for their achievements in agriculture sector. The respondents were belonged to Bathinda, Tarantaran, Muktsar, Gurdaspur, Patiala, Roopnagar, Moga, Sangrur, Kapurthala, Ferozpur, Barnala, Ludhiana, Amritsar, Ropar, Jalandhar, Nawasehar, Faridkot and Hoshiarpur districts of Punjab State.

An appropriate research instrument *i.e.* questionnaire was prepared as per the objectives of the study to collect the data from the respondents. A questionnaire was prepared for the data collection which was based on the criteria approved by Punjab Agricultural University, Ludhiana for selection of the

farmers for the various awards. It consisted of items related to the most profitable farming system. It includes items related to assessment of net income of successful farmers with different farming systems. It included costs and net returns from the farming system and farming system with highest net returns was considered as most profitable and it also comprised of items related to the impact of farming system approaches on employment generation. It dealt with employment generated for family labour and hired labour through different integrated farming system. The data were collected personally by the researcher by visiting the study area and interviewing the respondents. For receiving the response of respondents, the investigator contacted them personally in their villages. Proper precautions were taken to ensure unbiased response of the respondents by providing them necessary instructions after explaining the objectives of study. The present study comprised of two farming systems crop + dairy and crop + forestry. It dealt with comparison of profitability and employment generation through these farming systems. The results of study indicated that crop + dairy is more profitable than crop + forestry. But crop + forestry have more employment generation than crop + dairy.

### RESULTS AND DISCUSSION

The data presented in Table 1 indicated that net returns from only crops per hectare in crops + forestry farming system were Rs. 60105 but with floriculture the net returns per hectare increased to Rs. 61718. There was 2.61% per hectare increase in the net returns due to addition of forestry over crop system. Similarly, in case of crops + dairy farming system (Table 2) the net returns from only crops per hectare in crops + dairy farming system was Rs. 55074 but with second enterprise *i.e.* dairy the net return increases to Rs. 67841 per hectare. There was 18.82% per hectare increase in net returns. This increase in net returns is due to income flow from forestry by selling of wood production from the trees and in case of dairy there is income flow due to selling of milk and milk products. Gill *et al.* (2011) reported that there are a number of farmers who are running these farms in profitable ways by the use of modern and stable techniques. The fodder fed to the cattle produces milk. The dung, urine and litter produce farmyard manure and energy used for crops and fish

**Table 1: Returns from crop + forestry**

Area under crops	14.17 ha	
Area under forests	1.62 ha	1200 trees
Cost Items	Rs./farm	Rs./ha
<b>Crops</b>		
Seed	39832	2811
FYM and fertilizers	71374	5037
Plant protection	35623	2514
Irrigation charges	32832	2317
Fuel and mobile oil	50318	3551
Hired-in labour	101656	7174
Land rent	95208	6719
Miscellaneous	82668	5834
Total	509511	35957
Interest on variable cost	25476	1798
Total variable cost	534986	37755
Interest on fixed capital	34422	2429
Depreciation on fixed capital	31030	2190
Total fixed cost	65452	4619
Total cost	600438	42374
<b>Returns from crops</b>		
Gross returns	1452127	102479
Total cost	600438	42374
Net returns	851689	60105
<b>Forestry: Costs</b>		
FYM and fertilizers	14273	
White washing	452	
Irrigation charges	3167	
Labour charges	4978	
Interest on fixed capital	1837	
Total	24707	
<b>Returns from forestry</b>		
Gross returns	47561	
Total cost	24707	
Net returns	22854	
Total net returns from crops and forestry per farm	874543	
<b>Total net returns from crops and forestry per hectare</b>	<b>61718</b>	
<b>Additional net returns due to forestry/farm</b>	<b>22854</b>	
<b>Percentage increase in net returns due to forestry/farm</b>	<b>2.61%</b>	

pond. The siltation of fish pond is utilized as manure to crops. The farmyard manure can substitute about 25% of recommended N P and K for crops, besides improving the physical and biological properties of soil. Various farming systems approaches are being practiced by the farmers of Punjab which fulfill their needs by maintaining balance of ecology. They manage farm

**Table 2: Returns from crop + dairy**

Area under crops	24.68 ha	
Number of milch animals	10.83	
Cost Items	Rs./farm	Rs./ha
<b>Crops</b>		
Seed	72563	2940
FYM and fertilizers	133823	5422
Plant protection	65310	2646
Irrigation charges	55479	2248
Fuel and mobile oil	89342	3620
Hired-in labour	178749	7243
Land rent	183233	7424
Miscellaneous	146454	5934
Total	924954	37478
Interest on variable cost	46248	1874
Total variable cost	971201	39352
Interest on fixed capital	104421	4231
Depreciation on fixed capital	94130	3814
Total fixed cost	198551	8045
Total cost	1169752	47397
<b>Returns from crops</b>		
Gross returns	2528990	102471
Total cost	1169752	47397
Net returns	1359238	55074
<b>Dairying : Cost</b>		
Feeds and fodder	274684	
Labour charges	49276	
Veterinary services	25473	
Other costs	11243	
Interest on fixed capital	17472	
Total	378148	
<b>Returns from dairying</b>		
Gross returns	693228	
Total cost	378148	
Net returns	315080	
Total net returns from crops and dairying per farm	1674318	
<b>Total net returns from crops and dairying per hectare</b>	<b>67841</b>	
<b>Additional net returns due to dairying/farm</b>	<b>315080</b>	
<b>Percentage increase in net returns due to dairying/farm</b>	<b>18.82%</b>	

enterprises like crops, dairying, poultry, fishery, sericulture, piggery, tree crops etc. in such a way that they could get more profit from all the enterprises and field.

In any integrated farming system, engagement of year-round farm labour including family members and hired labour irrespective of gender and age, is generally

**Table 3: Employment generation through crop + forestry**

Enterprise	(Mandays/annum/farm)					
	Family labour		Hired labour		Total labour	
	Days	Percengate	Days	Percengate	Days	Percengate
Crops	346.11	40.61	506.23	59.39	852.34	100.00
Forestry	26.15	38.30	42.13	61.70	68.28	100.00
Crops + Forestry	372.26	40.44	548.36	59.56	920.62	100.00
Percent increase/farm	7.56%	8.32%	8.01%			
Per ha employment	26.27	38.70	64.97			

**Table 4: Employment generation through crop + dairy**

Enterprise	(Mandays/annum/farm)					
	Family labour		Hired labour		Total labour	
	Days	Percengate	Days	Percengate	Days	Percengate
Crops	643.16	44.17	812.98	55.83	1456.14	100.00
Dairying	24.28	39.99	36.44	60.01	60.72	100.00
Crops + Dairying	667.44	44.00	849.42	56.00	1516.86	100.00
Percent increase/farm	3.78%	4.48%	4.17%			
Per ha employment	27.04	34.42	61.46			

more as compared with conventional cropping system alone which has been reflected in this study (Table 3,4). Data presented in Table 3 showed that employment generated through crop + forestry farming system for family labour was 346.11 mandays/annum/farm (40.61%) and for hired 506.23 mandays/annum/farm (59.39%). Forestry increased the family labour by 7.56% mandays/annum/farm, hired labour by 8.32% mandays/annum/farm and total labour by 8.01% mandays/annum/farm. In crop + forestry farming system, employment for family labour generated was 26.27 mandays/hectare/annum/farm, for hired labour was 38.70 mandays/hectare/annum/farm and for total labour was 64.97 mandays/hectare/annum/farm. It was observed from Table 4 that employment generated through crop + dairy farming system for family labour was 643.16 mandays annum/ farm (44.17%) and for hired labour 812.98 mandays/annum/farm (55.83%). Dairy increased the family labour by 3.78% mandays/annum/ farm, hired labour by 4.48% man days/annum/farm and total labour by 4.17% man days/annum/ farm. Employment generated through crop + dairy farming system for family labour was 27.04 man days/ hectare/ annum/ farm, for hiredlabour was 34.42 man days/ hectare/ annum/ farm and for total labour was 61.46 man days/ hectare/ annum/ farm. Gill *et al.* (2011) reported that Integrated farming system requires more labour comparatively wheat-paddy farming

system. In wheat-paddy farming system mainly labour is required in sowing and harvesting time but in integrated farming system labour is required throughout the year. Farmers take only two crops in wheat-paddy farming system but farmers take more than two crops, so more employment is generated through integrated farming system. Combing crop with livestock enterprises would increase the labour requirement significantly and would help in reducing the problems of under employment to a great extent integrated farming system provide enough scope to employ family labour round the year at the farm of Bhupinder Singh at village Virk, the dairy enterprise could gave Rs. 10,761/ha and poultry also enhanced the margin to Rs 11,546/ha. This enterprise could generate additional manpower of 173 mandays/annum.

## CONCLUSION

Thus, it can be concluded that integrated farming system is the only way to get more profits from the agriculture and to generate the human labour as compared to monocropping. Integrated farming system on one hand increase economic yield per unit area per unit time by virtue of intensification of crop and allied enterprises, provides flow of money to the farmer round the year, make the agriculture profitable and on other hand it is very helpful to reducing the problems of under employment. Farmers can earn higher profit



margins and can generate more employment opportunities by adopting integrated farming systems approach. Integrated farming system reduces the cost of production by recycling the residues in the field and also helps to conserve water, soil health and nutrients

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# Assessment of Farmers' Knowledge about Beneficial Effects of Application of Paddy Straw onto Soil in West Bengal

Pinaki Roy\* and Manmeet Kaur

College of Agriculture, Punjab Agricultural University, Ludhiana-141004, Punjab

## ABSTRACT

West Bengal is the major paddy growing State in India and, as a consequence, a huge amount of paddy straw is also produced. Paddy straw has diversified uses. Paddy straw contains a significant amount of organic fertilizer which is helpful in improving the soil health. But a large portion of this straw is burnt in different States causing ecological damage. This paper, thus, aims to assess the level of farmers' knowledge related to beneficial uses and effects of paddy straw in soil. The study was conducted in West Bengal with 60 sample farmers in the year 2013-14. Farmers used paddy straw in various ways and it had a positive and significant impact on soil health. The results revealed that farmers had adequate level of knowledge about this issue. Majority of the farmers were marginal but they had moderate exposure to mass media and satisfactory level of ecological consciousness. Estimates of Difficulty Index, Discrimination Index and Correlation Coefficient were worked out. No significant relationship was found between the level of knowledge about utility of paddy straws and socio-personal & psychological variables. Thus, this study promotes useful information about the utilities of paddy straw which calls for carrying out dissemination of the knowledge to the farmers of other states for appropriate management of paddy straw for ecological as well as economic point of view.

**Keywords:** Paddy straw, Farmers' knowledge, Socio-personal, Psychological variables

## INTRODUCTION

Indian agriculture is unique with diverse agro-climatic conditions and is one of the oldest occupation of the farmers. The economy of India to a great extent depends on agriculture with a record production of 257.07 million tonnes of food grains in 2014-15; a significant step towards rendering the nation self-sufficient and food-secured (Anonymous, 2014a). Rice is the staple food in many States. During 2014-15, 103.04 million tonnes rice was produced (Anonymous, 2015). West Bengal is a major paddy growing State with an area of 62.42 m ha (Anonymous, 2014b) under paddy and a total estimated production was 153.72 lakh metric tonnes (D&ES, 2015). At the same time, along with paddy a large amount of straw i.e. 35.93 million tonnes have been generated in West Bengal every year (Anonymous, 2009). Open field burning is the most common practice for paddy straw disposal North India

States like Punjab, Haryana, M.P., U.P. etc. The problem of on-farm burning of paddy straw has remained intensive in recent years due to shortage of human labour, high cost of removal through conventional methods and use of Combine Harvesters for harvesting of crops (Pathak *et al.*, 2010, Liu *et al.*, 2008). Burning of paddy straw has the negative effects including local air pollution, increase in black carbon and contributions to regional and global climate change (Pathak *et al.*, 2010).

In fact, the paddy residue plays an important role in amelioration of soil acidity through the release of hydroxyls especially during the decomposition of residues with higher C: N ratio (Liu *et al.*, 2008), and soil alkalinity through decomposition of residues from lower C: N ratio from crops including legumes, oilseeds and pulses (Pathak *et al.*, 2010). The role of crop residues on carbon sequestration in the soil is an added

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\*Corresponding author email id: roypinaki51@gmail.com

advantage in relation to climate change effects and its management (Derpsch and Friedrich, 2010).

Yield response with residue management varies with soil characteristics (Liu *et al.*, 2008), climate variability, cropping patterns (Singh and Singh, 2001), and level of management skills. Greater yields with residue application results from increased infiltration and improved soil properties, increased soil organic matter and earthworm activity (Derpsch and Friedrich, 2010) and improved soil structure (MNRE, 2009), in 4-7 years from when the system is established (Pathak *et al.*, 2010).

Straw is the only organic material available in significant quantities before most of the rice farmers. About 40 percent of the nitrogen (N), 30 to 35 percent of the phosphorus (P), 80 to 85 percent of the potassium (K), and 40 to 50 percent of the sulphur (S) taken up by rice remains in vegetative plant parts at crop maturity (Dobermann and Fairhurst, 2002). Straw is also an important source of micronutrients such as zinc (Zn) and the most important influence on the cumulative silicon (Si) balance in rice (Dobermann and Fairhurst, 2002; Verma and Bhagat, 1992). In case, where Sulphur-free mineral fertilizers are used, straw may be an alternative but important source of Sulphur (Singh *et al.*, 1988; Dobermann and Fairhurst, 2002). Picture of removal of straw from the field is widespread in India, Bangladesh, and Nepal, which explains the depletion of soil K and Si reserves at many sites. Short-term effects on grain yield are often small (compared with straw removal or burning) but long-term benefits are significant. Where mineral fertilizers are used and straw is incorporated, reserves of soil N, P, K, and Si are maintained and may even be increased (Ventura and Ladha 1997; Dobermann and Fairhurst, 2002).

West Bengal is a unique State where there is extremely limited practice of burning of paddy straw. It is utility product and has beneficial uses in a diversified way. It is used as animal feed and as a source domestic fuel in all rural households. Sometimes a portion of the straw is ploughed back in to the soil for reused as bio-fertilizer. In handicraft industry, rice straw is used in making certain fancy products like bags, wall hanging etc. Rice straw along with other fibrous materials can be used to prepare pulp for making boards and papers. Rice straw is cut in to pieces and then used

also for making beds (medium) for growing mushroom (Anonymous, 2014b). Besides, it has other uses like feedstock, material for furniture manufacturer/home building, handicraft, mulching in the garden, decorating places, and so on (Kanokkanjana and Garivait, 2013).

Non-burning of residue and its incorporation can, in the long run, improve soil chemical and physical properties and pave way for sustainable agriculture and conserve natural resources. It is, thus, necessary to throw some light on the socio-personal and psychological characteristics of the farmers of West Bengal who bears some special attitudes about alternative uses of paddy straw. They discourage practice of burning paddy straw. In stead, they are using it for rejuvenating soil and improve its properties.

In view of above, the paper tries to find out the knowledge of the farmers while using paddy straw for different beneficial effects in their situations and explore the relationship of these variables related to socio-personal and psychological characteristics which have influence on these knowledge.

## MATERIALS AND METHODS

The study was conducted in West Bengal. A multistage random sampling design was followed to select the location and respondents for the study. At the first stage, a highly productive and major rice growing district i.e. Burdwan was selected. At the second stage, two blocks from each district were selected which was followed by, at the third stage, two villages from each block. Thus, a total of four villages were take for this purpose. Further, from each village fifteen farmers were chosen, thus, constituting a total sample of 60 farmers. The details of the distribution of the selected respondents have been presented in Table 1.

**Table 1: Distribution of the selected paddy farmers for the study**

State	West Bengal (n=60)			
	Burdwan			
District	Kalna-I		Jamalpur	
Block	Sultanpur	Nandai	Ajhapur	Bagila
Village	Sultanpur	Nandai	Ajhapur	Bagila
Respondent (No.)	15	15	15	15

The data were collected personally by the author through the technique of interview with the respondents. Precautions were taken to ensure unbiased response of

the respondents by providing them necessary instructions after explaining the objectives of the study. The pre testing of the knowledge test was done from sixteen non sampled farmers. Item Difficulty Index and Item Discrimination Index were work out. Item Difficulty Index implies how much a statement is difficult and is expressed in terms of correct response obtained from a particular question and worked out as per the following methods:

$$\text{Difficulty Index (P)} = \frac{x}{y} * 100$$

$x$  = Number of respondents giving correct answer  
 $y$  = Total number of respondents

For the present study, the items with (P) value ranging from 25 to 75 were retained. On the other hand, Item Discrimination Index indicates the ability of an item to differentiate the well informed respondents from poorly informed ones and is calculated as below:

$$\text{Discrimination Index} = \frac{R_U - R_L}{\frac{1}{2}T}$$

Where,  $R_U$  = Right response from upper group  
 $R_L$  = Right response from lower group  
 $T$  = Total number of respondents

The items with Discrimination Index value of above 0.25 were included in the final knowledge test. The reliability and validity of the knowledge test was also worked out. The reliability of a measuring instrument refers to the degree to which it yields consistent scores when it is administered number of times. The split half method was employed for testing the reliability of the scale. The scale was split into two halves on the basis of odd and even numbers of the statements. Thus two sets of scores were obtained and Pearson Product Moment Correlation Coefficient was worked out for the two sets of the scores for each of the scale. The correlation coefficient gave the reliability of the half of the test. Therefore, it was necessary to correct the reliability coefficient before taking it as evident reliability. The equation which is referred as ‘‘Spearman Brown Correlation’’ formula for split half reliability (Guilford, 1954) was used to find out the reliability coefficient for the full scale. The reliability coefficient of the scales test is given in Table 1a.

Reliability of the total test was worked out by applying Spearman-Brown prophecy formula which is as follows:

$$r_{tt} = \frac{nr}{(n - 1) + r}$$

Where,  $r_{tt}$  = reliability coefficient of the test  
 $n = 2$

$r$  = Correlation coefficient between two half tests.

Validity refers to the degree to which an instrument measures what it is supposed to measure (Guilford, 1954). The content validity of the scale was determined by the experts from the Department of Extension Education. The irrelevant statements were excluded from the final scale. While selecting the statements, due care was taken for obtaining a fair degree of content validity. The empirical type of validity determination was used to calculate what Guilford (1954) called the intrinsic validity. According to him, it is the degree to which whether a test measures the true score components. This validity is indicated by the square root of its reliability. Validity of the scale was worked out by using the square root of its reliability. The intrinsic validity of the scales is given as follows

**Table 1a: Reliability and validity knowledge test**

Instruments	Reliability	Validity
Knowledge test	0.76	0.87

Extent of relationship of socio-personal and psychological variables with the knowledge of the farmers was also found out with simple statistical tool (‘‘r’’ value). In addition, discussions were also held with the farmers for in depth probing and understanding of various aspects under study.

## RESULTS AND DISCUSSION

**Socio-personal and psychological characteristics of the farmers in West Bengal:** The information regarding socio-personal and psychological characteristics of selected farmers which included age, education, operational land holdings, mass media exposure, extension contacts, innovativeness, annual income, risk bearing capacity and ecological consciousness was collected. All these information are presented in Table 2.

**Table 2: Socio-Personal and Psychological characteristics of Farmers in West Bengal**

Socio-personal and psychological characteristics	Category	West Bengal(n=60)	
		Frequency (f)	Percentage (%)
Age	21-36	36	60
	36-51	15	25
	51-66	9	15
Education	Primary	1	1.67
	Middle	19	31.67
	Matric	20	33.33
	Senior Secondary	17	28.33
	Graduate	3	5
Operational Land Holding (acres)	Marginal (<2.5)	41	68.33
	Small (2.5-5)	19	31.67
	Semi-medium (5-10)	0	0
	Medium (10-25)	0	0
	Large (>25)	0	0
Annual Income	Low	22	36.67
	Medium	17	28.33
	High	21	35
Mass Media Exposure	Low (7-10)	35	58.34
	Medium (10-13)	20	33.33
	High (13-17)	5	8.33
Extension Contacts	Low (11-13)	10	16.67
	Medium(13-15)	40	66.67
	High (15-18)	10	16.67
Innovativeness	Low (15-18)	12	20
	Medium (18-21)	28	46.67
	High (21-25)	20	33.33
Risk Orientation	Low (33-37)	26	43.33
	Medium (37-41)	30	50
	High (41-45)	4	6.67
Ecological Consciousness	Low (9-12)	0	0
	Medium (12-15)	11	18.33
	High (15-18)	49	81.67

About 60 per cent of the farmers belonged to an age group of 21-36 years of age and 33.33 per cent of them were matriculates. These results support with the findings of Majumder (2013). Lack of opportunities and economic constraints compel the younger members of the family to join hands with their elders in farm activities. There is a whole family approach towards farming in West Bengal. As a consequence, the percentage dropout rate at the secondary level is 17.67 per cent which is very high (Anonymous, 2012). No outside or migrant labour is hired.

All the farmers in West Bengal were marginal and small. Among them, a little less than 70 per cent of the farmers were marginal farmers (i.e. less than 2.5 acres of land) and 31.67 per cent fell to the category of small

holdings (i.e. 2.5-5 acres). These results are in agreement with the findings of Majumder (2013). West Bengal has a population of 91276115 and the population density is 1028 per sq meter (Anonymous, 2011). While collecting data, it was observed that higher population and a high population density, larger family size and further partition of land from generation to generation are some of the most prominent causes for lower operational land holdings in the state. A perusal to Table 2 also showed that majority of the farmers belonged to a low income group (36.67%). In West Bengal operation land holding is in bigha (3 Bigha = 1 acre) and it was observed that number of children per family is also more. Land is fragmented among the children of the family from generation to generation

resulting in lower farm income from the fragmented land. It has also been found during the discussions that maximum land holding in West Bengal is 15 bigha which equals to 5 acres which leads to lower utilization of farm machineries which lowers down the farm productivity. Dairy products are more often used for home consumption not for additional income generation. Regarding the mass media exposure, less than 60 per cent of the farmers had accessed to low mass media exposure. A very few farm families had T.V. sets. Moreover, as the farmers are involved in agricultural operations, they hardly get any time to get exposure to mass media. Another reason that was observed during data collection and discussions with the farmers was the lack of electricity connections in some villages. Disturbances in supply of electricity prevented from watching television for the mass media exposure. Besides, low farm income discouraged the farmers to purchase newspapers, magazines, etc.

Nearly 70 per cent of the farmers had a medium level of extension contacts. The farmers reported that the extension personnel are not in regular contact with them as result of which they are not aware about various extension activities conducted by different agricultural organizations. Only a few progressive farmers had good extension linkages. Distance of the various agricultural institutions from the village, lack of time for visit due to intensive farming activities and non-availability of the extension personnel in the offices are some of the reasons as mentioned by the farmers for moderate extension linkages. The farmers had more trust on the input dealers and the fellow farmers rather than the agricultural institutes/organizations viz. SAU, KVKs etc. Similar results have been reported by Majumder (2013), Beal and Rogers (1959); Sofranko *et al.* (1988), Eponau, (1993) and Intodia (1998).

About 47 per cent of the farmers belonged to a medium level of innovativeness and unexpectedly, half of the farmers (50 percent) had a medium risk orientation. Farmers generally followed rice wheat cropping system because of the Minimum Support Price (MSP) given by the government on both these crops, thus leading to their easy marketing. Production constraints, good marketing facilities, satisfactory income from the two crops, less efforts required on the part of the farmers as compared to other cropping

practices has resulted in lower risk orientation among the farmers. However, a few progressive farmers were found to take risks by adopting varied cropping systems and enterprises. Majority of the farmers (81.67%) had a high level of ecological consciousness due to their restricted life style and standard of living.

**Knowledge regarding beneficial aspects of paddy straw:** The level of knowledge of the farmers regarding beneficial effects of paddy straw were studied in terms of the nutrient-content in the straw such as the extent of presence of nitrogen and phosphorous etc. and improved soil health because of straw incorporation like conservation of soil nutrients, increased soilfertility, reduced fertilizer cost, etc.

The findings presented in Table 3 indicated that 55 per cent of the farmers had a high knowledge regarding nutrient content in paddy straw, and 43.33 per cent had a medium level of knowledge. Only 1.67 per cent had a low knowledge. This findings support the results that farmers of West Bengal have been using paddy straw for various purposes such as incorporation, mulching, composting, etc. Nearly 55 per cent of the farmers knew about soil health improvement if paddy straw is applied in soil whereas 41.67 per cent had a medium and only 3.33 per cent had a low level of knowledge in this aspect.

Table 3 also indicated that a little less than half of the farmers had had a high overall knowledge followed by 46.67 per cent who had a medium overall knowledge and only 5 per cent had a low overall knowledge regarding in this aspects. It can, thus, be summed up

**Table 3: Knowledge Level of Farmers regarding beneficial effects of paddy straw**

Parameter	Knowledge level	State	
		West Bengal (n=60)	
		Frequency	Percentage
Nutrient-content	Low	1	1.67
	Medium	26	43.33
	High	33	55
Soil health	Low	2	3.33
	Medium	25	41.67
	High	33	55
Overall knowledge	Low	3	5
	Medium	28	46.67
	High	29	48.33

**Table 4: Extent of Relationship of socio-personal and psychological variables with the knowledge of the farmers**

Socio-personal and psychological variables	Knowledge of the farmer "r" Value
Age	-.076
Annual Income	.063
Education	-.053
Operational Land Holding	.107
Extension Contact	.082
Mass Media Exposure	-.042
Risk Orientation	-.135
Innovativeness	.083
Ecological Consciousness	.214

\*\*Significant at 0.01 level; \*Significant at 0.05 level

that farmers were quite aware about the economic benefits of paddy straw and had been found to apply this knowledge for cost effective improvement of soil.

#### ***Relationship of socio-personal and psychological variables with the knowledge of the farmers:***

Relationship between socio-personal and psychological variables of the farmers and their level of knowledge are shown in Table 4.

No significant relationship was found between the socio-personal and psychological variables of the West Bengal farmers and their knowledge level. Age, education, mass media exposure, risk orientation had negative and non-significant relationship with the knowledge level. Further, annual income, operational land holding, extension contact, innovativeness and ecological consciousness had positive but non-significant relationship with the knowledge level. It, thus, implied that selected variables have non-significant impact on the knowledge level of the farmers regarding paddy straw management.

### **CONCLUSION**

Application of paddy straw was found to have a positive and significant impact on soil health and as a consequence, it has variety of uses in West Bengal. It is, thus, suggested to disseminate these farmers' level knowledge of beneficial effects of paddy straw in the soil for sustenance of ecology and economic viability and create awareness among the farming community where burning of paddy straw is most frequent. It is also need to motivate the farmers of those states where

burning is most promising alternative of straw management and make them ecologically conscious by building their capacity through organizing campaigns on beneficial effect of paddy straw management in the soil health.

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# Heterotic Response and Combining Ability for Yield and Quality Attributes in Tomato (*Lycopersicon esculentum* Mill.)

Senjam Jinus Singh<sup>1\*</sup>, V.K. Batra<sup>1</sup>, Sanjay Kumar<sup>1</sup> and S. Khajuria<sup>2</sup>

<sup>1</sup>Department of Vegetable Science, <sup>2</sup>Department of Forestry, CCS Haryana Agricultural University, Hisar, Haryana

## ABSTRACT

Sixty hybrids were developed by crossing four testers with each of the fifteen lines in Line x Tester design at Vegetable Research Station, CCS Haryana Agricultural University, Hisar. The potent lines viz., 11/TODVAR-1, 11/TODVAR-3, H-86, 12/TODVAR-2, 12/TODVAR-8 and NP-NILD registered highest positive *gca* effects for quantitative attributes Plant Height and No. of Primary Branches per Plant; Yield per Plant and Early Yield per Plant (desirable negative effects); Flower per Truss and Fruit per Truss; Single Fruit Weight; Fruit Diameter, and Fruit per Plant respectively. For quality characters, the lines 11/TODVAR-7, 12/TODVAR-3, 11/TODVAR-3, 12/TODVAR-6, and NP-NILD registered highest positive *gca* effects for Fruit Firmness, Pericarp Thickness and No. of Locule per Fruit; Juice Yield per Fruit and Titratable Acidity; Pulp Weight per Fruit, and TSS and Ascorbic Acid respectively. Among testers, Punjab Ratta, BL-982, DVRT-2, and Punjab Barkha Bahar-2 registered highest positive *gca* effects for Plant Height and Fruits per Plant; Primary Branches per Plant and Days to 50% Flowering (desirable negative effect); Single Fruit Weight and Fruit Diameter, and Early Yield per Plant and Yield per Plant respectively. For quality traits, the testers BL-982, DVRT-2, Punjab Ratta and Punjab Barkha Bahar-2 registered highest positive *gca* effects for Juice Yield per Fruit; Titratable Acidity and Ascorbic Acid; Pulp Weight per Fruit and Titratable Acidity; Pericarp Thickness, and Fruit Firmness and No. of Locule per Fruit respectively. Those few hybrids viz., 11/TODVAR-1 x Punjab Barkha Bahar for plant height, H-86 x DVRT-2 and 11/TODVAR-6 x Punjab Barkha Bahar-2 for number of primary branches/plant, EC-402255 x DVRT-2 for number of flowers/cluster, EC-402255 x DVRT-2 for number of fruits/ truss, 12/TODVAR-8 x DVRT-2 for Single fruit weight, NP-NILD x Punjab Ratta for Fruit per plant, 12/TODVAR-2 x BL-982 for early yield per plant, 12/TODVAR-2 x BL-982 for yield per plant and 12/TODVAR-2 x BL-982 for juice yield per fruit, exhibiting high *per se* performance also showed high heterotic performance over the commercial checks implying the role of heterosis for selection of best cross combination coupled with significant *sca* effects for corresponding character.

**Keywords:** *gca*, hybrids, *sca*, standard heterosis and Line x Tester

## INTRODUCTION

Tomato (*Lycopersicon esculentum* Miller) is one of the most important, popular and remunerable vegetable crop, suitable for year round production especially off-season vegetables in different agro climatic zones as sustainable farming (Singh *et al.*, 2014). It contains vitamins A, C, essential mineral and nutrients as well as lycopene, a major component of red tomatoes with antioxidant properties. As a cash crop, in addition to our country it has a great demand in the international market

(Hannan, 2007). In India, tomato occupies an area of 8.650 lakh ha with production of 168.20 lakh tonnes and productivity of 19.387 mt/ha (NHB, 2011). Haryana produced 257.3 tonnes of tomato from an area of 17.3 thousands ha. with productivity of 15.0 tonnes/ha (Vanitha *et al.*, 2013).

The scenario of tomato production in the country has tremendously changed over the past few decades with increasing popularity of hybrids. It is imperative to obtain such hybrids which have high yielding

\*Corresponding author email id: singhsenjam@gmail.com

potential along with excellent quality. In agriculture high yielding varieties has contributed maximum in enhancing production (Gajbhiye *et al.*, 2014). Heterosis is an important way to develop high yielding varieties (Sanghera *et al.*, 2011). The yield impact of maize hybrid crosses was described in 1908 by George Harrison Shull at the Cold Spring Harbor Laboratory in New York (Shull, 1908). A considerable degree of heterosis has been documented and utilized in tomato for various characters even since the first official report by Hedrick and Booth (1907).

Combining ability studies are more reliable as they provide useful information for the selection of parents in terms of performance of the hybrids and elucidate the nature and magnitude of various types of gene actions involved in the expression of quantitative traits by using, line x tester technique as suggested by Kempthorne, 1957. It is one of the best techniques that provide information about general and specific combining ability of the parents and at the same time it is helpful in estimating various types of gene effects (Sprague and Tatum, 1942). Such studies not only provide necessary information regarding the choice of the parents but also simultaneously illustrate the nature and magnitude of gene action involved in the expression of desirable traits (Falconer, 1982).

## MATERIALS AND METHODS

Investigation on heterotic response and combining ability

**Table 1: Analysis of variance for nineteen characters in tomato**

Source of variations	df	Mean sum of squares								
		Plant height (cm)	No. of primary branches/plant	Days to 50% flowering	Flowers/cluster	Fruits/truss	Single fruit weight (g)	Fruit diameter (mm)	Fruits/plant	Early yield/plant
Replications	2	0.3753	0.6372	0.7159	0.2432	0.6167	3.5669	0.1935	0.7542	0.0002
Treatments	79	1351.3961**	4.0361**	294.6219**	5.7358**	6.6561**	3075.6299**	498.4502**	5871.3613**	0.0757**
Error	158	6.0031	0.5196	0.9851	1.1154	0.9078	4.9354	0.5008	13.8470	0.0021

**Table 1 contd.....**

Source of variations	df	Mean sum of squares								
		Yield/plant	Fruit firmness	Pericarp thickness (mm)	Number of locule Nos/fruit	Juice yield/fruit	Pulp weight/fruit	Titrateable acidity	TSS (°Brix)	Ascorbic acid (mg/100g)
Replications	2	0.0268	0.3265	0.0240	0.8573	0.0008	0.0201	0.0000	0.0275	1.3688
Treatments	79	1.5624**	8992.777**	11.7404**	17.0537**	122.4394**	30.1466**	0.0628**	2.9389**	33.2632**
Error	158	0.0089	4.4862	0.0146	0.3615	0.2345	0.2713	0.0003	0.0234	0.5866

\*Significant at 5 per cent level; \*\*Significant at 1 per cent level

was carried out in tomato. Sixty hybrids were developed by crossing four testers with each of the fifteen lines in Line x Tester design during *Rabi and Summer*, 2012-13 at Vegetable Research Station, CCS Haryana Agricultural University, Hisar. All the hybrids were evaluated along with their parents and one commercial hybrid check with the objectives of assessing magnitude of heterosis and identifying good combiners for various traits. The results obtained from the experiments are presented in this paper. The observations were recorded on five randomly selected plants for viz., Plant height, No. of primary branches/plant, Days to 50% Flowering, Flowers/cluster, Fruits/truss, Single fruit weight, Fruit diameter, Fruits/plant, Early yield/plant, Yield/plant, Fruit firmness, Pericarp thickness, Number of Locule Nos per fruit, Juice yield/fruit, Pulp weight/fruit, Titrateable acidity, Total soluble acid and ascorbic. Analysis of variance and combining ability analysis were done as suggested by Panse (1957) and Kempthorne (1957), respectively.

## RESULTS AND DISCUSSION

The line 11/TODVAR-1 registered highest positive *gca* effects for Plant Height and No. of Primary Branches per Plant. The highest positive *gca* effects for Early Yield per Plant and Yield per Plant along with desirable highest negative *gca* effects recorded by 11/TODVAR-3. The line H-86 registered highest positive *gca* effects for Flower per Truss and Fruit per Truss. The line 12/

**Table 2: ANOVA for combining ability for nineteen characters in tomato**

Source	df	Mean Sum of Squares								
		Plant height (cm)	No. of primary branches/plant	Days to 50% flowering	Flowers/cluster	Fruits/truss	Single fruit weight (g)	Fruit diameter (mm)	Fruits/plant	Early yield/plant
Replications	2	0.03313**	0.76195	0.53507	0.19454	0.62025	2.832	0.24691	0.65823	0.00067
Genotypes	78	1368.07768**	4.08675**	291.98353**	5.68916**	6.54495**	3089.5200**	504.79445**	5938.6104**	0.07342**
Parents	18	1018.08275**	3.51903**	419.77764**	6.34835**	9.30994**	3089.7667**	621.50777**	11019.059**	0.06854**
Parents (Line)	14	1211.93911**	2.90979**	356.48095**	6.23594**	9.45079**	3551.8377**	577.69444**	13575.556**	0.0768**
Parents (Testers)	3	163.54837**	0.37823	183.74306**	0.37723	0.22222	106.66657**	184.40739**	39.41667*	0.02192**
Parents (L vs T)	1	867.69681**	21.47081**	2014.03516**	25.83554**	34.60117**	5570.0723**	2546.1956**	8167.0249**	0.09272**
Parents vs. crosses	1	12738.3699**	6.42951**	30.65691**	133.57337**	233.92738**	1324.4114**	36.9336**	318.67585**	<b>0.2012**</b>
Crosses	59	1282.13898**	4.22024**	257.42476**	3.32053**	1.84746**	3119.3619**	477.11684**	4483.8962**	0.07274**
Line Effect	14	4726.39524**	11.24365**	526.70079**	3.68413	3.15476*	10023.596**	1443.0952**	15270.617**	0.17518**
Tester Effect	3	565.63704*	4.87963	472.21296*	0.99259	3.22222	2094.92237	352.97686	1317.47222	0.06753
Line * Tester Eff.	42	185.23228**	1.83201**	152.32407**	3.36561**	1.31349	891.12491**	163.9912**	1114.4960**	0.03896**
Error	156	5.8625	0.50615	0.97012	1.12699	0.91512	4.92477	0.50357	13.84199	0.00199
Total	236	456.03676	1.69173	97.14883	2.62693	2.77333	1024.3919	167.17381	1971.91643	0.02559

*Table 2 contd.....*

Source	df	Mean Sum of Squares								
		Yield/plant	Fruit firmness	Pericarp thickness (mm)	Number of locule Nos/fruit	Juice yield/fruit	Pulp weight/fruit	Titratable acidity	TSS (°Brix)	Ascorbic acid (mg/100g)
Replications	2	0.0272	0.54634	0.03006	0.92405	0.00596	0.02106	0.00001	0.03055	1.57398
Genotypes	78	1.54049**	8961.71442**	11.88963**	17.24567**	123.92283**	30.37167**	0.06338**	2.96639**	33.55809**
Parents	18	1.34921**	7334.93781**	13.17756**	13.35478**	60.63742**	23.89642**	0.04851**	3.30573**	54.5346**
Parents (Line)	14	1.27358**	6025.00516**	14.34598**	15.70079**	72.29045**	27.46328**	0.05966**	3.52581**	65.5676**
Parents (Testers)	3	0.72423**	15443.21692**	10.49303**	4.40972**	3.97456**	6.04903**	0.01232**	0.66889**	19.67885**
Parents (L vs T)	1	4.28312**	1349.15759**	4.87334**	7.34569**	67.48355**	27.50256**	0.00106*	8.13516**	4.63989**
Parents vs Crosses	1	5.93724**	14502.86663**	2.46467**	86.63204**	257.29357**	97.76882**	0.03641**	3.53221**	144.79293**
Crosses	59	1.52432**	9364.10132**	11.65645**	17.25669**	140.96972**	31.20485**	0.06837**	2.85328**	25.27315**
Line Effect	14	3.57722**	21481.86746**	38.22335**	52.81687**	310.02643**	88.41382**	0.18156**	7.44827**	69.04735**
Tester Effect	3	0.78025	43847.71111**	0.53093	9.87037	127.43737	11.418	0.06966	3.7688*	3.62623
Line * Tester Eff.	42	0.89317**	2861.73095**	3.5955**	5.93089**	85.58408**	13.54853**	0.03055**	1.25622**	12.22795**
Error	156	0.00901	4.46606	0.01418	0.36422	0.23495	0.27471	0.00026	0.02354	0.58163
Total	236	0.51533	2964.87934	3.93925	5.94843	41.1129	10.21986	0.02112	0.99624	11.48904

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

TODVAR-2 registered highest positive *gca* effects for Single Fruit Weight. The line 12/TODVAR-8 registered highest positive *gca* effects for Fruit Diameter. The line NP-NILD registered highest positive *gca* effects for Fruit per Plant. For quality characters, the line 11/TODVAR-7 registered highest positive *gca* effects for Fruit Firmness. The line 12/TODVAR-3 registered highest positive *gca* effects for Pericarp Thickness and No. of Locule per Fruit. The line 11/TODVAR-3 registered highest positive *gca* effects for Juice Yield per Fruit and Titratable Acidity. The line 12/TODVAR-6 registered highest positive *gca* effects for Pulp Weight per Fruit. The line NP-NILD registered highest positive *gca* effects for TSS and Ascorbic Acid. Among testers, Punjab Ratta registered highest positive *gca* effects for

Plant Height and Fruits per Plant. The tester BL-982 registered highest positive *gca* effects for Primary Branches per Plant along with desirable negative *gca* effect for Days to 50% Flowering. The tester DVRT-2 registered highest positive *gca* effects for Single Fruit Weight and Fruit Diameter. The tester Punjab Barkha Bahar-2 registered highest positive *gca* effects for Early Yield per Plant and Yield per Plant. For quality traits, the tester BL-982 registered highest positive *gca* effects for Juice Yield per Fruit, Titratable Acidity and Ascorbic Acid. The tester DVRT-2 registered highest positive *gca* effects for Pulp Weight per Fruit and Titratable Acidity. The tester Punjab Ratta registered highest positive *gca* effects for Pericarp Thickness. The tester Punjab Barkha Bahar-2 registered highest positive *gca* effects for

**Table 3: Estimates of *gca* effects for lines and testers for yield and yield contributing characters in tomato**

	Plant height (cm)	No. of primary branches/plant	Days to 50% flowering	Flowers/cluster	Fruits/truss	Single fruit weight (g)	Fruit diameter (mm)	Fruits/plant	Early yield/plant	Yield/plant
<b>LINES</b>										
11/TODVAR-5	-6.77**	-0.01	-2.46**	-0.23	-0.33	-10.21**	-1.35**	-6.97**	-0.04*	-0.34**
12/TODVAR-3	-4.43**	-1.01**	-6.13**	0.52	0.50	37.04**	15.14**	-19.22**	0.09**	0.42**
H-67	-9.77**	-0.59**	1.96**	-0.56	-0.58	-9.19**	0.97**	-11.30**	-0.03*	-0.20**
11/TODVAR-6	-7.77**	0.49*	4.71**	-1.06**	-1.17**	-3.69**	-4.11**	-11.47**	-0.04*	-0.20**
11/TODVAR-7	-23.52**	-0.84**	-3.21**	-0.23	-0.08	13.65**	0.29	-15.72**	0.08**	0.49**
EC-402255	-7.18**	0.91**	7.79**	0.11	0.08	-30.18**	-12.61**	16.45**	-0.12**	-0.63**
12/TODVAR-2	-2.68**	-0.42*	1.87**	-0.23	0.17	39.05**	7.60**	-8.97**	0.08**	0.58**
NP-NILD	33.65**	0.24	11.37**	-0.06	-0.25	-58.01**	-24.03**	119.37**	-0.28**	-1.12**
11/TODVAR-3	-3.68**	-0.84**	-10.54**	0.69*	0.33	38.31**	4.71**	-19.13**	0.19**	0.77**
12/TODVAR-8	-4.02**	-0.01	-7.21**	-0.06	0.00	19.82**	22.75**	-18.30**	0.09**	0.19**
H-86	13.82**	1.83**	6.96**	1.36**	1.17**	-39.34**	-9.34**	28.53**	-0.10**	-0.52**
12/TODVAR-6	-28.27**	-1.17**	-6.04**	-0.14	-0.08	20.45**	1.12**	-19.72**	0.13**	0.53**
11/TODVAR-1	49.98**	1.99**	4.29**	-0.14	0.08	-10.62**	-3.05**	-8.30**	-0.03*	-0.04
EC-401911	4.23**	-0.01	4.21**	-0.14	0.00	-12.71**	1.78**	-13.05**	-0.07**	-0.40**
H-68	-3.60**	-0.59*	-7.54**	0.19	0.17	5.64**	0.14	-12.22**	0.07**	0.48**
<b>TESTERS</b>										
BL-982	-1.72**	0.37**	3.71**	-0.18	-0.37	-5.41**	-1.13	-0.06	-0.04**	-0.17**
DVRT-2	-1.43**	-0.34*	-2.67**	0.13	-0.01	7.17**	2.73	-3.79	0.01	-0.02
Punjab Ratta	5.30**	0.17	1.73**	-0.07	0.26	-6.23**	-3.40	7.67	-0.02*	0.06**
Punjab Barkha Bahar-2	-2.14**	-0.21	-2.76**	0.11	0.12	4.47**	1.80	-3.82	0.05**	0.14**
CD at 5% (Line)	1.38	0.41	0.56	0.61	0.55	1.27	0.41	2.13	0.03	0.05
CD at 5% (Tester)	0.71	0.21	0.29	0.31	0.28	0.66	0.21	1.10	0.01	0.03

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

Fruit Firmness and No. of Locule per Fruit. From the present investigation, for processing qualities, the crosses like; 11/TODVAR-5 x BL-982, 11/TODVAR-5 x Punjab Ratta, EC-402255 x BL-982, EC-402255 x Punjab Ratta, NP-NILD x DVRT-2 and, H-86 x DVRT-2 were found to be superior for TSS. 11/TODVAR-5 x BL-982, 11/TODVAR-5 x Punjab Ratta, H-67 x BL-982, EC-40225 x BL-982, EC-402255 x Punjab Barkha Bahar-2, NP-NILD x DVRT-2, NP-NILD x Punjab Barkha Bahar-2 and H-86 x Punjab Ratta for ascorbic acid purpose. The crosses; 11/TODVAR-6 x DVRT-2, 12/TODVAR-2 x BL-982, 12/TODVAR-2 x Punjab Ratta, 11/TODVAR-5 x DVRT-2, H-68 x DVRT-2, 12/TODVAR-8 x DVRT-2, 12/TODVAR-8 x BL-982, 12/TODVAR-3 x Punjab Ratta, 11/TODVAR-3 x Punjab Ratta, 11/TODVAR-3 x Punjab Barkha Bahar-2, 12/TODVAR-6 x BL-982, were found to be superior for table purpose. The findings are compatible with the evidence of Singh and Singh (1993), Dharmatti *et al.* (2001), Kumari and Sharma (2011), Ahmed *et al.* (2011), Singh and Asati (2011), Hannan *et al.* (2007), Mondal *et al.* (2009) and Shankar *et al.* (2013).

## CONCLUSION

Thus in the present study potential crosses *viz.*, 12/TODVAR-2 x BL-982, 12/TODVAR-2 x Punjab Ratta, 11/TODVAR-3 x Punjab Barkha Bahar-2, 12/TODVAR-8 x DVRT-2, 11/TODVAR-7 x Punjab Ratta, H-68 x Punjab Ratta, 11/TODVAR-3 x BL-982, 11/TODVAR-1 x Punjab Ratta, 12/TODVAR-6 x BL-982 and H-67 x Punjab Barkha Bahar-2 were identified as promising hybrids combining yield per plant with desirable plant attributes. Hence, based on their *per se* performance, heterosis and *scs* effects, these hybrids can be exploited through heterosis breeding for commercial cultivation after thorough testing in different environments.

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Table 4: Estimates of *gca* effects of lines and testers for fruit quality characters in tomato

	Fruit firmness	Pericarp thickness (mm)	No. of locule/ fruit	Juice yield/ fruit	Pulp weight/ fruit	Titrateable acidity (%)	TSS (°Brix)	Ascorbic acid (mg/100g)
<b>Lines</b>								
11/TODVAR-5	8.49**	-1.10**	2.24**	-0.80**	-0.75**	-0.02**	0.31**	2.43**
12/TODVAR-3	7.32**	2.46**	4.07**	6.14**	2.34**	0.22**	-0.80**	-1.54**
H-67	-37.34**	-1.56**	-0.59**	-2.41**	-0.81**	-0.04**	-0.18**	0.17
11/TODVAR-6	-65.01**	0.22**	-1.05	-1.48**	-0.27	-0.04**	-0.18**	0.94**
11/TODVAR-7	76.07**	0.99**	-0.89**	0.90**	2.02**	0.04**	-0.24**	-3.04**
EC-402255	-29.93**	-2.43**	-2.51**	-5.79**	-3.40**	-0.13**	0.73**	3.88**
12/TODVAR-2	28.41**	0.89**	1.74**	7.25**	0.86**	0.05**	-0.62**	-3.86**
NP-NILD	-57.01**	-3.48**	-2.47**	-7.73**	-5.53**	-0.20**	1.64**	4.27**
H/TODVAR-3	10.82**	2.19**	4.03**	9.69**	2.91**	0.22**	-0.37**	-3.01**
12/TODVAR-8	14.91**	1.42**	0.24	3.21	2.70**	0.10**	-1.29**	-0.67**
H-86	10.66**	-2.46**	-0.09	-4.95	-3.52**	-0.18**	1.47**	1.62**
12/TODVAR-6	64.49**	0.96**	-1.43**	3.88**	4.23**	0.08**	-0.46**	-1.19**
11/TODVAR-1	8.66**	0.44**	-0.72**	-2.74**	-0.93**	-0.02**	0.18**	0.39
EC-401911	18.91**	0.84**	-1.59**	-4.04**	-1.04**	-0.06**	-0.13*	0.13
H-68	-59.43**	0.63**	-0.97**	-1.12**	1.20**	-0.02**	-0.06	-0.50*
<b>Testers</b>								
BL-982	-18.54**	0.08**	-0.13	1.50	-0.38**	-0.03**	0.33**	0.29*
DVRT-2	4.30**	-0.07**	-0.01	1.41	0.70**	0.06**	-0.26**	0.07
Punjab Ratta	-27.94**	0.10**	-0.49**	-1.56**	0.04	-0.02**	0.15**	0.04
Punjab Barkha Bahar-2	42.19	-0.11**	0.63**	-1.35**	-0.36**	-0.01**	-0.22**	-0.39**
CD at 5% (Line)	1.21	0.07	0.34	0.28	0.30	0.01	0.09	0.44
CD at 5% (Tester)	0.62	0.04	0.18	0.14	0.15	0.00	0.05	0.23

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

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# Impact of Globalisation on Traditional Rural Artisans of Jammu Region of J&K State

Poonam Abrol, Vinod Gupta and Neelima Gupta\*

Krishi Vigyan Kendra, Jammu, J&K, India

## ABSTRACT

Rapid changes are today taking place in most economics across the worlds, due to process of globalization, these changes affect enterprises and workers not only in the markets, which are directly globally linked through exports, but also in all markets nationally and locally, often down to the remotest villages. Similarly in this age of globalisation the survival of the traditional rural artisans of Jammu region are in peril even they have skills and capability for self-employment. A study was conducted “to study the profile and work pattern of the artisans” of the Jammu region (J&K). The sample comprised of 80 artisans i.e. 20 sculptor, 20 weavers, 20 potters and 20 embroidery workers from the two selected districts of Jammu province i.e. Udhampur and Jammu purposively and the artisans were selected through snowball sampling technique as the artisans were remained very less in the region. Interview schedule was used to obtain the required information. The findings of the study revealed that majority (63.8%) of the respondents have adopted their family occupation, among them, only 10.2% were in the age group of 20-25 yrs. This show the young generation are opting for other occupation leaving their traditional one because Majority (97.5%) were not satisfied with their earning and were not able to manage their family needs 56.3% of the respondents did not make any changes in their work pattern over a period of time due to lack of awareness about trends and unavailability of funds. In order to save the traditional artisans and to make the craft products nationally and internationally well known and commercially viable, it is necessary to upgrade the skill of the artisans who should be supplied with quality raw material and financial assistance and connecting them to the national and international markets.

**Keywords:** Globalisation, Impact, Rural artisans, Traditional

## INTRODUCTION

Traditional rural artisans – be it goldsmiths, blacksmiths, carpenters, potters, sculptures, weavers, embroidery workers etc. have certain capabilities acquired through practice. It could be true that they may not have any machinery or sophisticated technology. But, the sculpture or the wheel of potter- to deliver the service or product is starting. One obvious thing about traditional artisans is that they may be thinking most often of the supply side of the market. They have almost not paid any attention to the demand side of the market or the market trends, as there was no need for it until a few yrs ago. Remaining relevant to the contemporary market demand has assumed significance as a consequence of globalization. Secondly, in the

context of globalization in India, It is reported that agriculturists themselves are in grief. If Agriculturists themselves are in grief, what is happening to the rural artisans, who, most often depended on Agriculturists?

The term globalization points out the grouping of the whole world economy into a unique economic system. The novelty is not so much in the globalization of the market, but that of production. The world is being transformed more and more in a sole productive space, where every phase of the production can be shifted to the country that offers better profit opportunities. The World Context of Globalization is defined by: Internalization, Technological innovations, Liberalization, Privatization and Competitiveness (Carlo Milone, 2002).

\*Corresponding author email id: gupta.ng1@gmail.com

The Vice President **“SHRI BHAIRON SINGH SHEKHVAT”** said while releasing a book. **“Globalization : Its impact on industrial relation in India**, written by Dr. P.D. Shenoy that” Today Globalization is a reality and has the potential to open and provide new opportunities at a much wider scale, but the challenge before us in India lies in making globalization work in manner that enables us to achieve our twin objective of growth and equity. He further underlined that growth doesn’t just mean the percentage increase in GDP. The real content and elements of growth have to be inclusive of increase in employment opportunities and economic uplift of all sections of society. We need ‘Growth’ that promotes development and brings down disparities by bridging the gap and divide between the rich and the poor. But unfortunately, this has not so happened, while the world economic has shown unprecedented growth, the disparities and the extent of poverty have not reduced. The Vice president said that keeping in view the fact that the organized sector constitutes 93% of the total work force in the country. We have to ensure that the process of globalization works for their welfare. We have millions of weavers and artisans having unique traditional skills and it is critically important to safeguard and protect them from high technology driven large scale mechanized production (Pardeep, 2007).

The study entitled “Globalization and traditional rural artisans” has found that there are instances of modernity marginalizing the tradition. It has happened in the case of potters, blacksmiths, goldsmiths and carpenters. But there is no trace of this to have happened in sculpture. One common thing found in all of these traditional occupations is that the youngsters opt out of this or all the more their parents advice them to pursue, something that would be more relevant to today’s society. The most modernity looks for a better world with less drudgery and more comforts. In the process the occupations that bring with it certain drudgery get sidelined. It is also happening as a natural course of things that technology, resources and capital marginalizing the tradition. When a traditional and age old occupation is tossed out, *one thing that bothers us as social scientists is*: what should we do with the artisans or craft person who depend on such occupation as a main source of livelihood. This is vital because many such occupations have been handed down from one

generation to another. They know nothing else so well, as they do as artisans – potters, weavers, sculptures and so on. One inevitable thing with post modernity is that it evolves not with any intention of displacing any artisans or traditional occupations. But in the process, it does necessarily happen that some of the occupations get seen off silently (Ramesh et al., 2006).

**Empowering Artisans through International Craft Market:** The objective is to empower Indians artisans in the international craft market and reduce the poverty of Indian artisan who now produce work of quality and beauty but who are exploited in the market and the following points need due consideration.

- Develop expanded market outlets in North America and Europe for high quality of craft, products available from India and advice to artisan an improvements in technologies which would make their products more serviceable.
- Expand the income going directly to the artisans.
- Enable groups of poor Indian artisans to sustain livelihood they value and improve their well-being in terms of opportunities, empowerment and satisfaction or motivation.

**The other Organization like ATA:** Aid to Artisans, a non-profit organization offers practical assistance to artisans group worldwide, working in partnership to foster artistic traditions, cultural vitality, improved livelihoods, and community well-being. Through collaboration in three major services i.e. Product development, business skills, training, market links and development of new markets, Aid to Artisan provides sustainable and environmentally sensitive and culturally respectful livelihood (Smith, 2005).

**Asia/Africa Network for Artisan development** works for the development of artisan worldwide. Artisans, their products and the “artisan way of life” endangered in this era of increased globalization and marginalization of indigenous groups and traditional communities. Artisans embody and represent an organic bond between natures, culture and human artefacts and are a result of the collective consciousness of sub-cultures and ethnic groupings. Unfortunately, they are among the poorest and the most disadvantage groups, and their very livelihoods and existence is threatened



(Asia/Africa Network for Artisan Development, (1999-2000).

**Handicraft workshop aims to solve artisan problem** organized one day workshop called “Sui-Dhaga” or Needle and thread when translated in to English was organized in the capital city of Pakistan, Islamabad. It was attended by designers, experts, artisans and craft lovers. The workshop was organized with the specific purpose of providing an opportunity to master artisans to discuss their problem with experts and seek their opinion and views and the biggest problem cited by the artisans was access to credit which they said was the biggest hurdle in their quest to expand and discussed the assistance needed by them in design and marketing, in order to compete in international markets. To the question of availing credit, the experts have suggested that the artisans should approach Small Business Finance Corporation (SBFC) and other govt. bodies. They also suggested that this location, Lok-Virsha be made a permanent venue for displaying arts and crafts of the artisans to hold exhibition and that it be given out to artisans on a rotational basis as this will help them be in continuous contact with experts who can guide them in improving their designs, quality, control, provide marketing guidance and also advice on packaging and works towards preserving the living folk and traditional culture of Pakistan (Handicraft Workshop Aims to solve Artisans problem 2008, Pakistan).

### **SAHAJ**

Established in 2001, Sahaj is a registered fair trade NGO empowering tribal communities through handicrafts. They began with a small amount of funds to enable off farm income generating opportunities for Eastern Gujarat tribal women to prevent them from migrating. Poverty, exploitation and lack of status were some of the problems these women faced. They were totally dependent on the male members of the family and lacked a voice. SAHAJ came together to address these issues and provide skill training, design and market support for helping the women produce handicrafts. They aim to empower tribal women through art and craft based activities to provide them opportunities and wider choices in life towards an equitable society. They are dedicated to socioeconomic empowerment of the woman to help secure her position in society where she

can think independently, become a role model for future generations and above all, does not have to prove herself because of her gender. The organization now has 2700 members and is a fair trade member of IFAT. At the village level, groups are becoming stronger and more active. From the same villages, more numbers of men and women are joining the activities and acceptance of non farm livelihood projects is on the rise. The organization is expanding it's work to create strengthened groups. They also have a large savings program for the members. Their products include jewelry, wood carving, bamboo furniture, tribal painting, embroidery, papermache, cushion covers and pottery.

Thus this study entitled “Impact of Globalisation on Traditional Rural Artisans” has been taken to explore the impact of economic globalization on rural artisans and aims to outline the survival strategy of these artisans, detailed and recorded innovation in artisan's skills to improve marketability of crafts and describe the changing market for the craft. Hence the present study has been taken up with following objectives in Jammu region.

### **MATERIALS AND METHODS**

A pilot study was conducted to know the location of artisans cluster where they are residing and appropriateness of the sample. Two districts of Jammu province i.e. Udhampur and Jammu were selected purposively as the artisans were mostly based on these two districts. Interview schedule was framed for the pilot study and tested for the validity among 10% sample to check the clarity of questions. The sample of 80 artisans was drawn from the selected villages i.e. 20 potters, 20 weavers, 20 embroidery workers, and 20 sculptors. Both local and migrant artisan men and who have one of the livelihoods as artisan were selected. Snowball sampling technique was used from the selected villages of the two districts. Data was collected through home visits

### **RESULTS AND DISCUSSIONS**

The present study was conducted with an aim “to study the profile and work pattern of the artisans” of Jammu region. The information was elicited as per the objectives of the study. The findings of the study have been reported under the following sections: (i) Profile of the artisans; (ii) Work pattern of the artisans

Table 1 depicts the respondent's profile. The survey reveals that among local artisans 50.8% were in the age group of 35-50 yrs, 10.2% were in 20-35 yrs. 32.2% from the age group of 35-50 yrs and 1.7% from the age group of 25-35 yrs were under metric respectively. Among local artisans equal percentages 20.4% from the age group of 35-50 yrs were weavers, sculptors and potters. 25.4% from the age group of 35-50 yrs were continuing with their occupation from the last 10-20 yrs and also from the age group 50-60 yrs. Only (5%) artisans were working in the same occupation for the last 40 yrs. Among local artisans 27.2% from the age group of 35-50 yrs got income from Rs. 5-10 thousand, 3.4% from the age group 20-35 yrs got income between Rs. 5-10 thousand, 28.8% in the age group 35-50 yrs have family income between Rs 1-5 thousand. Among migrant artisans maximum number 13.8% and 12.5% were in the age group of 20-35 yrs and 35-50 yrs respectively. 33.4% from the age group 20-35 yrs were

under metric and 9.6% from the age group 35-50 yrs were graduate. A good number (47.6%) from the age group 35-50 yrs and 38.1 % from the age group 20-35 yrs were embroidery workers. 42.9% from the age group of 20-35 yrs and 38% from the age group 35-50 yrs were continuing with their occupation from the last 10-20 yrs and 20-30 yrs respectively. Maximum migrant artisan (52.4%) from the age group 20-30 yrs were earning Rs. 1-5 thousand per month whereas very few (9.6%) were earning Rs 5-10 thousand and equal number of artisans (9.6%) were earning Rs 10-15 thousand per month. Reason being the migrant artisans were mostly doing embroidery which is in fashion so they happen to earn more than the Local artisans. 38.1% and 9.6% in the age group 30-35 yrs were living in nuclear and joint family respectively. An equal percentage 28.6% from both the age groups 20-35 yrs and 35-50 yrs have family income between Rs.1-5 thousand and Rs. 5-10 thousand respectively.

**Table 1: Percentage responses about profile of the Artisans (N=80)**

Profile	Local (Age in years)				Migrant (Age in years)	
	20-35	35-50	50-65	65-above	20-35	35-50
Total No. of respondent	10.2	50.8	25.4	13.6	13.8	12.5
<b>Education qualification</b>						
Illiterate	3.4	10.2	13.6	6.8	9.6	–
Under Matric	1.7	32.2	8.5	6.8	33.4	9.6
Hr. Secondary	5.08	8.5	3.4	–	9.6	28.6
Graduate	–	–	–	–	–	9.6
<b>Type of Artisan</b>						
Potters	3.4	10.2	11.9	8.5	–	–
Embroidery worker	–	–	–	3.4	38.1	47.6
Sculptors	3.4	20.4	8.5	1.7	–	–
Weavers	3.4	20.4	5.08	–	14.3	–
<b>No. of years in this work</b>						
10 – 20 yrs	8.5	25.4	1.7	–	42.9	9.6
20 – 30 yrs	1.7	15.3	8.5	–	9.6	38.1
30 – 40 yrs	–	10.2	10.2	8.5	–	–
40 – Above	–	–	5.08	5.08	–	–
<b>Income of Respondent/Month</b>						
1 – 5 thousand	6.8	27.2	13.6	11.9	52.4	28.6
5 – 10 thousand	3.4	23.8	11.9	1.7	–	9.6
10 – 15 thousand	–	–	–	–	–	9.6
<b>Type of Family</b>						
Nuclear	3.4	22.03	11.9	10.2	19.04	38.1
Joint	6.8	28.8	13.6	3.4	33.4	9.6
<b>Family income</b>						
1 – 5 thousand	3.4	23.8	13.6	11.9	28.6	9.6
5 – 10 thousand	6.8	23.8	11.9	1.7	23.8	28.6
10 – 15 thousand	–	3.4	–	–	–	9.6

Table 2 depicts the occupation of family members and reveals that 46.3% were engaged in other occupation such as carpenter, mobile repairing, teacher and agricultural activities etc rather than adopting their traditional occupation. 41.3% were helping their counterparts in their work and 12.5% were in same occupation as the respondent. 42.5% of family members have not cleared even secondary examination whereas 32.5% have passed their higher secondary education, 14% were graduate and 11.3% were illiterate. The income level of the family members was by and large very less. 41.2% who were helping in their traditional occupation were not into paid jobs whereas 50% were earning Rs. 3-5 thousand within the family and 8.8% were getting Rs. 5-10 thousand from other occupation like carpenter, mobile repairing, teacher and agricultural activities etc.

Table 3 shows that majority (63.8%) of the respondents have adopted their family occupation, out of which 31.3% work as employee with the artisans. 27.6% had their own enterprise. 5% of artisans were working on share basis. 36.3% of the respondents had started their new enterprise after learning their traditional skill. Of course, out of (36%) only 15% adopted the occupation due to the demand at the time of starting the enterprise, 12.5% adopted the occupation because no other opportunity was available and only

8.8% started because of the interest in the family occupation.

Table 4 reveals that majority (78.8%) of the artisans were getting monetary benefit monthly whereas 21.3% were getting according to the work done. Majority (97.5%) were not satisfied with their earning whereas only 2.5% of embroidery worker were satisfied with the earning as they have upgraded their products as per the market trends as a result of which there is a fair demand of their products in the market. Hence only 2.5% were satisfied with their earning whereas 97.5% were dissatisfied.

Reddy 2001 also reported in his study that the market for the Jamshedpur artisans products/ services are shrinking, productivity in household modes of production continues to be low, quality of products made is poor compared to industrial products and costs of various inputs are rising while the mostly poor clientele are reluctant to pay higher prices.

Table 5 shows that 43.8% of the artisans wanted to make changes in the products, out of which 40% want to make changes due to trends in the market, 37.5% due to consumer demand and 28.8% to get more monetary benefit. Whereas 56.3% of the artisans did not want to make any changes in the products, 37.5% were of opinion that preference for traditional products was

**Table 2: percentage responses about the family member's profile (N=80)**

Occupation			Education				Income (Monthly in thousands)		
Same occupation	As helping hand	Other occupation	Illiterate	Under matric	Hr. Sec.	Grad.	No income	3 -5	5-10
12.5	41.2	46.3	11.3	42.5	32.5	14	41.2	50	8.8

**Table 3: Adoption of family occupation/starting new enterprise (N=80)**

Responses				Opting family occupation						Reason to start the occupation					
*FO		*NE		Your own enterprise		As partner		As employee		More in demand		Interest		No other opportunity	
N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
51	63.8	29	36.3	22	27.6	4	5	25	31.3	12	15	7	8.8	10	12.5

\*FO = Family occupation; \*NE = New Enterprise

**Table 4: Monetary benefit/satisfaction with the earning (N=80)**

Monetary benefit				Satisfaction with the earning			
Monthly		According To Work		Yes		No	
N	%	N	%	N	%	N	%
63	78.8	17	21.3	2	2.5	78	97.5

an obstacle which hinder to make changes. About 18.8% were not aware about market trends, 12.5% gave reason that financial problem hinder them to make changes in the products.

Singh 2003 also reported that the artisans of Saharanpur who were making wood craft items made no changes in the products and work pattern. They were into traditional design and marketing styles. But in order to revive the tradition and make it relevant to modern day taste and preference, special inputs were provided on designs and market intelligence.

From Table 6 it is clear that 56.2% of the respondents did not make any changes in their work pattern over a period of time whereas 43.8% who have made changes in their work pattern, 27.6% made change by changing the design as per the market demand, about 11.3% changed their place of work, 5% used new equipments and tools in their work and only 2.5% changed their marketing style. The changes made were to have better sale and earn more profit.

Sharma et al. (2007) also revealed in his study that the local weavers of Himachal Pradesh were following their ancestral tradition and skills but were intentionally

making some alteration in the designs and motifs to cater the needs of modern buyers.

Table 7 shows that 32.5% of the artisans enjoy their work as they have interest and their livelihood depends on the skill whereas 51.3% responded that the work is very hectic and needs lot of efforts, 22.5% opined that it doesn't meet the family needs.

Reddy 2001 in its study also revealed that 80% of women in handloom sector working for more than 10 hours per day in handloom production. Often there is no payment for this work or if paid they are given very low wages.

Table 8 revealed that majority (75%) of respondents have similar artisans within their locality. 56.3% had competition with them, 18.8% respondent expressed that the artisans in the locality were as helping hand whereas 25% of the respondents did not have similar artisans within their locality and could monopolize the rates for their products.

Table 9 depicts that majority 65% of the artisan were not able to manage the family needs whereas 35% were able to manage the family needs. Those who were

**Table 5: Change in the products (N=80)**

Change				If yes, Reasons to make changes*								If no, Obstacle to make changes*					
Yes		No		Due to consumer demand		Own innovation & creativeness		Trends in the market		More monetary benefits		Lack of money		Preference for family occupation		Lack of awareness about trends	
N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
35	43.8	45	56.3	30	37.5	7	8.8	32	40	23	28.8	10	12.5	30	37.5	15	18.8

\*Multiple responses

**Table 6: Change in work pattern over a period of time (N = 80)**

Change				If yes, types of Changes*											
Yes		No		Using new Technology/ Equipments				Change in design		Changes in marketing style		Change in place of work			
N	%	N	%	N	%	N	%	N	%	N	%	N	%		
35	43.8	45	56.2	4	5	22	27.6	2	2.5	9	11.3				

\*Multiple responses

**Table 7: Artisan's Perspective towards work (N= 80)**

Enjoyment from work		Very hectic/needs lots of efforts		Not meeting family needs	
N	%	N	%	N	%
26	32.5	41	51.3	18	22.5

\*Multiple responses

able to manage, 25% said that they were also indulged into other occupation like farming, daily wages etc, 10% mentioned that they work in double shift to manage their needs and 7.5% take credit to fulfill their daily requirements. Hence majority of the artisans were not happy with their income and were trying to compensate it one or the other way.

Pandey *et al.* (2004) also revealed in his study that the exports of the artisans from Rajasthan (wood carvers) who are linked to Global market were able to make more earning than the artisans who sell their products locally remain below Rs. 8000 annually.

The findings of a similar study conducted by Reddy 2003 revealed that almost all the artisans of Tripura (Bamboo artisans) fall below poverty line and levels of living are at subsistence level. The income composition analysis shows that for most of the artisans craft income constitutes nearly 50%. The per capita income of the household was ranging from a minimum of Rs. 900 to maximum of Rs. 3365/- This clearly indicates that all artisans fall below poverty line and were not able to make both ends meet.

Table 10 shows that 52.8% of the respondents did not get any help from the family members and other, 47.5% got help from their family members. Among them 41.2% got help from family members as a helping hand, 6.3% got financial help. 20% of the respondents revealed that they get regular help from their family members, 15% said that whenever they are free they help. Only 6.3% mentioned that whenever financial help is needed the family members come forward to help.

Table 11 depicts that majority (60%) wanted to continue with their occupation for life time, among them 53.8% said that they do not have knowledge of other skill, 12.5% expressed that they are not aware of any other opportunity for income generation and 8.8% have interest in the occupation so they want to continue with the same.

Whereas 40% of the respondents do not want to continue with the same occupation, Majority (32.5%) among them gave reason that the job is very hectic and earning less, 22.5% said that they were not able to meet

**Table 8: Impact of similar artisans within the locality (N= 80)**

Similar artisans in the locality				If Yes,			
Yes		No		Competition with them		As helping hand	
N	%	N	%	N	%	N	%
60	75	20	25	45	56.3	15	18.8

**Table 9: Ability to manage family needs (N=80)**

Able to Manage				If yes					
Yes		No		Have other occupation		Take credit		Work in double shift	
N	%	N	%	N	%	N	%	N	%
28	35	52	65	20	25	6	7.5	8	10

\*Multiple responses

**Table 10: Support from family members (N=80)**

Family Support				If yes, Kind of Support									
Yes		No		As financial help		As helping hand		They help*					
								Regularly		Occasionally		When need arises	
N	%	N	%	N	%	N	%	N	%	N	%	N	%
38	47.5	42	52.5	5	6.3	33	41.2	16	20	12	15	5	6.3

\*Multiple responses

**Table 11: Perception for continuation of occupation (N=80)**

Continue in occupation				Reasons to Continue*						Reasons to discontinue*							
Yes		No		No knowledge of other skill		No other opportunity for income		Have interest in it		Very hectic		Not meeting family needs		Not satisfy with income		Want to do other reputable job	
N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
48	60	32	40	43	53.8	10	12.5	7	8.8	26	32.5	18	22.5	18	22.5	10	12.5

\*Multiple responses

family needs and were not satisfied with the income, 12.5% who were Higher Secondary pass or Graduates responded that they want to do other job in Govt. office which has a better social status.

### SUMMARY AND CONCLUSION

The findings of the study reveals that maximum numbers of the artisans were in the age group of 35-50 yrs. and very few from the age group of 20-35 yrs. This shows that the young generations opt for other occupation rather than adopt the traditional one. The education level of most of the artisans was under metric as they were not able to continue due to lack of finance. Maximum were into the ancestral occupation for the last 10-20 yrs. Most of the artisans were living in joint family and have family income between Rs. 1-5 thousand/month. The artisans personal incomes was very less between Rs. 1-5 thousand as their traditional occupation is declining day by day and have moved to other occupation such as mobile repairing, driving, teaching, agricultural activities etc to earn their livelihood.

The artisans have adopted their family occupation and got monetary benefit monthly but have not satisfied with the earning. Most of the artisans do not want to make changes in the products as they have lack of finance and preference for traditional skill in still prevails. But some are doing it as per the trends in the market and to get more monetary benefit. Majority of the artisan had not made any changes in their work pattern but very few of them have made changes by using different materials, innovation, new technology and tools in their work and agreed that it enhance the productivity and quality of the products. Maximum number of the artisan enjoyed their work as they have interest in the occupation and their livelihood depends

on the skill but other who do not enjoying found the work is very hectic and does not meet family needs but forcibly have to continue the occupation because they don't have knowledge of other skill and were not aware of any other opportunity for income generation. The other artisans who do not want to continue because they were not satisfied with the earning and moreover the artisans who are educated wants to do other jobs which have a better social status.

### SUGGESTIONS

From the findings of the study it is very clear that in the age of globalization, the survival of artisans of the Jammu region is in peril even they have skills and capability for self employment. Globalization has had both positive and negative effect. But the fact remains that new opportunities can be opened and also reviving the old ones.

- Various steps should be taken for the welfare of the artisan like giving training to the artisans, introducing new techniques and designs to meet the demands of variety seeking consumers.
- The prime need of the handicraft is to reorient the techniques of production without interference with the artistic varieties of production.
- Establishment of necessary facilities e.g. centres for imparting training, marketing, providing market intelligence, establishing linkages with financial institutions is the need of the hour.
- Capacity Building and Training for artisan community members to produce the new products/designs for the mainstream markets and buyers
- Brand Development of identified products produced by the communities to enable them to

receive higher returns and entry into niche markets. This will also involve strengthening the supply chain and community implemented stringent quality control measures.

- Identifying key trade fairs and structuring participation, developing catalogues, product briefs and other marketing materials.
- Linkage with banks for credit facilities for the artisans.

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# Bio Fertilizer a Potent Supplement of N and P Fertilizers in Economical and Sustainable Wheat Cultivation in NEPZ

Anil Kumar, C.B. Singh and Rishi Raj

IARI Regional Station, Pusa, Bihar-848125

## ABSTRACT

A field experiment was conducted to study the feasibility and economics of bio-fertilizer application in wheat at IARI Regional Station, Pusa (Bihar) during 2002-03 and 2003-04. In general, cultivated land of this region falls under medium fertility range, thereof, use of bio-fertilizers for replacement of costly chemical fertilizers appears to be of immense important. In this study, recommended doses of major nutrients i.e., N.P.K. were compared with different combinations of N.P.K. doses and bio-fertilizers like *Azotobacter* and *Phosphate Solubilizing Bacteria*. Two years data indicated that application of half of the recommended dose of N and  $P_2O_5$  i.e., 60 kg N along with 30 kg  $P_2O_5$ /ha supplemented with seed treatment of wheat by *Azotobacter* and Phosphate culture, produces a mean wheat yield of 39.10 q/ha which is much more economical (2.69 kg grain/rupee invested) in terms of grain produced per rupee invested in fertilizers with bio-fertilizers as compared to the plot where recommended dose of fertilizers (1.65 kg grains/rupee invested) were applied in the form chemical fertilizers only in both the years. Beside above the treatment, Half recommended N + half P + full K + *Azotobacter* + P culture also save 1099.30 / ha as compared to the treatment full recommended dose of NPK (120:50:30 kg/ha). At the same time, the seed treatment of wheat with *Azotobacter* and *Phosphate Solubilizing Bacteria* is very easy and can be handled by any farmer without any problem. Besides, the advantage gained in terms of economics, application of bio-fertilizers do not interfere with the balance of soil and ultimately adds to soil health build up in long run.

**Keywords:** Bio-fertilizer, *Azotobacter*, Phosphate solubilizing bacteria, Economics of biofertilizers, recommended dose fertilizers of wheat

## INTRODUCTION

In view of the stagnating food grain production and an increasing consumption need of the growing population, Government of India had launched centrally sponsored scheme "National Food Security Mission (NFSM) in August 2007. The major objective of this scheme is to increase production and productivity of wheat, rice and pulses on a sustainable basis so as to ensure food security of the country (Kakkar *et al.*, 2014). Wheat (*Triticum aestivum* L.) is one of the major sources of food energy, protein and fibre in human diet, staple food for nearly 35% of the world population and hence the most important cereal crop globally. Semi dwarf, high yielding wheat varieties developed in the mid sixties led to an impressive increase in wheat yields in several conventional wheat

belts (Rajaram, 1999). However, the gain in yield based on breeding (or genetic traits) has been rather low since the mid nineties. The expected global demand for wheat in the year 2020 will vary between 840 to 1,050 million tonnes (Rosegrant *et al.*, 1995). To meet this growing demand, the global average grain yield must increase from the current 2.5 t/ha to 3.8 t/ha. India has largest area under wheat (28.4 million hectares) and is the second largest producer of wheat (86 million tonnes in 2011-12) after china in the world (Rajendra Prasad and Gupta, 2012). However, to meet the food security requirement, 1.5 million tonnes of additional wheat per year would be required and production targets of wheat to be enhanced from 95 million tons at present to 109 million tons by 2020. Such a daunting task may not be achieved easily considering the various natural and



technological constraints. Bio-fertilizers are formulated products of living cells of different types of microorganisms that have the ability to mobilize nutrients from non-usable to usable form through biological processes. These microorganisms come from the soil biosphere and hence are parts of the plant's natural environment. The microorganisms that are in use as bio-fertilizers in wheat broadly include the free living and associative nitrogen fixing and *phosphate solubilizing rhizobacteria* and the *mycorrhizal* fungi that are capable of mobilizing on-available nutrients from soil and transporting them to and across plant roots, e.g. phosphorus. The contribution of vesicular arbuscular mycorrhiza (VAM) and *Azotobacter* to growth and development of many plant families has long been recognized (Wani *et al.*, 1988). Earlier studies of such types of symbiosis in wheat have described considerable variability for the colonization by VAM and response to *Azotobacter*. Even when wheat is colonized, biomass and yield improvement due to symbiosis depends on the nutrient absorbing efficiency of the fungal symbiont, fertility of the soil and genotype of the cultivar.

We, the Indians are at a stage, where, it is becoming difficult to meet the nutrient needs of farming through chemical fertilizers alone. Escalating cost of raw materials for production of chemical fertilizers plays a major role in supply of costly chemical fertilizers through industries to farming community. Only bio-fertilizers are cheaper and environmental friendly microbial fertilizers which can play a significant role in improving soil fertility by fixing atmospheric nitrogen, solubilizing the insoluble soil phosphate and producing plant growth substances in soil, thereby, improving soil health. It is very difficult for marginal and small farmers of our country, who till about 72 percent of total farm holdings to purchase and use recommended fertilizer doses at current price. Therefore, it is needed to exploit less expensive nutrient sources which can maximize crop productivity per unit area in most cost effective manner. *Azotobacter*, a non symbiotic bio-fertilizers contributes about 20-25 kg N/ha in crop like wheat, maize, cotton and other crops and under favorable conditions, *phosphorus solubilizing bacteria* can solubilize 20-30 percent of insoluble phosphate and increase yield up to 20 percent. If these two microorganisms interact favorably they may show synergistic effect to produce even better result than expected separately. Keeping in

view the importance of bio-fertilizers for economical wheat crop production, above experiment was planned and conducted.

## MATERIAL AND METHODS

A field experiment was conducted to study the feasibility and economics of bio-fertilizers application in wheat at IARI Regional Station, Pusa (Bihar) during 2002-03 and 2003-04. The soil of experimental field was sandy loam in nature having medium range of organic carbon, available  $P_2O_5$  and available  $K_2O$ .  $p^H$  of the experimental field was in the range of 8.4 to 8.6 where as EC was in the range of 0.2 to 0.3. Eight combinations of chemical fertilizer doses and bio-fertilizers were applied in wheat field trial to assess its effects on feasibility and economics in terms of wheat yield. The experiment was laid out in randomized block design with four replications.

Bio-fertilizers (*Azotobacter* and *Phosphate Solubilizing Bacteria*) were applied with seed treatment method as per need of the treatment. Both bio-fertilizers were applied on seed after making slurry in minimum amount of water and mixing the seeds evenly by hand to get uniform coating on all seeds. After bio-fertilizer application on seed, seeds were dried in shade for two hours before sowing. Wheat was sown at the seed rate of 100 kg/ha in line with row to row spacing of 20 cm. The seeds were placed at about 4-5 cm depth by *ker*a method. Wheat was grown as per the recommended package of practices and harvested in the second forth night of April in both the years. At the time of maturity the net plots (leaving 2 border rows on each side) were harvested and sun-dried for three days in the field and total biomass yield was recorded. After threshing, cleaning and drying the grain yield was recorded at 14% moisture. Yields were expressed in q/ha as in manuscript. Cost of fertilizers and bio-fertilizers were calculated based on the prevailing market prices of the inputs during the respective crop seasons.

## RESULT AND DISCUSSION

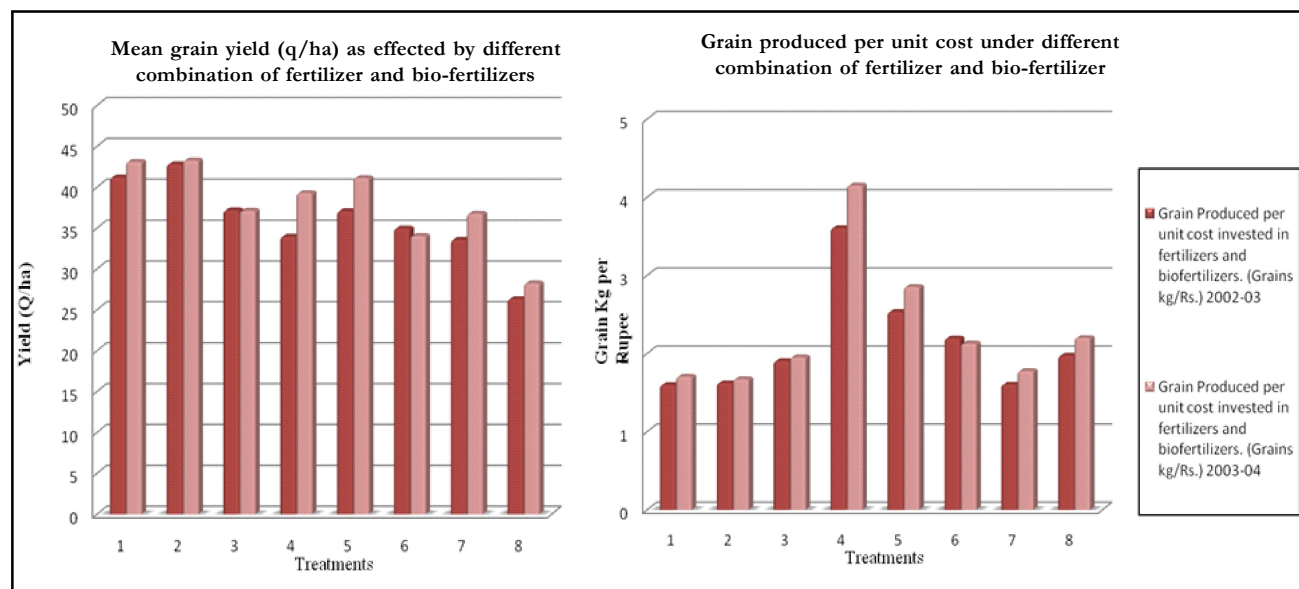
**Grain yield:** A perusal of two years data indicated a significant difference in grain yield of wheat due to change in doses of nitrogenous and phosphate fertilizers application and its combination with bio-fertilizers (Table 1). Highest grain yield of 42.8 and 43.3 q/ha during 2002-03 and 2003-04, respectively was obtained



where full doses of N, P, K, were applied along with Azatobacter and Phosphate culture (Nutrient cost of 2636 and 2586), which was at par with yields obtained by applying full dose of NPK (Control) having the nutrient cost of 2576 and 2526 or half dose of N and P<sub>2</sub>O<sub>5</sub> along with Azatobacter and P culture with nutrient cost of 1462 and 1441 during 2002-03 and 2003-04, respectively. Strikingly, a treatment combination of half N, no P<sub>2</sub>O<sub>5</sub> and full K along with Azatobacter and P culture having the lowest nutrient cost of 941 and 947 during 2002-03 and 2003-04 respectively and found most cost effective but yields were not at par with control (33.9 and 39.3 q/ha) during respective periods. Panda and Rai (2008), Bharti *et al.* (2010), Abbasi and Yousra (2012) have also been reported positive response in increase in wheat yield through inoculation with Azatobacter and P culture.

**Grain per unit investment in fertilizer nutrients and bio-fertilizers:** The application of half dose of N and P, full K along with Azatobacter and P culture gave statistically at par grain yield (37.08 and 41.12 q/ha) as compared to control in 2002-03 and 2003-04

respectively. Same time this treatment also observed cost effective in terms of grain produced per unit cost invested in fertilizers and biofertilizers (2.53 and 2.85 grain kg/invested) in the above given years. Kushare *et al.* (2009) also observed that 25% saving in nitrogen and phosphorus application could be possible with combined inoculation of Azotobacter + SB under late sown irrigated wheat. However, a substantially low cost per unit grain produced (3.60 and 4.15 kg grain per Rupee invested on nutrients and bio-fertilizers used) in treatment where only half of recommended dose of N, no P<sub>2</sub>O<sub>5</sub> and full dose of K<sub>2</sub>O along with bio-fertilizers were used but this treatment combination could not give the grain yield which is need for statistically at par with control. In an another treatment, maximum grain yield (42.8 and 43.3 q/ha) were obtained when full dose of chemical fertilizers nutrient along with bio-fertilizers were used, had 1.62 and 1.67 kg grain per unit cost incurred on fertilizers and bio-fertilizers (Table 1 and Figure 1). Difference in the yield of above two treatments were of the tune of 8.9 and 4.0 q/ha during 2002-03 and 2003-04 respectively.



**Treatment detail:**

1. Full recommended dose of NPK (120:50:30 kg/ha)
2. Full recommended dose of NPK + Azatobacter + P culture
3. Half recommended N + full P + full K + Azatobacter
4. Half recommended N + no P + full K + Azatobacter + P culture
5. Half recommended N + half P + full K + Azatobacter + P culture
6. Full recommended N + no P + full K + Azatobacter +P culture
7. Half recommended N + half P + full K + P culture
8. No N + full P + full K + Azatobacter + P culture

**Figure 1: Grain yield and grain produce per unit cost of fertilizers and bio-fertilizers of Wheat as influenced by different doses of N and P and their combinations with Azatobacter and P culture**

## CONCLUSION

Considering the gain per unit cost incurred on fertilizer nutrient and economic status of marginal and small farmers of India to invest, it becomes evident that a farmer would like to gain substantially more grain per unit of cost with marginal reduction in total production. At the same time they can escape the hazards of soil health deterioration caused by imbalance fertilization. Improvement in soil health is also one of the additional advantages brought about by the use of bio-fertilizers. Other inputs cost remaining the same, data on the difference in yield caused due to different doses of chemical fertilizer nutrients and bio-fertilizers supplements. Bio-fertilizers appears to be a cost effective supplements to chemical fertilizers and can help to economize on the high investment needed for fertilizer use as far as N and P are concerned.

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# Developing Agripreneurship for Sustainable Farm Income: Action Research Study on Women Farmers of *Hapur* District, Uttar Pradesh

Rashmi Singh\*, M.S. Nain, J.P. Sharma and J.R. Mishra

Division of Agricultural Extension, ICAR-Indian Agricultural Research Institute, New Delhi-110012

## ABSTRACT

Considering shrinking land base and rampant unemployment, there is need to commercialize and diversify Indian Agriculture in such a way that one can generate more income per unit of area and time and create agro-based employment opportunities (Sharma and Singh, 2006). For this to happen we need to convert agriculture into agribusiness. Agriculture has to move from subsistence culture to Agripreneurship for higher profits. With this background, an action research project was taken up during 2009-14 in *Hapur* district of Uttar Pradesh state to develop a trained cadre of farm women having the capabilities for agri-entrepreneurial endeavours of value added and processed food products so that the incomes at household level could be enhanced and post harvest losses of farm produce could be minimized. It was revealed that building entrepreneurial competencies of farm women and mobilizing women for group action to take up food processing and value addition agri-ventures for maximising farm profits is possible with the concerted efforts of appropriate training of not only technical skills but also behavioral attributes. A perceptible increase in achievement motivation levels and inculcation of entrepreneurial risk taking behaviour was observed. Women also perceived that they had accrued advantages after taking up agripreneurship ventures. Experiences of institutional convergence of synergistic strengths in *Hapur* has illustrated that there is need for all working together in spirit and action for translating maximum benefits and sustainable growth. Agripreneurship development may be visualized as a process whereby individual's motivations and aspirations trigger it and their entrepreneurial competencies, adoption of best practices and facilitative socio-economic factors play sequential role in reaching agripreneurial success.

**Keywords:** Agripreneurship, Entrepreneurs, Entrepreneurial Competencies, Developing Entrepreneurship, Institutional Convergence and Agribusiness.

## INTRODUCTION

Agriculture is an important sector of Indian economy as it contributes significantly to GDP and provides employment to more than 60% of its population. The food grain production has increased from 51 million tons in 1950-51 to 260 million tons during 2013-14. On 2.4 percent of world land India is managing 17.5 percent of world population. Agriculture and allied sectors are important sources of raw materials for industries and it consumes many industrial products particularly fertilizers, pesticides, agriculture implements and other consumer goods. Due to low land man ratio, more and

more farmers and their children are finding themselves out of work. In view of shrinking land base and rampant unemployment, there is need to commercialize and diversify Indian Agriculture in such a way that one can generate more income per unit of area and time and create agro-based employment opportunities (Sharma and Singh, 2006). For this to happen we need to convert agriculture into agribusiness. Agriculture has to move from subsistence culture to Agripreneurship for higher profits.

The contribution of women in agricultural development is immense but often goes unnoticed and unrecognized.

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\*Corresponding author email id: rashmi.iari@gmail.com

Women since long have been performing many agricultural activities not only during crop production but also in post harvest management of products within and outside the household in most parts of the country. Women form a large segment of the agricultural workforce. As per Census 2011, out of 1.22 billion population of India, 591.4 million (48.46%) are women who live in rural areas. These women are still underprivileged, disadvantaged and discriminated and without the empowerment. The women deserve increased attention of agricultural extension services in every developing nation. In the present scenario of globalization, liberalization and privatization of agricultural sector, the sustainable development and empowerment of farm women is considered as a key factor for development of any country. Participation of women in economic activities is now emerging as a universal phenomenon. Social and economic empowerment through entrepreneurial skill of women is the key factor for overall development of any country. Challenges usually faced by women entrepreneurs in India include low literacy rate (60% of women are still illiterate), visualized role of women as confined to household activities only, lack of access to resources, lack of motivation, lack of support from family members, lack of suitable infrastructure, lack of marketing facilities and lack of proper storage facilities in rural areas. Besides these, they are also plagued by low risk bearing ability, lack of information regarding new technologies, lack of training, lack of finance and other social and cultural constraints (Nain *et al.*, 2015; Singh *et al.*, 2014).

Women farmers usually having low education level usually do not dare to take risk for establishing a business fearing marketing problems. Consequently, entrepreneurial intention among women farmers to take up processing and value addition food products is impacted. Also, their knowledge about processed food's prospect is very limited. Preliminary appraisal revealed that even in *Hapur* district of Uttar Pradesh which is only 85 kms away from National Capital of Delhi, though production of vegetables and fruits is substantial but farmers were not getting enough returns and also the produce being perishable was resulting into huge post harvest losses, thereby not contributing to the household incomes at farmers' level. Despite working hard in the fields, farmers and farm women were not able to meet even basic requirements of their families.

With this background, an action research project was taken up during 2009-14 in *Hapur* district of Uttar Pradesh state to develop a trained cadre of farm women having the capabilities for agri-entrepreneurial endeavours of value added and processed food products so that the incomes at household level could be enhanced and post harvest losses of farm produce could be minimized. Thus the study was undertaken with the objectives of studying the factors responsible for encouraging women to become entrepreneurs, to examine the process of entrepreneurship development, to study the performance of farm women entrepreneurs and to study the institutional networks of support agencies in promoting women's entrepreneurship.

### MATERIALS AND METHODS

The study was conducted in *Hapur* district of Uttar Pradesh where three villages *Lalpur*, *Shyampur* and *Kania-kalianpur* were selected purposively being predominantly engaged in agriculture and having scope of agripreneurship development due to their proximity to National capital of Delhi. Ninety farm women, 30 each from three villages and 21 officials from institutions engaged in agripreneurship development in the area (three from all seven agencies) formed the sample size of the study. The data from women was collected as per standard instruments prior to undertaking training interventions for agripreneurship development. Andragogical training tools were utilized to inculcate behavioural attributes required for entrepreneurial intention. Technical methods were also demonstrated and opportunities given for experiential skills learning in the training interventions designed specifically for the farm women of three villages. Post production training for packaging, labelling and marketing was also facilitated with collaboration with supporting agencies. Data pertaining to impact in terms of social and economic enhancement was collected. The action interventions undertaken for enhancing entrepreneurial skills among farm women training courses were organized, follow up and mentoring of the trained women was done and linkages initiated with supportive institutions and agencies. A social network analysis of interorganisational collaboration was conducted using Harris *et al.* (2012) method.

## RESULTS AND DISCUSSION

Since the villages were predominantly engaged in production of perishable agricultural produce of vegetables and fruits, identification of specific agri - entrepreneurial ventures to be taken up was done. The micro agri based enterprises which could be taken up were classified as follows:

1. Micro Enterprise development related to agriculture and allied agricultural activities like cultivating to organic vegetables, flowers, oil seeds and seed production are some of the areas besides taking up mushroom growing and bee-keeping. Some more areas can be like dehydration of fruits and vegetables, canning or bottling of pickles, chutneys, jams, squashes, dairy and other products.
2. Micro-Enterprise development related to livestock management activities like dairy farming, poultry farm, livestock feed production and production of vermi composting using the animal waste can be an important area in which women can utilize both her technical skills and raw materials from the farm and livestock to earn substantial income and small scale agro-processing units.
3. Micro – Enterprise development related to household based operations like knitting, stitching, weaving, embroidery, bakery and flour milling, petty shops, food preparation and preservation.

As presented in Table 1, women expressed needs for training in four areas-group management skills, marketing skills, enterprise management skills and production technical skills. Most of them were found to be confident of production and technical skills for taking up value addition enterprises but were found to skeptical of marketing and enterprise management skills. This may be due to the traditional nature of enterprises as they have been taking up value addition of surplus vegetables / fruits at their household level for family

consumption. The social processes of group management skills were also mentioned by some as training need area. In village Lalpur this was found to be the major concern as self help groups' development took some convincing at the part of NABARD and NGO LJKSS.

### **Supportive Schemes of Government for Women Entrepreneurship Development:**

Development of women has been a policy objective of the government since independence. Until the 70s the concept of women's development was mainly welfare oriented. In 1970s, there was a shift from welfare approach to development approach that recognised the mutually reinforcing nature of the process of development. The 80s adopted a multi-disciplinary approach with an emphasis on three core areas of health, education and employment. Women were given priorities in all the sectors including SSI sector. Government and non government bodies have paid increasing attention to women's economic contribution through self employment and industrial ventures. The First Five-Year Plan (1951-56) envisaged a number of welfare measures for women. Establishment of the Central Social Welfare Board, organization of Mahila Mandals and the Community Development Programmes were a few steps in this direction. In the second Five-Year Plan (1956-61), the empowerment of women was closely linked with the overall approach of intensive agricultural development programmes. The Third and Fourth Five-Year Plans (1961-66 and 1969-74) supported female education as a major welfare measure. The Fifth Five-Year Plan (1974-79) emphasized training of women, who were in need of income and protection. This plan coincided with International Women's Decade and the submission of Report of the Committee on the Status of Women in India. In 1976, Women's welfare and Development Bureau was set up under the Ministry of Social Welfare. The Sixth Five-Year Plan (1980-85) saw a definite shift from welfare to development. It

**Table 1: Training needs expressed by farm women**

Villages	No of respondents (N=90)	Group management skillsF (%)	Marketing skillsF(%)	Enterprise management skillsF(%)	Production technical skills F(%)
Kania Kalyanpur	30	29 (96.7)	30 (100)	20 (66.7)	4 (33.3)
Lalpur	30	30 (100)	29 (98.7)	19 (63.3)	5 (16.7)
Shyampur	30	16 (53.3)	20 (66.7)	13 (43.3)	3 (10.0)

recognized women's lack of access to resources as a critical factor impeding their growth. The Seventh Five-Year Plan (1985-90) emphasized the need for gender equality and empowerment. For the first time, emphasis was placed upon qualitative aspects such as inculcation of confidence, generation of awareness with regards to rights and training in skills for better employment. The Eight Five-Year Plan (1992-97) focused on empowering women, especially at the Gross Roots Level, through Panchayati Raj Institutions. The Ninth Five-Year Plan (1997-2002) adopted a strategy of Women's Component Plan, under which not less than 30 percent of funds/benefits were earmarked for women related sectors. The Tenth Five-Year Plan (2002-07) aims at empowering women through translating the recently adopted National Policy for Empowerment of Women (2001) into action and ensuring Survival, Protection and Development of women and children through rights based approach.

At present, the Government of India has over 27 schemes for women operated by different departments and ministries. Some of these are: a. Prime Minister's Rojgar Yojana (PMRY) b. Entrepreneurial Development programme (EDPs) c. Management Development programmes d. Women's Development Corporations (WDCs) e. Marketing of Non-Farm Products of Rural Women (MAHIMA) f. Assistance to Rural Women in Non-Farm Development (ARWIND) schemes g. Trade Related Entrepreneurship Assistance and Development (TREAD) h. Micro & Small Enterprises Cluster Development Programmes (MSE-CDP). i. National Banks for Agriculture and Rural Development's Schemes j. Rajiv Gandhi Mahila Vikas Pariyojana (RGMVP) k. Priyadarshini Project- A programme for Rural Women Empowerment and Livelihood in Mid Gangetic Plains. The efforts of government and its different agencies are ably supplemented by NGOs that are playing an equally important role in facilitating women empowerment. Despite concerted efforts of governments and NGOs there are certain gaps. Of course we have come a long way in empowering women yet the future journey is difficult and demanding.

**Action Interventions and Outcomes:** In the project area, NABARD, NGO LJKSS, ASI, Bharati wallmart, RUDSETI were also approached for collaboration to

cater to different needs of agripreneurial development process to take place. All these agencies were having their respective strengths and collaborated to develop a convergence model of agripreneurship development by synergizing all activities. Showcasing of following IARI scientific technologies led to uptake of enterprises: Baby corn cultivation/ processing, Post-Harvest Processing of soya bean, bajra puffs, cookies, cracker etc., Value Addition of Vegetables/ Fruits for Pickle making, juice extraction etc. Floriculture and dry flower technology, Vermi-composting, Mushroom Cultivation Vegetable Seed Production, Home based enterprise of Biocontrol of White Grub through Nematodes.

Trained women have launched their agri-enterprises of turmeric powder production floriculture, vermi-composting, mushroom production, seed production, protected cultivation of vegetables and opening up of an agri-input outlet. Replication effect of mobilization for agri-entrepreneurial activities was noticed in adjoining villages as well. Farm Women who were trained launched their pickle making, dalia making, wheat flour mill and grinding of spices enterprise named "*Sunbara Lalpur*" an "*Neelraj*". Handholding and mentoring activities were undertaken to establish their enterprises on a strong footing. Linkages with other agencies were established for finance requirements, marketing and certification purposes. Convergence of Synergistic efforts of all stakeholders for farmer based agri enterprise development has been taken up. Farm women entrepreneurs of Hapur villages were linked with all stakeholders in the process- IARI for mobilizing an mentoring, RUDESETI for training, Agribusiness Systems International (ASI) and Bharat Wallmart for marketing, NGO Laxmi Jan Kalyan Sewa Sansthan for grassroots mobilization logistics and NABARD for financial support. The initiative resulted in three marketing outlets under the name of "*Sunbara Fresh*" in *Hapur*, Two outlets for Agri-inputs, fair price shop as a non-farm venture launched by the rural women of project village *Shyampur*. grinding of spices at *Kania Kalyanpur* and *Neelraj* flour mill at Muradnagar.

**Socio Economic Empowerment: Perceived Impacts of Training Interventions:** The data prior to conducting training courses both at IARI and at RUDSETI, Ghaziabad were collected in terms of risk taking behavior (Scale by Mishra,1979),



**Table 2: Interventions undertaken and outcome**

Interventions Undertaken	Outcome
Entrepreneurial Motivation Training Labs conducted	Farmers mobilized to take up agri based enterprises for enhancing profits from the same land
Training course on Value addition – pickle making, bakery and post harvest technology	Value Added Manufacturing Enterprises Best Price outlet at village Shyampur
Interaction Meet of nascent pickle makers with established value addition entrepreneur	Refinement of products as per market demand Linkage established for marketing purposes Training in packaging
Interaction of Farm women entrepreneurs with Post Harvest Scientists	Awareness regarding certification procedures and other food standards to be followed
Facilitated 3 women to attend 5 days Training Course on Value Addition and Post Harvest Techniques at PHT Division	Two women have started their own pickle making unit and are selling it at 3 outlets under brand name of Sunhara Fresh.
Motivational and information based lectures through Videoconferencing	Awareness generation with an enthusiasm and interest being shown for various IARI technologies
Facilitated Linkage establishment with various stakeholders	Linkages established for sustenance of newly set agrienterprises

achievement motivation (Mehta, 1982 method for scoring need for achievement).

**Risk taking Behaviour:** As depicted in Table 3, there was a shift recorded by farm women (91.1%) towards moderate and calculated risk taking behavior after the training interventions were undertaken. Pre training orientation towards risk was either safe playing (11.1%) or undertaking blind risk (8.9%). 10% women were also found to be undertaking very high risk probability of 80%.

**Table 3: Distribution of respondents as per their Risk taking behavior**

Probability of risk	Pre Training		Post Training	
	Freq- uency	Perc- entage	Freq- uency	Perc- entage
No risk	10	11.1	—	—
20% risk	26	28.9	35	38.9
50% risk	37	41.1	47	52.2
80 % risk	09	10.0	08	08.9
100% risk	08	08.9	—	—
	90	100.0	90	100.0

*Need for Achievement*

Similar shift (was also recorded in their achievement motivation levels which was found to be enhanced to 67.47% stories having achievement imageries post training as compared to only 44.39% stories possessing achievement imageries prior to undergoing training interventions. The women were stimulated psychologically through Entrepreneurial Motivation Labs being conducted in their villages. This way the human domain was developed ready for enterprise uptake.

**Convergence for synergistic efforts of seven institutions for Agripreneurship Development:**

Besides human domain, entrepreneurial climate is also very significant in enterprise success. The data was also taken up *vis a vis* marketing channels being used by the women. Majority (66.7%) women were found to be using local market for disposing the produce but with linkages developed with ASI and Bharati wallmart, retail agencies were the preferred for marketing. The linkages with marketing agencies benefitted them with higher returns and assurance of a buyer.

**Table 4: Distribution of respondents as per their Achievement motivation**

Total number of TAT Stories		No. of Unrelated Imagery		No. of Achievement Imagery		Need for Ach (%)	
Pre T.	Post T.	Pre T.	Post T.	Pre T.	Post T.	Pre T.	Post T.
223	246	124	80	99	166	44.39	67.47

**Table 5: Marketing channels**

Different markets	Pre -Action Interventions	Post - Action Interventions
	F (%)	F (%)
Farm gate	10 (11.1)	—
Village/local market	60 (66.7)	05 (05.6)
Hapur market	20 (22.2)	15 (16.7)
Delhi market	00 (00.0)	10 (11.1)
Retail marketing Agencies	—	40 (44.4)
Own shops/outlets	—	20 (22.2)

Besides IARI, National Bank for Agriculture and Rural Development (NABARD), Rural Development & Self Employment Training Institute (RUDSETI), Agribusiness Systems International, Bharati Wallmart, State Development Department and NGO *Laxmi Jan Kalyan Sewa Sansthan* were working for enhancing farm incomes in the area. Each institution had respective strengths (Table 6) which were synergized by organizing interaction meets and focus group discussions to arrive at common programmes and activities in a collaborative manner. Already established entrepreneurs were also engaged in action interventions which were helpful in giving them the practical tips to run their businesses and also helped in linking with market. Farm women of the three project villages were mobilized to form Self Help Groups which further got organized under SHG Federation named *Mahila Kisan Vikas Sanstha* by NABARD intervention. SHG federation is having about 1000 members which comprised of women from study

villages and other villages of Hapur, Baghpat and Muradnagar areas.

The case illustrates well established partnerships of women manufacturers of these value added products with established dealers and up-market channels. Farmers who have taken up entrepreneurial activities are often found facing problems in marketing of their products. Well developed effective linkages among all the stakeholders usually results in higher profits for producers and consolidated production sites for marketing and supply chain agencies. The group approach involving common interest groups, farmers' societies/cooperative societies, self- help groups etc. should be encouraged to capitalize the optimum resource utilization and maximization of food processing and value addition to address the multi faced issues underlying socio-economic development of farm households. The analysis revealed that besides impacts in terms of income enhancement and economic empowerment, there were also visible impact in form of social assets development and process of value addition ventures. Social assets are taken to be the social resources that people can use to pursue their livelihood objectives: networks and connections, membership of formalized groups, relationships of trust, reciprocity and exchange. The concept of livelihoods defined as the "capabilities, assets (including both material and social resources) and activities required for a means of living" (Chambers and Conway, 1992) provides the desired

**Table 6: Roles and responsibilities of various Institutions involved**

IARI	RUDSETI	NABARD	ASI	LJKSS	Bharati-Walmart	Est. d Entrepreneurs
Technological knowhow	Training Infrastructure	Wide network Institutional support	Established Supply Chain Procuring Quality Produce directly from Producers Less Procurement costs, better share to Farmers	Highly motivated and hard working staff	Supply of Bulk quantity from one production site Minimizing post harvest losses Different segments of producers catered to	Enlargement of network of producers
Superior Varieties & Technology for Commercial uptake	Skill Training Courses	Financial Role as supporter for rural Development Initiatives		Abilities to mobilize women for entrepreneurship		Established Marketing channels
Entrepreneurial Motivational Trainers	Hand - holding Measures	Credibility As National Agency				

viewpoint for this research: that of the individual as an actor, in these cases: the entrepreneur. Livelihoods in this sense are holistic, encompassing not only income, the narrow meaning of the term often used in economic research and also in common speech, but all assets that can form the means to making a living, and assets that give a person the capability to act and to use resources.

What do we mean by convergence? Convergence literally refers to the alignment of issues, interests and therefore solutions across all institutions engaged in development of Agripreneurship. Thus convergence is not just collectivization, it is not referring to cooperation only but definitely more than collaboration. In fact, rather than just being episodic and event-driven, convergence actually implies constant shared commitment with recognized “wins” for all partners involved. Internationally, organizations such as Barclays, Care and Plan are working together on a large-scale local community finance project which aims to reach 300,000 to 500,000 people across Africa, Asia and South America in development sector. Similar mechanisms can be emulated nationally for Agripreneurship Development. The emergence of multistakeholder alliances between profit oriented companies, social enterprises, non-governmental organizations (NGOs) and government institutions collaborating in totality is

an important solution to many of our problems plaguing agriculture sector.

**Social Network Analyses:** The officials of agencies, established entrepreneurs and farm women were interviewed and data on collaboration and extent of collaboration was also probed. As per the social network matrix in Table 7, it was found that more cohesive collaboration could be sought from marketing agencies (ASI and Bharati wallmart) and established entrepreneurs for the speedier process of agripreneurship development. For training purposes also established entrepreneurs would be having more credibility for potential entrepreneurs. Similar results were also confirmed by utilizing the method by Harris *et al.* (2012) as given in Table 8 below.

The study revealed development of social assets as an impact and process of value addition venture. Social assets are taken to be the social resources that people can use to pursue their livelihood objectives: networks and connections, membership of formalized groups, relationships of trust, reciprocity and exchange. The concept of livelihoods defined as the “*capabilities, assets (including both material and social resources) and activities required for a means of living*” (Chambers and Conway, 1992) provides the desired viewpoint for this research: that of the individual as an actor, in this case: the

**Table 7: Inter-organisational Social Network Matrix**

	IARI	RUDSETI	NABARD	NGO-LJKSS	Bharati Wallmart	ASI	Est Ent
IARI		1	1	1	0	1	1
RUDSETI	1		1	1	0	0	1
NABARD	1	1		1	1	1	0
NGO- LJKSS	1	1	1		1	0	1
Bharati Wallmart	0	0	1	1		1	0
A S I	1	0	1	0	1		0
Est Ent.	1	1	1	1	1	0	
	5	4	6	5	4	3	3

**Table 8: Social Network Analyses**

Agency	Density (Freq. of contact)		Reciprocity/Strength of tie (Level of Collaboration)		Indegree Centrality			
	Frequent	Infrequent	Collabo- rative	No Collbo- ration	Referrals Made		Perceived Expertise	
					Referred to	Not referred	Expert knowledge given	No assist- ance
IARI	83.4	16.6	66.7	33.3	100.0	-	83.4	16.6
RUDSETI	83.3	16.6	83.4	16.6	100.0	-	83.4	16.6
NABARD	66.7	33.3	83.4	16.6	100.0	-	100.0	-
NGO- LJKSS	100.0	-	83.4	16.6	100.0	-	100.0	-
Bharati Wallmart	66.7	33.3	50.0	50.0	66.7	33.3	50.0	50.0
A S I	33.3	66.7	33.3	66.7	33.3	66.7	33.3	66.7
Estd Ent.	50.0	50.0	66.7	33.3	66.7	33.3	66.7	33.3

entrepreneur. Livelihoods in this sense are holistic, encompassing not only income, the narrow meaning of the term often used in economic research and also in common speech, but all assets that can form the means to making a living, and assets that give a person the capability to act and to use resources.

Self-employment in small-scale businesses presents a constructive option for income generation. In many developing countries, a high percentage of small-scale businesses that cater to local needs are controlled or owned by women. In Latin America, women own between one-third and one-half of all small rural enterprises. Women's enterprises tend to be relatively small, have informal structures, flexibility, low capital needs, modest educational requirements, high labour intensity, and depend on local raw materials. They are also characterized by their dependence on family labour and limited technical and managerial skills. Commonly, these enterprises are not registered, maintain no business records and do not have access to credit from formal credit institutions. Rural women are active participants in retail trade and marketing, particularly where trade is traditional and not highly commercialized. In many parts of Asia, women market foods such as vegetables; in West Africa, they distribute most major commodities; and in the Caribbean, women account for nearly all local marketing. Through their marketing efforts, women provide valuable links among farmers, intermediaries and consumers. Petty trade, often thought of in the past as non-productive, in fact serves to stimulate the production and consumption linkages in the local economy.

A particularly successful approach has been implemented here with this project creating new income-earning opportunities for rural women by developing organizations with both social and economic functions. By diversifying and intensifying agricultural production, enlarging the agricultural area, expanding marketing and improving technology, the project enabled women to add value to their products.

***Perceived advantages of agripreneurship activities taken up after IARI interventions:*** Data was also collected from the farm women regarding what advantages they have got after the action project initiatives and linkages with various agencies being established. The details are presented in Table 9.

**Table 9: Benefits as perceived by farm women of Hapur district**

Benefits of Agripreneurship	W.M.S.*	Rank
Improved standard of living	8.9	II
Enhanced Profits	9.2	I
Self confidence in agripreneurial activity	7.8	V
Enhanced awareness	8.2	IV
Sense of achievement	8.9	II
Increased social interaction	8.5	III
Enhanced leadership qualities and political activities	6.1	VIII
Involvement in solving problems related to women and community	7.5	VI
Decision making capacity in family and community	7.8	V
Recognition in peer group	8.2	IV
More investment in children's education	6.5	VII

\*Weighted mean score (Range 1-10)

The women perceived earning profits, enhanced sense of achievement and improved standards of living as the most important advantages accrued by the IARI project in Hapur area. The other benefits were found to be increased social interaction, enhanced awareness, self confidence in agripreneurial activity, recognition in peer group, decision making, more investment in children's education and enhanced leadership among women.

### CONCLUSION

The food processing and value addition is an integral component of agriculture and contributes significantly to economic and social development of the country. However, its potential has largely been underutilized, leaving a huge opportunity and scope to develop and promote the sector. Farm women individually or in group can tap this immense opportunity and potential. There is a pertinent need for developing an effective and efficient strategy incorporating the issues like development of appropriate, location specific and need based production and processing technologies; strengthening infrastructural facilities; dissemination of technologies to the farmers; implementing capacity building and entrepreneurial interventions; developing effective and meaningful marketing linkages for serving the interest of the consumers to tackle the multi-dimensional problems of rural poverty, lower farmers' share in profit, unemployment and lesser income generation opportunities. Building entrepreneurial competencies of farm women and mobilizing women for group action to take up food processing and value addition agripreneurships for maximising farm profits. Experiences of institutional convergence of synergistic strengths in *Hapur* has illustrated that there is need for all working together in spirit and action for translating maximum benefits and sustainable growth. Agripreneurship development may be visualized as a process whereby individual's motivations and aspirations

trigger it and their entrepreneurial competencies, adoption of best practices and facilitative socio-economic factors play sequential role in reaching agripreneurial success. It is the farmers' ability to effectively manage the inhibitive factors present in the rural environment which proves critical for achieving success. For developing agripreneurs, its essential that an effective network is built consisting of various stakeholders like input suppliers, mentors, technical experts, marketing and supply chain agencies.

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## **AUTHOR GUIDELINES**

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