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Validation of farmer to farmer extension model for dissemination of quality seeds of pulse crops: experiences from Bundelkhand Region of Uttar Pradesh

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ABSTRACT

The study was conducted during 2010-14 at Indian Institute of Pulses Research (IIPR), Kanpur among 143 farmers from Jalaun district of Bundelkhand region of India. The key farmers were provided quality seeds of improved pulse varieties and they were asked to diffuse the seeds in a pre designed structured manner to other farmers in their social networks after the harvest. Logit model was used to analyze the factors associated with farmers' decision to follow the structured diffusion of improved pulse varieties. Study revealed that majority of the farmers preferred 1:1 ratio for structured diffusion. The structured diffusion varied significantly, with respect to years and pulse crops. Variables like educational level, social participation, yield advantage accrued, attitude level and training exposure significantly determined the decision of farmer to follow the structured diffusion of quality seeds of pulse crops.

Keywords: Farmer to farmer extension, pulse crops, logit analysis, structured diffusion

INTRODUCTION

Indian agricultural scenario encompasses wide variation with respect to soil type and fertility status, farmers' preferences for crops, regional adaptation of crops and varietal options therein, associated economics, the weather and climatic factors, social system and the related need for information and agricultural technology. The associated large number of combinations of the aforesaid factors and many others make it a complex situation, difficult to decipher and intervene. This requires trained work force to be equipped vastly with the information and services related to agricultural technologies for catering to the demands. The task of reaching the farmers with most appropriate improved technological options with due persuasion for adoption is entrusted on the extension system of India.

Farmer led extension approaches have emerged to be important mechanisms for dissemination of agricultural technologies within a vast expanse at a reasonable cost within a limited time frame. Farmer-to-Farmer Extension (FFE) approach is one such approach for informal technology diffusion through farmers' social network in rural settings (Sah *etal* 2014). FFE approach attempts to harness the indigenous leadership exiting in the farming community and their social networks for the achieving the goals of agricultural development. The basic strength of this model is the high credibility assigned by the farming community on local information source. The FFE approach is being widely practiced in many countries in Latin America, Asia, and Africa in different forms. At the base of this approach are the farmers who are wither selected or appointed, paid or otherwise, for facilitating the technology diffusion

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among a specified region. These farmers initially work in close interaction with the experts, develop capacities in experimentation and sharing of the acquired knowledge with other farmers in their social networks. A wide variety of terms are used by researchers across the world for these community leaders. They are called key farmers (Sah *et al.,* 2014), lead farmers (Tsafack *et al.,* 2015), *kamayog* in Peru (Hellin and Dixon 2008), farmer promoters in Bangladesh (Islam *et al*., 2011), farmer teachers in western Kenya (Amudavi et al., 2009), community extension workers in Uganda (Ssemakula and Mutimba 2011) and VFTs in Malawi and Kenya (Kiptot *et al*., 2016). The entire approach works on empowering the farmers' leaders to be the change agents.

The FFE model is of great relevance to Indian context in view of the wide extension personnel and farmer ratio, limited financial resources for operation, strict assigned targets, multiplicity of the assigned task etc. Despite the plurastic extension system with due structural arrangements are in existence for effective transfer agricultural technologies to the end users, the NSSO data reflect a different perspective. According to NSSO (2003), about 60 % of the farmers sampled had not accessed to any source of information on modern technology last year. For the 40 % who accessed the information sources, progressive farmers and input dealers were a primary information source. Only 5.7 per cent of farmers had received information from public extension agents. The FFE extension approach is a farmer centric, low cost approach that utilizes the pathways of social networks for effective dissemination of agricultural technologies in the farming communities. The approach could play complementary role to formal extension services in facilitating the dissemination of agricultural technologies and improving farmers' capacities. Empirical studies have found the informal farmers to farmer seed exchange mechanism to be effective for dissemination of quality seeds of important crops in various geographies in the world. (Cromwell, 1990, Ndjeunga *et al* 2000, Sinja *et al* 2004, Hassan *et a.,* 2008, Sah *et al.,* 2014).

Progressive farmers through formal interactions with the research system gain the required skills in technology assessment and application could efficiently extend the reach of improved agricultural technologies in their respective communities. This would however, require institutional mechanisms for formalizing the informal farmer to farmer diffusion mechanism. In this context, it would be imperative to characterize the progressive farmers who could be used as the key/lead/ master farmers who are willing to share the experiences of technology application with other farmers in his social networks. Identification of this type of farmer to work with extensionist to increase technology diffusion among farmers (Sinja etal 2004) is important.

Pulses are component of daily Indian meal as well as existing cropping pattern in the country. These crops are important source of low cost dietary proteins for humans as well has a soil amelioration effect in India. Bundelkhand region is a major pulse-growing region of Uttar Pradesh state and is rightly called as the pulse bowl of the state. The region accounts for about 52 percent of pulse area in the state and contributes about 43 of the total pulse production in the state. The figures clearly indicate a lower pulse productivity levels (0.54 t/ha) in the region as compared to the state average (0.82 t/ha). Pulse crop in the region are grown as the main crops rather than subsidiary crops as grown in other resource-endowed areas.

In an attempt to gain experience of experimenting with the existing informal diffusion mechanism for its effectiveness in enhancing the diffusion of improved pulse seeds in Bundelkhand region of India, ICAR-Indian Institute of Pulses Research, Kanpur initiated a project on farmer to farmers extension of quality seeds of improved varieties of major pulse crops i.e., chickpea, lentil and field pea. This paper discusses the experiences gained with respect to validation of farmer to farmer extension approach for dissemination of improved pulse varieties among the farmer of Jalaun district in Bundelkhand region of Uttar Pradesh state of India. The study analyses the extent of structured diffusion achieved and the influence of socio

psychological, economic and technological attributes on the farmer's decision to follow the structured diffusion. The generated information would be the guiding insight to the researcher, extension agencies on the potential of structured farmer to farmer extension for dissemination agricultural technologies and the determining characteristics of farmers suited for selection to lead diffusion.

METHODOLOGY

The present study was the part of an action research project as implemented by ICAR-Indian Institute of Pulses Research, Kanpur during 2010-14. The study was operationalised in six project villages in two block of Jalaun district of Uttar Pradesh. Stratified random sampling was followed for selection of development blocks and villages based on the predominant agricultural production situations.

A list of interested pulse growers from the selected villages were identified who accepted to disseminate the double the quantity of seed they received to two other farmers in their social network. From this list, farmers were randomly drawn each year and were referred as key farmers in the paper. Before providing quality seeds, the selected key farmers were given training on appropriate crop production and protection technologies. Seeds of high yielding varieties of chickpea, lentil and field pea were introduced in the project villages through the selected key farmers.

The present study initiated with the identification of 143 key farmers who volunteered to be part of the research experimentation in the identified villages.

A total of 143 key farmers were provided quality seeds of supplied improved pulse varieties in the region and were asked to diffuse double the quantity of seed received by him/her after the crop harvest to other farmers in their social networks. A total of 2535 kg seed of major pulse crops i.e., chickpea (variety : JG-16, DCP 92-3, KGD 1168 and Ujjawal), lentil(Variety : DPL 62) and field pea (variety: IPFD 1-10) was provided to key farmers and consequently the improved varieties were introduced in the seed system of the project area. A total of 85.5 acres of area was brought under the project interventions. The fields of the key farmers served as demonstration fields and the adjoining fields served as the local checks. However, the farmers decision to transfer the improved varieties or not and also the extent of transfer is hypothesized to be dependent on farmers socio-psychological, economic and similar other characteristics like farmers perception of the technology.

The primary data was collected using pretested interview schedule developed for the study and the data was subjected to suitable statistical analysis like chi square, logit analysis for appropriate interpretation.

Yate's chi-square test

Chi-square test is employed to determine if there is a statistically significant relationship exists between categorical variables. If at least 20% of the expected frequencies are less than five, then Yate's correction needs to be applied to prevent overestimation of statistical significance. In this study, Yate's $\chi 2$ was used to test the association between year and structured diffusion ratios.

Logistic Regression

Logistic regression was utilized to assess the socio-personal, psychological and economic factors affecting the key farmers' decision to follow the structured pattern of diffusion or not.

$$y_i = \begin{cases} 1 \text{ if key farmers' decision is to follow the structured pattern of diffusion} \\ 0 \text{ otherwise} \end{cases}$$

The logistic regression model employed is given below:

$$ln\left(\frac{P(y=1)}{1-P(y=1)}\right) = Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k \ldots. \quad (I)$$

Where β_1 *to* β_k represents the coefficients of X_1*to* X_k independent variables which include different socio-personal variables, economic variables and psychological variables. The left-hand side of the equation (I) is log-natural of odds ration which is also known as logit function.

RESULTS AND DISCUSSIONS

Details of quantity of pulse seed supplied and area covered

The study was carried out during 2010-11 to 2013-14 with participation of 143 farmers identified from the project villages. The details as mentioned in table 1 show that the initial quantity of 25.35 q of quality pulse seeds of recommended high yielding varieties of pulses were provided selected 143 key farmers covering an area of 85.5 acres.

Differential response of key farmers to the structured diffusion pattern

The selected key farmers responded differently to the expected structured diffusion after assessing the improved varieties of pulse crops in their fields. Against the pres designed structured diffusion in the ratio of 1: 2, majority of the key farmers resorted to diffusion in 1: 1 ratio, i.e., each key farmer diffusing to only one new farmer. In the year 2013-14, all the key farmers except one resorted to diffusion in 1: 1 ratio. The response of key farmers in terms of diffusion, i.e., 1:2, 1:1.5, 1:1 and 1:0, over the years was to differ significantly as per the calculate Yates chi square value (Table 2).

In addition, the response of key farmers was also found to differ significantly with respect to the pulse crops (Table 3). The probable reason for this could be the differential impact of introduced varieties of different pulse crops on farmers productivity level.

Differential response of farmers to structured diffusion of chickpea varieties

The data on diffusion by 79 key farmers that were provided improved chickpea varieties (JG-16, DCP-92-3 and KGD 1168) during the project duration (2010-11 to 2012-13) showed that the key farmers

Table1. Details of interventions carried out during the study

Varietal component	No of key farmers	Total seed provided	Area covered (acres)
Year 2010-11 Crop : Chickpea			
JG-16	5	1.1	4
DCP 92-3	10	3.3	9
Year 2011-12 Crop : Chickpea , Lentil and Field pea			
DCP 92-3	43	6.4	22.5
DPL-62	20	2.0	10
IPFD 1-10 (Prakash)	25	5.0	12.5
Year 2012-13 Crop : Chickpea			
KGD1168	21	3.1	10.5
Year 2013-14 Crop : Chickpea			
Ujjawal	7	1.95	5
Lentil	12	2.5	12
Total	**143**	**25.35**	**85.5**

Table 2. Differential response of farmers to structured diffusion over project duration

Year	1:2	1:1.5	1:1	1:0	Total
2011-12	11	2	2	0	15
2012-13	34	10	34	10	88
2013-14	0	0	20	1	21
Yates $\chi 2$ value 27.621 **					

** $P < 0.01$

Table 3. Differential response of farmers to structured diffusion with respect to pulse crops

Crop	1:2	1:1.5	1:1	1:0	Total
Chickpea	31	2	43	3	79
Field pea	4	0	13	8	25
lentil	10	10	0	0	20
Yates $\chi 2$ value62.41 **					

** P<0.01

Table 4. Differential response of farmers to structured diffusion of chickpea varieties

Chickpea Variety	Seed provided (q)	Expected diffusion (q)	Actual diffusion (q)	Ratio
JG-16	1.1	2.2	1.8	1.64
DCP 92-3	9.1	18.2	14.75	1.62
KGD 1168	3.1	6.2	3.0	0.48

responded differently to the expected structured diffusion after assessing the improved varieties of chickpea after introduced in their fields. It could be observed from the Table 4 that for varieties JG-16 and DCP-92-3, against the structured diffusion in the ratio of 1: 2, majority of the key farmers resorted to 1: 1 ratio, while for KGD 1168, the diffusion was in the ratio of 0.48 against 1:2.

Assessment of the factors promoting structured diffusion of quality seed

Logit model of regression was utilized to assess the socio-personal, psychological and economic factors affecting the key farmers' decision to follow the structured pattern of diffusion or not (Table 5).

Table 5. Logit estimates of factors influencing the respondents' likelihood of following structured diffusion

Parameter	Estimate	Standard Error	WaldChi-Square	Exp(Est)
Intercept	15.8251	4.3147	13.4519	7460207
I) SOCIO-PERSONAL VARIABLES				
Age (years)	-0.0307	0.0372	0.6813	0.970
Education score	0.2937	0.1503	3.8211*	1.341
Information Score	0.1365	0.3380	0.1630	0.872
Social Par	1.5169	0.4824	9.8887**	0.219
II) ECONOMIC VARIABLES				
Operational Land holding(acres)	-0.0398	0.0432	0.8479	0.961
Total income (Rs/year)	0.00183	0.00455	0.1609	1.002
Land under crop (ha)	0.5377	0.4026	1.7833	0.584
Income from crop (Rs)	0.0549	0.0524	1.0987	1.056
Seed replacement (no. of years)	0.0640	0.1195	0.2868	1.066
Yield Advantage (q/ha)	0.0171	0.00666	6.5833*	0.983
III) PSYCHOLOGICAL VARIABLES				
Attitude Score	0.6168	0.2622	5.5335*	0.540
Training score	0.3928	0.2433	2.6052*	1.481
Innovative score	0.0390	0.2340	0.0278	1.040

* * P<0.01 * P<0.05

Among socio-personal variables, education score and social participation were significantly influencing respondent's likelihood of following structured diffusion of seeds of improved pulse varieties. This reveals that farmers having higher educational score and greater affiliation to social organizations were more likely to follow the structured diffusion pattern. Among economic variables, yield advantage was observed to have positive impact on farmers' choice for following structured diffusion as per the expectations. This indicates that farmers were ready to part with the farm produce, if they receive the expected economic advantage. Among psychological variables, coefficients of attitude score and training scores were positive and significant indicating their positive impact on the structured diffusion made by the key farmers with increase in their training exposure and attitude score.

Impact on varietal uptake of non-participant farmers in the project villages

The informal diffusion of the introduced varieties in the project villages among the non participating farmers reflected that the area under chickpea variety DCP-92-3 that was introduced during the project period in the project villages increased over 2010-11 to 2012-13 after wards it declined. In case of lentil, area under the introduced variety DPL-62 increased in 2013-14 among the non-participating farmers due to informal diffusion. A slight increase in the area under the field pea variety Prakash was also reported (fig 2).

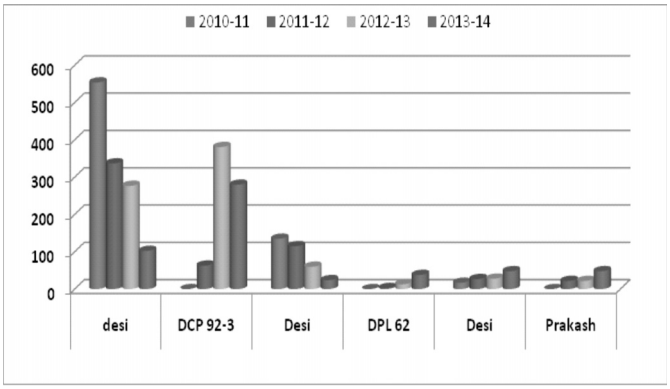

Fig. 2: Varietal uptake of non participant farmers in the project villages (N= 90)

Change in crop preference in the project villages

The change in crop preference of farmers in the project villages was observed to be highest for wheat crop, however it was observed to decline over years (2010-11 to 2013-14) and the preference for field pea increased significantly over the project duration. The preference for chickpea crop after an initial increase witnessed a decrease for the year 2013-14. (Fig 3).

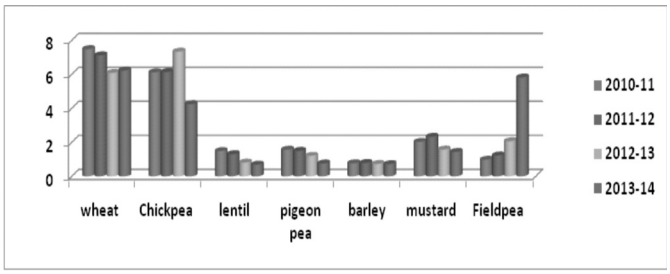

Fig. 3: Change in crop preference (overall N= 90)

The cropping pattern of the project villages thus was observed to change in favor of introduced pulse crops over project period.

CONCLUSION

The study analyzed the applicability of farmer-to-farmer extension approach for dissemination of improved varieties of pulses among the farming community. In addition, the study analyzed the structured mechanism of farmer to farmer extension that was accepted by the farmers. The study revealed that farmers' response to structured diffusion in ratio of 1:2 varied with the pulse crops and majority of the farmers preferred structured diffusion in ratio of 1:1 rather than 1:2. Variable like education qualification, social participation, yield advantage, attitude and training source variables found to significantly influencing the structured diffusion made by the key farmers. Thus, farmers with higher education qualification, higher affiliation to social institutions, higher yield advantage and exposure to trainings progrmmes were more likely to follow the structured diffusion of quality pulse seed to other farmers. Thus, such farmers are need to be included as key farmers in programs aimed at wider utilization of informal social networks for diffusion of improved varieties of pulses through farmer to farmer extension approach.

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