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Role of Farmer Field School in Increasing Production of Maize Crop in District Malakand of Khyber Pakhtunkhwa Province Pakistan

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Abstract
The present study was designed to have an insight into the role of Farmer Field Schools in increasing production of maize crop in district Malakand of Khyber Pakhtunkhwa province. The study was carried out in five villages of tehsil Dargai of district Malakand namely, Sindano, Mukam Kaly, Makhnawala, Baghicha, and Ashako. A total sample of 100 respondents, 20 from each village was selected for the study. The data used for the study was primary data collected directly by face-to-face interaction through a well-designed interview schedule. The collected data were analyzed by Statistical Package for Social Sciences (SPSS) and t-test statistics was used for the comparison of means before and after FFS. It was discovered that majority (37%) of the respondents of the study area were in the age group 41-50 years. In terms of educational level, majority (52%) were illiterate. It was observed from analysis of data that the FFS had an influence over different parameters of study. The average seed rate of maize before FFS was found to be 51.91 kg per hectare with an average seed cost of Rs. 6210.90 which after FFS reduced to 25.69 kg per hectare with an average seed cost of Rs. 3322.80 per hectare. The respondents of the study area did not realize any plant to plant and row to row spacing before FFS but after FFS they maintained 8.72 inches and 2.08 feet of plant to plant and row to row spacing respectively. The cost of fertilizer before FFS was found to be Rs. 19396.00 per hectare which after FFS changed to Rs. 22468.00. Before FFS the cost of crop protection was much higher i.e. Rs. 3167.80 per hectare which reduced to Rs. 314.06 after FFS. The cost of farm yard manure was found to be Rs. 4383.00 per hectare which after FFS changed to Rs. 5787.00. The average yield of maize production before FFS was recorded as 2.24 tonnes per hectare which increased to 3.31 tonnes per hectare after FFS through the adoption of modern techniques of maize production recommended at FFS to the farmers that resulted in higher income of Rs. 98215.00 after FFS as compared to income before FFS i.e. Rs. 65165.00. Majority (89%) of the respondents of the study area was satisfied from the FFS services and was willing to adopt that approach in future as well. It was recommended that more and more FFSs should be established in other parts of the province to enhance agricultural productivity so that the food requirements of the ever increasing population of the province be met.
Keywords: Farmer, Field, School, Maize, Production, Malakand, Khyber Pakhtunkhwa, Agricultural.

1. Introduction

Agriculture is the largest sector of our country. Most of the country's population depends on agriculture directly or indirectly. This sector has about 24 percent share in the Gross Domestic Product (GDP) and employs about half of the country's total labour force as well as it is the largest contributor to the foreign exchange. Whole rural and urban population is fed by this sector. The planners and policy makers have realized the importance of this sector and they are keen in getting reliable statistics of area and production of agricultural crops on right time. They primarily require statistics of major agricultural crops such as cotton, wheat, rice, maize, and sugarcane etc. However due to the consistent ups and downs in the prices of essential agricultural products such as potato, onion, tomato, pulses and chilies, these crops are also considered important crops now a days (www.statpak.gov.pk, 2011).

Maize crop has been identified as a priority crop in Pakistan and especially in Khyber Pakhtunkhwa province. It plays an important role in food security and income generation for the majority of Pakistan's population. Maize contributes to poverty reduction and has thus been particularly targeted in Malakand and Hazara Division in District Development Plans as a crop with high potential to contribute significantly to its development agenda. The area in Khyber Pakhtunkhwa province under maize crop in 2007-08 was 461910 hectares and production was 833153 tonnes. In Malakand district area under this crop was 5430 hectares with a production of 11134 tonnes (http://www.khyberpakhtunkhwa.gov.pk 2011).

Malakand district is situated in the lower reaches of Swat and has an area about 952 square kilometer with a population of 0.45 million according to the population census of the year 1998. Its limits start when the last boundary of Shergarh village in Mardan District touches the outskirts of Sakhakot village as one travels from

Peshawar to Swat on the main highway. At the meeting point between Shergarh and Sakhakot, police and custom check posts are functioning and this point is known as Sakhakot Board. Travelling through Sakhakot one enters Dargai village, which is followed by the mountainous terrain of about 15 kilometers known as Malakand Pass or Darrah Malakand, less difficult to cross than before because of a metalled road in it now. Crossing through the same hilly pass you will enter the country's longest Batkhela Bazar. You proceed onwards till Landakay village where the limits of District Malakand end and District Swat welcomes you (www.malakand.com, 2011).

FFS is a school for farmers' right in the middle of the vegetable/crop field where farmers come together on a weekly basis to learn about Integrated Crop Management. About 25-30 farmers usually attend the FFS from the same village. Farmers learn about Integrated Crop Management (ICM) through the weekly conduct of Agro Ecosystem Analysis, which is an educational tool for the empowerment of farmers in the management of their own crop ecosystems through informed decision-making based on critical analysis of actual field situations. Every week, farmers come to study field to make observations, critically analyze these observations and make informed decisions regarding the proper management of their crops. These decisions are then implemented in the field and evaluated during the next week's re-entry in the field. In the Farmer Field School farmers test new crop protection strategies, including exotic natural enemies, insect traps and bio-pesticides and determine their effects on crops. In addition to the acquisition of technical production skills, Farmers learn about marketing, test and share knowledge for improving marketing strategies and explore the rationale of group action for increased farm profitability. As a result of these Farmers Field Schools, farmers become experts in the production and marketing of crops.

The Farmer Field School is derived from the two words of Indonesian language i.e. "Sekolah Lampangan" that simply means "Field School". In 1989, first Farmer Field School was established in central Java during the first phase of national IPM program assisted by FAO. The program was initiated because of the outbreaks of *Nilaparvatalugens* (Brown Plant Hopper) estimated to have destroyed 20,000 hectares of rice only in java alone in 1989. The Indonesian government response was to train 1,20,000 farmers through emergency training project which mainly focused on recording and reducing the application of pesticides which were considered to be harmful and killing natural enemies of brown plant hopper. In 1986 and 1987 technicalities were refined for IPM and in 1988 national IPM was launched with a core curriculum for training the farmers. The program strategy was not based on instructing the farmers about what to do, but it focused on empowering the farmers to make their own farm decisions through education (James, *et al.* 2010).

FFS approach is derived from "optimal learning derives from experience in case of farmers" concept from observation in the field. The FFS also provides opportunities to farmers to learn about the crops and to learn from one another by integrating the ecological domain and non-formal education. The main learning objectives of FFS are: 1) growing healthy crops, 2) conducting field observation on regular basis, 3) conserving predators of pests, 4) to make the farmers understand the ecology and making them experts in their field. The FFS based IPM approach was first time started in 2001 in Pakistan (www.agrihunt.com, 2011).

2. Objectives of the Study

1. To determine the role of Farmer Field Schools in increasing per hectare yield of maize crop in the study area.
2. To find out reduction in per hectare input cost and increase in profit margin per hectare of the farmers of the study area.
3. To formulate suggestions and recommendations based on results of the study for further improvement.

3. Methods and Materials

The study was conducted in District Malakand. Main crops of Malakand are rice, maize, wheat, sugarcane and tomato. This area was selected due to the establishment of FFS through Agricultural Extension Department and IPM national and Malakand Rural Development Project (MRDP). District Malakand comprises of a large number of villages, but FFS approach has covered fifty two villages. Twenty eight FFS on tomato, ten on rice, four on sugarcane and ten on maize crop. It was not possible to entertain all the villages, five FFS villages for maize in district Malakand were studied purposively.

A list of all maize FFS participants was obtained from Sindano, Mukam Kaly, Makhnawala, Baghicha, and Ashako. From each FFS on the basis of equal allocation, 80% of the respondent 20 farmers were selected purposively. Thus total number of the respondents was 100. Research was based on both primary and secondary data. The primary data were collected from the farmers directly through face-to-face interaction while secondary data were collected from the agricultural extension department of the study area as well as different published and un-published reports etc.

Each respondent was interviewed personally by the researcher. The purpose of the study was conveyed to the respondent during conduction of the interview so that any suspicion about the information being collected could be removed. Statistical Package for Social Sciences (SSPS V.16) was used for the analysis of the collected data to know the farmers' opinion about the role of FFS in increasing the production of maize crop. The results were summarized in terms of count and percentages. The comparison was made for maize crop individually to test whether the difference was significant for cost, yield and income before & after FFS by using paired sample t-test.

The formula for t-test used in this study is as follows.

$$t = \frac{\bar{d}}{sd/\sqrt{n}}$$

Which follows a t- distribution with (n-1) degree of freedom, under the null hypothesis.

Where:

$d =$ $X_a - X_b$ (Difference between after and before)

$\bar{d} =$ Mean of d-values

$sd = \sqrt{\frac{1}{n-1}\sum(d-\bar{d})^2}$ = is the standard deviation of d-values.

$n =$ Number of pairs.

4. RESULTS AND DISCUSSION

4.1 Age of respondents

Age is an important factor to be studied as the adoption or rejection of new techniques and ideas is highly influenced by the age factor. In many social science studies it has been found that age plays a vital role in disseminating, adopting and diffusing an innovation. In other words adoption and diffusion of innovation are positively related with age (Crusan, 1982). Table I shows that 23% of respondents were between the age group of 51-60 years and maximum 37% of the respondents were of the age group of 41-50 years.

4.2 Education of respondents

Education is one of the most important factors that affect farmers' decision regarding new farming techniques and practices. On the basis of educational level, the farmers of the study area were classified into six different groups. The illiterate farmers were placed in first group. Farmers having education upto Primary, Middle, Matric and Intermediate level were placed in second, third, fourth and fifth group respectively. The farmers with educational level above intermediate were placed in sixth group. The distribution of farmers with respect to their educational level in the study area is depicted in table II which clearly shows that 52% of respondents were illiterate, 8% had education of primary level, 10% of middle, 19% of matriculate level, 7% of intermediate level and only 4% of the respondents were above intermediate. The lake of awareness about education might be a reason of lower literacy rate in the study area (Ishaq, *et al.* 2007).

4.3 Land holding status of the respondents

Land holding status was enquired from each farmer of the study area which is presented in table III. The total average land of the farmers was found to be 21.75 hectares with an average total owned area of 12.05 hectares and average total leased in area of 9.68 hectares of the farmers of the study area. No cultivable waste and leased out area was reported in the study area while the average total area under maize crop production was found to be 15.14 hectares. Land holding size and adoption of innovation are positively connected with each other (Mirza, 1993).

4.4 Statistical comparison of seed rate, seed cost, before and after FFS

The statistical comparison of seed rate and seed cost is presented in table IV. The statistical comparison provides us information that whether FFS has any effect on the prescribed particulars or not.

It was found that the mean seed rate used in the study area before FFS was 51.91 kg per hectare while after FFS it was 25.69 kg per hectare (Table IV). The t-value (44.31) shows a significant difference ($p<0.05$) between the mean seed rate used before and after FFS in the study area as t_{cal} (44.31) > t_{tab} (1.98) at 5% level of significance.

The statistical comparison of seed cost incurred in the study area before and after FFS is presented in table IV. The mean seed cost incurred before FFS in the study area was Rs. 6210.90 per hectare while it was Rs. 3322.80 per hectare after FFS. The t-value (39.14) shows a significant difference ($p<0.05$) between the mean seed cost incurred before and after FFS in the study area as t_{cal} (39.14) > t_{tab} (1.98) at 5% level of significance.

4.5 Statistical comparison of cost of fertilizer, cost of crop protection and cost of farm yard manure before and after FFS

The statistical comparison of cost of fertilizer, cost of crop protection and cost of farm yard manure before and

after FFS in the study area is presented in table V to know whether FFS has any effect on them or not.

4.6 Cost of fertilizer

It was found that mean cost of fertilizer incurred before FFS was Rs. 19396.00 per hectare while it was Rs. 22468.00 per hectare after FFS in the study area (Table V). The higher cost of fertilizer after FFS is due to inflation in the prices of fertilizers in the study area. The t-value (-29.81) shows a significant difference ($p<0.05$) between the mean cost of fertilizer incurred before and after FFS in the study area as the t_{cal} (-29.81) > t_{tab} (1.98) at 5 % level of significance. The results are in line with that of Gyali and Salokhe, (1997).

4.7 Cost of crop protection

The statistical comparison of cost of crop protection incurred before and after FFS is presented in table V. It was found that the mean cost of crop protection incurred before FFS was Rs. 3167.80 per hectare while it was Rs. 314.06 per hectare after FFS. The much higher cost of crop protection before FFS was mainly due to rashly use of expensive chemicals by the farmers of the study area which was replaced by Trichogram cards which is a biological measure of crop protection recommended at FFS that is much cheaper and eco-friendly. The t-value (38.20) shows a significant difference ($p<0.05$) between the mean cost of crop protection before and after FFS in the study area as the t_{cal} (38.20) > t_{tab} (1.98) at 5 % level of significance. The results are in confirmation with that of Gyali and Salokhe, (1997).

4.8 Cost of farm yard manure

The statistical comparison of cost of farm yard manure incurred before and after FFS is presented in table V. The mean cost of farm yard manure before FFS was found to be Rs. 4383.00 per hectare while after FFS it was Rs. 5787.00 per hectare in the study area. The higher cost after FFS was mainly due to the inflation in cost of farm yard manure. The t-value (-20.96) shows a significant difference ($p<0.05$) between the mean cost of farm yard manure before and after FFS in the study area as the t_{cal} (-20.96) > t_{tab} (1.98) at 5 % level of significance. The results are in accordance with that of Gyali and Salokhe, (1997).

4.9 Statistical comparison of yield and income before and after FFS

The table VI presents the statistical comparison of yield and income per hectare of the maize growers before and after FFS in the study area to know whether FFS has any effect on maize yield and income or not.

4.10 Yield of maize crop

The statistical comparison of yield before and after FFS (Table VI) shows that the mean yield of maize crop before FFS was 2.24 tonnes per hectare while it was 3.31 tonnes per hectare after FFS in the study area. The higher yield of maize crop after FFS was mainly due to the adoption of modern farming activities by the farmers that were recommended at FFS in the study area. The t-value (-46.85) shows a significant difference ($p<0.05$) between the mean yield per hectare before and after FFS in the study area as the t_{cal} (-46.85) > t_{tab} (1.98) at 5 % level of significance. These results are in confirmation with the findings of Leosin *et al.* (2000).

4.11 Income of maize grower

The statistical comparison of income per hectare of maize growers before and after FFS (Table VI) shows that the mean income of maize growers before FFS was Rs. 65165.00 per hectare while it was Rs. 98215.00 per hectare after FFS in the study area. The higher income of maize growers after FFS was mainly due to the higher production per hectare by adoption of modern farming activities recommended at FFS in the study area. The t-value (-34.91) shows a significant difference ($p<0.05$) between the mean income per hectare of maize growers before and after FFS in the study area as the t_{cal} (-34.91) > t_{tab} (1.98) at 5 % level of significance. These results are in line with the findings of Leosin *et al.* (2000).

5. Conclusion

The results of the study clearly show that FFS approach has positively influenced the respondents of the study area. The FFS approach efficiently increased the farmers' efficiency in maize production and helped them to gain more production and more income by providing them knowledge about the modern and better techniques of maize production through both formal and informal methods in the study area. This study is a useful effort to help the researchers in future for such studies about FFS.

6. Recommendations

- FFS technology is being adopted by the farming communities and requires further trainings and refresher courses so that the process be continued and become sustainable.
- The increase in crop yield is positively related to high quality agriculture inputs, hence it is recommended as per demand of the farming communities to provide them with high quality inputs at their door steps.
- As evident from the study, FFS is a participatory technique. The farmers who participated in FFS should be mobilized to promote the new techniques to the non FFS farmers so that more and more famers could be trained through participatory technology development approaches.
- FFS is an out of school educational approach which is based on adult education must follow the

principle of consenting farmers to derive and adopt recommendations as per their own dynamic ecological, social and economic realities.

- A timely follow up by the facilitator should be ensured so that the problems of farmers could be addressed to enhance quality and production of agricultural crops.

Table: I Distribution of respondents regarding age

Village Name	Age group (years)					Total
	21-30	31-40	41-50	51-60	Above 60	
Sindano	0	2	9	5	4	20
Mukam Kaly	3	5	5	4	3	20
Makhnawala	1	4	8	5	2	20
Baghicha	1	2	7	6	4	20
Ashako	0	5	8	3	4	20
Total	5	18	37	23	17	100

Source: Survey Data, 2011-12

Table: II Distribution of respondents regarding educational status

Village Name	Level of education						Total
	Illiterate	Primary	Middle	Metric	Inter.	Above Inter.	
Sindano	9	1	3	4	2	1	20
Mukam Kaly	11	0	0	4	4	1	20
Makhnawala	6	6	2	5	1	0	20
Baghicha	11	1	5	3	0	0	20
Ashako	15	0	0	3	0	2	20
Total	52	8	10	19	7	4	100

Source: Survey Data, 2011-12

Table: III Distribution of respondents regarding land holding status (ha)

Village Name	Land Holding Status			
	Owned	Leased in	Total	Under Crop
Sindano	1.67	3.52	5.20	3.27
Mukam Kaly	2.87	2.00	4.87	3.23
Makhnawala	3.13	0.66	3.80	3.19
Baghicha	2.48	0.87	3.35	2.52
Ashako	1.90	2.63	4.53	2.93
Total	12.05	9.68	21.75	15.14

Source: Survey Data, 2011-12

Table: IV Statistical comparison of per hectare seed rate and seed cost before and after FFS

Particulars	Before FFS		After FFS		Difference		t -value	P-value
	Mean	SE	Mean	SE	Mean	SE		
Seed Rate (kg)	51.91	0.61	25.69	0.35	26.21	0.59	44.31	0.000
Seed Cost (Rs.)	6210.90	84.34	3322.80	45.86	2888.10	73.78	39.14	0.000

Source: Survey Data, 2011-12

Table: V Statistical Comparison of per hectare cost of fertilizer, cost of crop protection and cost of farm yard manure before and after FFS (Rs.)

Particulars	Before FFS		After FFS		Difference		t –value	P-value
	Mean	SE	Mean	SE	Mean	ES		
Cost of fertilizer	19396.00	167.30	22468.00	156.95	-3072.00	103.06	-29.81	0.000
Cost of Crop Protection	3167.80	76.37	314.06	8.35	2853.70	74.68	38.20	0.000
Cost of Farm Yard Manures	4383.00	112.58	5787.00	128.47	-1404.00	66.96	-20.96	0.000

Source: Survey Data, 2011-12

Table: VI Statistical comparison of per hectare yield and income before and after FFS

Particular	Before FFS		After FFS		Difference		t -value	P-value
	Mean	SE	Mean	SE	Mean	SE		
Yield (t)	2.24	0.02	3.31	0.02	-1.06	0.02	-46.85	0.000
Income (Rs.)	65165.00	1000.06	98215.00	1280.43	-33050.20	946.66	-34.91	0.000

Source: Survey Data, 2011-12

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