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The Role of Punjab Agricultural Extension Services in Promoting Cotton Cultivation: Case Study

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Abstract:
This study was conducted in the arid region of Multan, Punjab – Pakistan to assess the benefits of the PAEWP strategies adopted by the local farmers for growing cotton crop. A total of 478 respondents from three different groups i.e. (79 PAEWP Lead farmers, 299 PAEWP Learning farmers, and 100 Non-PAEWP farmers) having total land of 310.25 hectares, 928.5, and 239.21 hectares respectively were studied through a survey. The results revealed that the PAEWP lead farmers were having decent yield with less investment and more net returns followed by PAEWP learning farmers. From the statistical analysis, it has been observed that PAEWP learning farmers applied 5.66% more irrigation water, 6.2% more DAP, 5.4% more Urea, overall 4.89% to 8.30% more pesticides as compared to the PAEWP lead farmers. Likewise, seed production was 4.62% more for PAEWP lead farmers as compared to PAEWP learning farmers. Similarly, PAEWP learning farmers spend 6.34% more money to grow cotton and achieve 13.50% less profit as compared to the PAEWP lead farmers. However, non-PAEWP farmers are having fewer yields and more investment in all scenarios respectively.

Keywords: Cotton, Agriculture, Fertilizer, Soil, Pesticide, Multan, Punjab.

INTRODUCTION

Pakistan is a country which is rich in natural resources of every shape and form. Cotton (*Gossypium hirsutum L.*) is the most important, indeterminate non-food cash crop and a significant source of foreign exchange earnings for Pakistan(Anwar, 2007). Approximately 1.5 million smallholder farmers rely on cotton for a living. Cotton is the country's most widely cultivated crop and an important raw material for its growing textiles industry, representing 8.5% of GDP (Baloch *et al.,* 2016). However, as cotton farmers contend with the effects of extreme weather and pest outbreaks damaging the crops, the future of Pakistan's cotton production will depend on men and women playing an equal role in fighting climate change and promoting sustainable farming practices (Gemotos *et al.,* 2002).

Farmers have widely adopted BT cotton (*Bacillus thuringiensis*) since its first trial in Sindh province in 2002(FBS, 2018). It is now used in 95% of the area. They are generally planted from April to July, and harvested during August–December(Arshad, 2015).Tillage operations are necessary to remove weeds and prevent crust formation. The advantages of different tillage systems are moisture conservation, reduction of soil erosion, less labour and energy requirement, more timely planting of crops and increased intensity of land use (Benjamin, 2013). Proper fertilizer dosage and good tillage practices would be quite promising not only in providing greater stability in production, but also in maintaining higher soil fertility status (Farooq *et al.,* 2007). Thus Punjab Agriculture Extension Wing Pakistan (PAEWP) prepared a stratagies for the local farmers of the Punjab province where that may use the less inputs and obtain higher yield(Abbas*et al.,* 2009). PAEWP motivate the farmers to reduce the use of conventional methods to grow cotton and adopt using climate and crop friendly techniques. Considering the above facts, the present study was, therefore, undertaken to evaluate the benifits of Punjab Agriculture Extension Wing Pakistan (PAEWP) strategies provided to the local farmers for the cultivation of cotton.

MATERIALS AND METHODS

Location

Considering the scope of the study, the study was conducted at a district Multan in Punjab Province in the People Republic of Pakistan in 2018-2019. This area was selected because there are many problems with cotton, from its production to transport and storage that cause billions of dollars of losses.

Sampling procedure

A sample size of total 478 farmers registered with Punjab Agriculture Extension Wing Pakistan (PAEWP) i.e. (79 PAEWP Lead farmers, 299 PAEWP Learning Farmers, and 100 Non-PAEWP farmers) from district Multan was purposively selected. Questionnaires were used as the instrument of data collection, they sought information on farming experience of the farmers, time of sowing, total area covered under study and water applied on total number of hectares, and stages at which they harvest, ways of handling, transporting, storage and other relevant information(Ahmed*et al.,* 2018). Results of the survey were analyzed and presented in percentages.

Crop Production Methodology as Assigned by PAEWP

The cotton was grown on 1477.96 hectares of land within the radius of 20 kilometers of Multan districts. For this purpose all the relevant operations was conducted as per the prescribed principles and methodology of PAEWP. The land was prepared by given two cross wise Raja Plough followed by disk harrow to eradicate the weeds and uniform distribution of irrigation water. A 4 hectare-inch of irrigation water as soaking dose was applied (Latif*et al.,* 2014). Finally, a good seed bed (furrows and ridges) was prepared accordingly. Homogenous

seeds of different cotton varieties after germination test as prescribed by PAEWP were sown mostly on 15 April 2018. Sowing was mostly done manual by arranging the row to row distance of 75 cm, just before 1st irrigation, the seedlings were thinned to maintained a plant to plant distance of 30 cm.

For the fertilization of crop farmers used farmyard manure, DAP, TSP, SSP, Urea and NP as per their interest however, most farmers used DAP and Urea for the production. The total amount of phosphorous was applied in the form of DAP at the time of seed bed preparation (sowing)(Qaimkhani, 2008). While nitrogen in the form of Urea was applied in split dozes at different crop development stages i.e. 1/3 of the nitrogen fertilizer doze was applied at first irrigation and remaining dozes of the nitrogen fertilizer was applied before flowering and boll formation accordingly. The required irrigation water was applied on the basis of ET calculated from climatically parameters. A soaking dose of 100 mm was applied and the subsequent irrigations were based on 60% soil moisture depletion. The first irrigation after soaking dose was provided after 4 weeks and the remaining 5 subsequent irrigations were given after 3 weeks of interval accordingly. In each subsequent irrigation, the applied water was kept at 75mm per hectare accordingly (Arshad *et al.,* 2017).

With the objective to use less chemical pesticides and to achieve good quality cotton from field and save money farmers mostly used IPM interventions of bio-pesticides and other biological control methods as prescribed by PAEWP. However the use of chemical pesticides was very less. Picking was mostly done by local available female workers and child labor was avoided. The required cultural operations were adopted throughout the growing, harvesting, picking, temporary storage and transportation period accordingly (Sadaf *et al.,* 2006). The final survey was conducted in the mid of September 2018 when cotton crop was just harvested and data were collected through cost and revenue entries registered provided by PAEWP. Collected data was classified, entered and analyzed on MS Excel software.

RESULTS AND DISCUSSION

The subject research was carried out to evaluate the impact of PAEWP strategies on the yield contributing characters and yield of cotton in Multan, Punjab - Pakistan. The critical gathered data during the present research period are appended below:

Socio-economic characteristics of respondents

The data revealed that majority of the farmers growing cotton in the study area were of age between 31 – 50 years and small land holder respectively. Table 01 showed that 73.42% to 94% of the respondents were small land holders, 5% to 13.92% were medium land holders, and 1% to 12.39% was large land holders respectively. Likewise, Table 02 showed that overall 3.13% of the respondents were under 18 years of age, 20.29% were having age upto 30 years, 43.93% were having age in between 31 – 50 years, and 32.63% were of age above 50 respectively.

Similarly, overall 34.93% to 29.08% of the respondents had some education i.e. primary and secondary respectively. About 12.97% to 7.95% of the respondents are having higher education and graduation respectively. About 15.06% of the respondents had no formal education due to some personal reservations. Likewise, overall 16.94% of the respondents were having farming experience of under 10 years, 44.97% of the farmers were having experience in between 11 – 20 years, 25.10% were having experience in between 21 – 30 years, and 12.97% were having experience above 30 years respectively.

Table 1. Sample Size of the Farmers Area Studied.

Particulars	Small land holder	Medium land holder	Large Land Holder	Total
PAEWP Lead farmers	58 (73.42%)	11 (13.92%)	10 (12.39%)	79 (100%)
PAEWP Learning Farmers	249(83.28%)	33 (11.04%)	17 (5.69%)	299 (100%)
Non-PAEWP farmers	94 (94.00%)	5 (5.00%)	1 (1.00%)	100 (100%)

Table 2. Socio-economic characteristics of the respondents (n=478).

Indicators	Numbers	Percentage
Age group (years)		
Under 18*	15	3.138
Upto 30	97	20.293
31 - 50	210	43.933
Above 50	156	32.636
Education (Level)		
Illiterate	72	15.063
Primary	167	34.937
Secondary	139	29.079
High Education	62	12.971
Graduation	38	7.950
Working Experience		
Upto 10	81	16.946
11-20	215	44.979
21-30	120	25.105
Above 30	62	12.971

* All 3.13% of the under 18 years of age group farmers belongs to Non – PAEWP Farmers Group

Physical Productivity Parameters

Total Land Prepared and Water Applied (m^3/Ha)

In present research study in order to justify the water application practice per hectares the comparison of different respondents was conducted (Table: 03). Altogether total land prepared by PAEWP lead farmers, PAEWP learning farmers, and Non-PAEWP farmers was 310.25 hectares, 928.5, and 239.21 hectares respectively. From statistical analysis it has been observed that PAEWP lead farmers applied (1036.02 m^3/Ha) irrigation water to produce their cotton crop. However, PAEWP learning farmers applied (1098.24 m^3/Ha) and Non-PAEWP farmers (1195.48 m^3/Ha) irrigation water which was 5.66% and 13.33% more than PAEWP lead farmers as described in Figure 1.

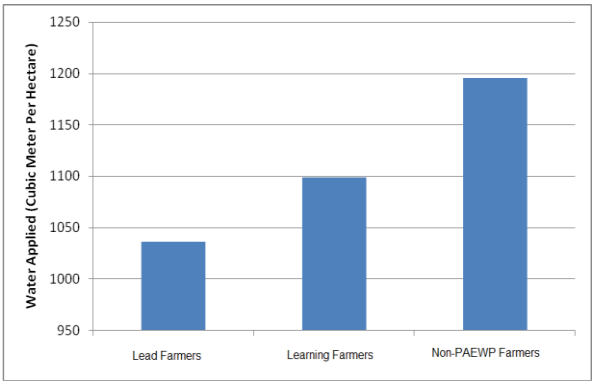

Fig. 1. Water Applied cubic meter per hectare by different respondents.

Fertilizers Used (Kg/Ha)

Likewise the comparison of different respondents was conducted (Table 3) for fertilizers used to grow cotton crop. Altogether total (123.52 kg/Ha) DAP and (468.77 kg/Ha) Urea was used by PAEWP lead farmers. However, PAEWP learning farmers applied (131.82 kg/Ha) DAP and (495.86 kg/Ha) Urea and Non-PAEWP farmers (149.56 kg/Ha) DAP and (529.37 kg/Ha) Urea respectively. This is evidence that PAEWP learning farmers and Non-PAEWP farmers applied 6.2% and 17.41% more DAP and 5.4% and 11.44% more Urea then PAEWP lead farmers as mentioned in Figure 2. As maximum farmers from all three groups used DAP and Urea for the fertilization of cotton crop therefore, only these two fertilizers was considered in this research work.

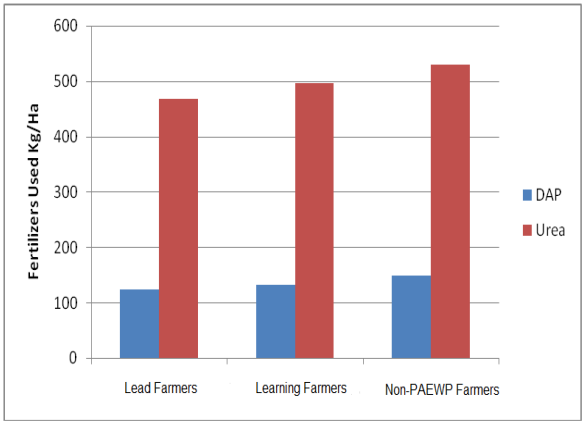

Fig. 2. Fertilizers used (Kg/Ha) by different respondents.

Pesticides Used (Liters/Ha)

Similarly, the comparison of different respondents was studied for pesticides used during the production of cotton crop. As most of the farmers from all three groups used Imidacloprid, Nitenpyram, and Profenophos as pesticides to protect their crop therefore, only these three fertilizers was considered in this research work. The statistical results showed that Imidacloprid was used (16.93%) more by Non-PAEWP farmers and (4.89%) by PAEWP learning farmers as compared to PAEWP lead farmers respectively. Likewise, Nitenpyram and Profenophos was used (33.90% & 22.81%) more by Non-PAEWP farmers followed by PAEWP learning farmers (8.30% & 7.10%) as compared to PAEWP lead farmers respectively. Once again all three pesticides were less used by PAEWP lead farmers which are an evident that lead farmers are strongly following the PAEWP principles. Figure 3 describes the overall usage of pesticides by different respondents in this study respectively.

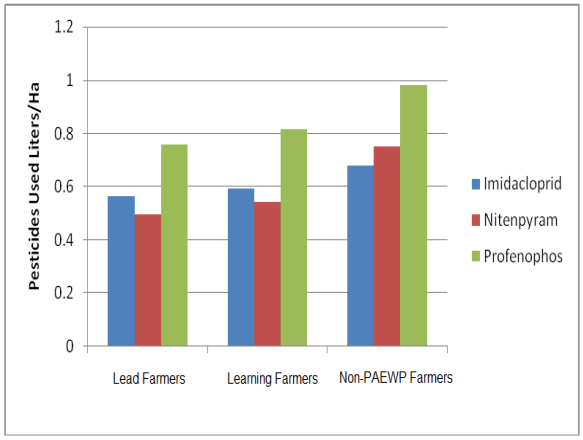

Fig. 3. Pesticides used (Liters/Ha) by different respondents.

Seed Harvested (Kg/Ha)

The overall yield of cotton seed in Pakistan has been lower as compared to the other neighboring countries due to less effective traditional field operations and methods. Use of modern techniques and methodologies can help farmers to increase their production. Present research study is evidence that by using modern ways and strategies PAEWP lead farmers improved their seed production as compared to the Non-PAEWP farmers. The PAEWP lead farmers harvested 2485.01 Kg/Ha seeds which was remarkable in Multan region. However, PAEWP learning farmers harvested (2375.09 Kg/Ha) seeds which were 4.62% less as

compared to PAEWP lead farmers. Once again the survey showed that Non-PAEWP farmers achieved less seed production (2198.23 Kg/Ha) which 13.04% less than PAEWP lead farmers as elaborated in Figure 4.

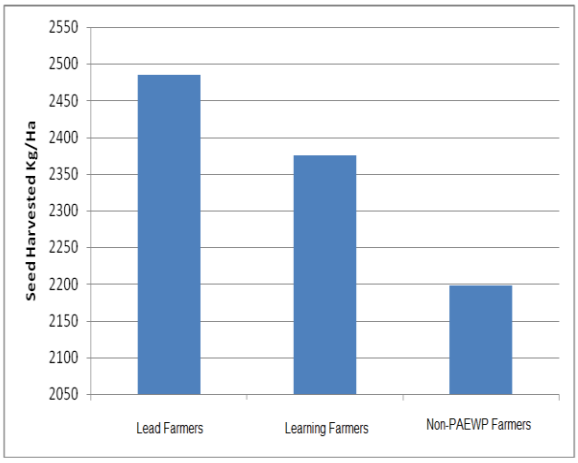

Fig. 4. Seed Harvested (Kg/Ha) by different respondents.

Costs and Revenues

With the objectives to assess and compared the cost of production and net profit per hectare accrued to the farmers by following the PAEWP strategies and principles the data revealed that PAEWP lead farmers spend 71613.08 PKR per hectare to grow cotton and the profit margin was found 78076.22 PKR per hectare which is ultimate gain for them (Table 3). PAEWP learning farmers spend 6.34% more money to grow cotton and achieve 13.50% less profit as compared to the PAEWP lead farmers. Likewise, Non-PAEWP farmers spend 12.65% more money to grow cotton and achieve 23.83% less profit as compared to the PAEWP lead farmers respectively. Figures 5 and 6 describe the overall cost and profit comparison of different respondents studied in this research respectively.

Table 3. Per Hectare benefits of PAEWP Strategies in Cotton cultivation of sample farmers.

Particulars	PAEWP Lead Farmers	PAEWP Learning Farmers	Non-PAEWP Farmers
Total Land Prepared (Hectares)	310.25	928.5	239.21
Water Applied (m^3/Ha)	1036.02	1098.24	1195.48
Fertilizers used			
DAP (Kg/Ha)	123.52	131.82	149.56
Urea (Kg/Ha)	468.77	495.86	529.37
Pesticides used			
Imidacloprid (Liter/Ha)	0.564	0.593	0.679
Nitenpyram (Liter/Ha)	0.497	0.542	0.752
Profenophos (Liter/Ha)	0.758	0.816	0.982
Yield Achieved			
Seed Harvested (Kg/Ha)	2485.01	2375.09	2198.23
Cost and Revenue			
Cost of Production (PKR/Ha)	71613.08	76465.39	81986.78
Net Profit (PKR/Ha)	78076.22	68786.55	59050.18

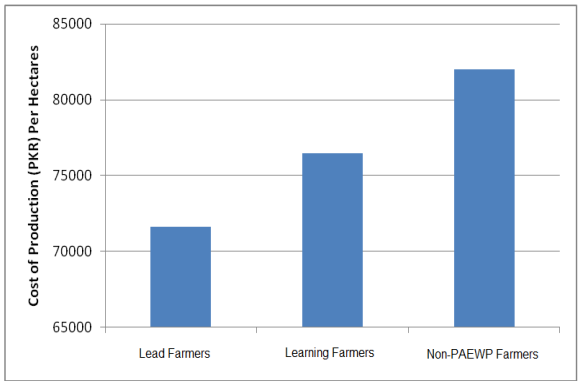

Fig. 5. Cost of Production PKR per Hectare by different respondents.

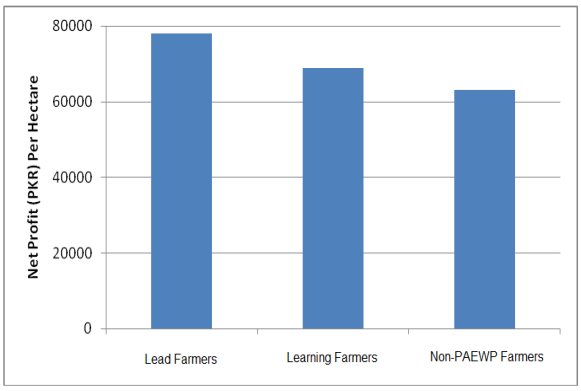

Fig. 6. Net Profit PKR per Hectare by different respondents.

CONCLUSION

The outcome of the conducted research in arid region of Multan, Punjab – Pakistan during the year 2018-2019 revealed that by adopting PAEWP strategies and principles the PAEWP lead farmers are having decent yield with less investment and more net returns followed by PAEWP learning farmers. Total 478 respondents from three different groups i.e. (79 PAEWP Lead farmers, 299 PAEWP Learning Farmers, and 100 Non-PAEWP farmers) and having total land 310.25 hectares, 928.5, and 239.21 hectares was studied through survey respectively. From statistical analysis it has been observed that PAEWP learning farmers applied 5.66% more irrigation water, 6.2% more DAP, 5.4% more Urea, overall 4.89% to 8.30% more pesticides as compared to the PAEWP lead farmers. Likewise, seed production was 4.62% was more for PAEWP lead farmers as compared to PAEWP learning farmers respectively. Similarly PAEWP learning farmers spend 6.34% more money to grow cotton and achieve 13.50% less profit as compared to the PAEWP lead farmers. However, the non PAEWP farmers are having less yield and more investment in all scenarios respectively. Keeping in view the above research figures it can be concluded that if PAEWP learning farmers work more efficiently and comply all PAEWP principles the can surely achieved the production rate like PAEWP lead farmers. Furthermore, PAEWP could promote their strategies to the Non-PAEWP farmers in order to increase the cotton yield in this region and development of agriculture sector.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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