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Impact of Inputs Price Subsidy on Sunflower Production in Punjab, Pakistan: A Mode of Productivity Enhancement

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ABSTRACT

The importance of edible oil cannot be ignored because it is used in each and every home. Pakistan is a major edible oil importer. Each year millions of dollars are spent for its imports. The gap between demand and supply can be fulfilled by increasing the production of sunflower because of its high oil and protein content. This study conducted in the District Bahawalpur to check the impact of inputs subsidies on sunflower production. Respondents were divided into two groups to examine the productivity with available subsidy and without subsidy on production. Primary data were collected from two hundred respondents by using purposive sampling technique to fulfill the objectives of the study. One hundred respondents were selected who got subsidy and one hundred growers who did not get subsidy. For analyzing the data descriptive statistics, estimation of cost of production and profitability and regression analysis methods were used. Based on finding of results, it is strongly recommended that the present subsidy program should be continued and be also extended to other oil potential oilseed crops. There are (71 percent) farmers have average yield 27.70 mounds and confirmed that they will cultivate sunflower in the future due to subsidy provision. It is strongly recommended that the present subsidy program should be continued and be also extended to other oil potential oilseed crops.

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INTRODUCTION

The agriculture sector contributes 22.7 percent to Gross Domestic Product (GDP) and it employs 37.4 percent total labour force of Pakistan (GOP, 2022). Edible oil is produced by the agricultural sector and used for preparing food at the household level. Domestic production of edible oil during 2020-21 (July-March) was estimated at 0.507 million tonnes. The total availability of edible oil from all sources is provisionally estimated at 3.255 million tonnes (GOP, 2021). The most important oilseed cultivated crops in Pakistan are cotton seed, rapeseed, and sunflower. In 2018-19, locally produced edible oil was 0.5 million tons while 2.748 was imported from other countries. With a per capita consumption of 22kg, Pakistan is the world's 8th largest consumer of edible oil and ranked third in the import of edible oil globally (PCRA, 2021). The cultivated area for oilseed crops was constant but smaller changes in rapeseed and sunflower, mustard (particularly sunflower), and sesame had a great impact on per unit area and productivity of oilseed crops in the previous 12 years. In the country's production of oilseed crops major

contributor is cottonseed that has 51.55 percent share in edible oil, rapeseed and mustard 32.84 percent and Sunflower contributes about 10 percent in Pakistan. (CRS, 2020).

Sunflower is an important crop grown to produce oils frequently utilized by human beings. This is recognized as a main mode of biodiesel production (Smyth *et al*., 2010). Energy and weather are interdependent; therefore, bioenergy is used in agriculture. However, it shows a near association between agriculture and energy. In the current situation, production and profit for agricultural commodities are dependent on energy use (Tabatabaeefar *et al*., 2009). Sunflower is an important alternative when it has hurdles to growing other crops owing to weather risks. Demand for sunflower has been enhanced because sunflower oil is best for health as the oil contains very low cholesterol. The optimal extraction of 500 to 600 grams of oil from one kg of sunflower seed is best from another oilseeds crop (Anon., 2015). Sunflower is a cash crop and gained popularity in recent years. Sunflower varieties have been introduced for general cultivation by the public and private sectors in the country. Sunflower varieties grown in Pakistan are losing their yield potential and quality characteristics due to contamination and outcrossing the existing varieties (Mahmood *et al*., 2011). Worldwide sunflower is the main oil crop. This crop has 3rd biggest source of edible oil after soybean and palm oil in the world. Pakistan ranked 14th position in total world sunflower production. The per capita consumption of edible oil in Pakistan is 14 kg per year (Anwar *et al*., 2006).

Being an agricultural country, Pakistan is still deficient in oilseed production. The average sunflower yield is incredibly lower compared to its production potential. Out of the many constraints relating to low production of oilseeds, the quality of seed is primarily important, however, some existing research has proved that hybrid varieties have a yield potential of more than 3500-3900 kg ha-1 which reflects that a significant rise up to 2-3 times in normal yield is possible (Farooq *et al*., 2017). Last year sunflower was cultivated at 33 thousand acres and its seed was produced at 15 thousand tonnes in Pakistan. Sunflower is cultivated in Punjab, Sindh and KPK provinces of Pakistan. The most important districts which are producing sunflowers in Punjab are Bahawalpur, Vehari, Multan, Faisalabad, Bakkar, Mianwali, Jhang, Sargodha, Khanewal, Kasur and Okara. The Sunflower crop has been replaced by the wheat crop in Pakistan due to deficiency of support prices, availability of new technologies, and modern techniques used for available crops. Recently, the Government of Punjab announced a subsidy of Rs. 5,000 per acre cultivation of sunflowers. The growers will be eligible to get the advantages of scheme those registered under the government of the Punjab, agricultural department scheme. Under the scheme, a subsidy will be given to farmers holding 10 acres of land. There were several varieties of sunflower cultivated in Pakistan Oscar, Shirale, 19-H, CON-II and Rainbow etc. (Din *et al*., 2011).

Sunflower production has expanded for some reasons including hybrids with higher yield and enhanced resistance against disease, much less expensive weed control alternatives, and the ideal production cost of sunflower compared with wheat. In the conventional sunflower-producing areas, a survey of sunflower producers found that 39.6 percent of the annual cropped area was planted sunflowers during 2011 (Blacksheep, 2012). According to the crop reporting service, the 2020 area for sunflower cultivation was 90.5 thousand acres in Punjab in 2019-20. While in 2018-19 it was 73.9 thousand acres in Punjab. It has been noted that 22.42 percent area was enhanced for sunflower cultivation in the previous year. In 2019-20 sunflower production was 80.4 thousand tons, while in 2018-19 was 56.7 thousand tons. This enhancement of 41.74 percent in sunflower production over the previous year was due to an increase in the area for the production of sunflowers.

Many sunflower growers have implemented rotations with short intervals among sunflower crops due to their current profitability. For the short term, diminishing the interval between sunflower crops will have a negligible effect on sunflower yield and cost of production (Smith *et al*., 2013). The cultivation of sunflowers has behaved differently in different areas, because of some environmental factors such as irrigation, soils, sowing date and fertilizer application etc. It can be grown on all types of land, except enormously sandy and saline soils. Water and fertilizer requirements are low which makes it more attractive to farmers. Therefore, it's going to be remarked that sunflowers would have a better future than wheat crops in the present circumstances. Sunflower growers are facing the main barriers of new technology, lack of suitable incentives, low level of acknowledgement, expensive yield, insufficient budgets, insufficient technology, training, lack of a reasonable

system of communication with the farmers, lack of training in communication skills and social mobilization methods.

Keeping in view the past studies, it has been learnt that subsidy provided by the Government for the production of sunflower is an encouragement and financial support to the farmers because of its high oil and protein content, so this is designed to estimate the impact of subsidy on sunflower in District Bahawalpur. Firstly, this study analyzed the economic analysis of sunflower production and secondly, it will check the effect of the subsidy on the yield of sunflowers before and after the provision of subsidy to the farmers in the study area.

METHODOLOGY

Methodology guides the researchers on how to collect, organize, analyze and interpret the data. It is a crucial part of research because unreliable methods always provide unreliable results and findings that create troubles for researchers to handle (Baxter and Jack, 2008). The nature of the problem deserves much wider but due to obvious limitations of time and financial resources, the study was restricted to only the Bahawalpur district and a purposive sampling method was used. Primary data was collected from 200 sunflower producers keeping in view the farm size as small (less than 5 acres), medium (5 to 12.5 acres) and large (above 12.5 acres).

The sample size was calculated from the formula given by Poate and Daplyn (1993). To check the efficiency of the designed questionnaire a test survey became carried out on randoml10 certain farmers of Bahawalpur According to the pre-testing desire changes were made and designed final questionnaire, and a survey was carried out from farmers selected from different villages randomly. Data were collected during April 2020.

Descriptive Statistics

To calculate the results of the current study descriptive statistics were used to find out the percentages and frequencies of the selected sunflower respondents. Averages are calculated by using the following formula.

$AM = \sum X / N$ (1)

Where; AM is the Arithmetic mean; N is the total number of observations and $\sum X$ is the Sum of all variables.

Estimation of Cost of Production and Profitability

Estimation of the production cost of a given farm involves estimation and allocation of the costs of fixed resources available on the farm and all inputs used.

$TC = TFC+TVC$ (2)

Where TC is the Total Cost of Production, TFC is Total Fixed Cost (Land rent) and TVC is Total Variable Cost (Seed, Land preparation, Fertilizer, Spray, harvesting cost etc.)

$TR = P^* Q$ (3)

Where TR is Total Revenue, P is the output price of sunflower per mound and Q is the quantity of sunflower

Profit was analyzed through the following formula;

$\Pi = TR - TC$ (4)

Regression Analysis

To identify the impact of various factors affecting the yield and production of sunflower crops regression analysis was applied. Variable (Y) is dependent on multiple variables based on the regression equation of a given set of data. The general equation was given below;

$Y= b_o + b_1X_1+ b_2X_2+b_3X_3+ b_4X_4+ b_5X_5+ b_6X_6+ b_7X_7+ b_8X_8+ e_i$ (5)

Where Y is Sunflower production per acre (mounds), X1 is Experience of sunflower crop growing (years), X_2 is Farm size (acres), X_3 is Education (schooling years), X_4 is Family size of the farmer (number), X_5 is Seed cost (Rs.), X_6 is Land preparation cost (Rs.), X_7 is Spray cost (Rs.), X_8 is Subsidy (Yes=1, Otherwise=0) and e_i is the error term.

RESULTS AND DISCUSSION

This section interprets the results and tabulates the data collected from respondents. It includes the descriptive statistics of respondents, before and after the impact of subsidy on sunflower production, economic analysis, and multiple linear regression results and discussion.

Descriptive Statistics

A descriptive statistic is used to analyze the data. It helps to describe, summarize and show data in a more meaningful way since trends emerge from data. This is simply a way to describe data. Descriptive statistics is very important because if simple data (raw data) are presented. It is hard to understand what the data are showing specifically if there is a lot of data. Descriptive statistics, therefore, enables the presentation of the data in a more meaningful way on the bases of which simple interpretations of the data are made.

Table 1. Socioeconomic characteristics of respondents.

Variables	Mean	Min.	Max.	Std. Dev.
Age (years)	41.63	21	68	11.6
Education (Years)	6.97	0	16	5.02
Household size (No)	6.25	3	12	2.34
Income (in thousands Rs. /month)	32.8	19	135	31.41
Distance from the main road (in Kilometers)	2.92	0	7	1.48
Distance from the main market (in Kilometers)	18.82	8	25	7.05
Total area (Acres)	22.41	2.0	77.0	17.22
Land Rent (PKR)	30704.22	22000.0	42000.0	4148.65

Source: Field Survey, 2020.

Table 2 shows that the minimum age of the farmer was 21 years and the maximum was 68 years. The mean age was 41.63 years. The minimum education of farmers is zero years and the maximum 16 years mean years of education is 6.97 and the standard deviation from the mean value is 5.02. The minimum household consists of 3 members and the maximum number of household members is 12. As for as income was concerned, the minimum income of farmers was 19 thousand/month whereas the maximum was 135 thousand. The minimum distance from the main road was 0 and the maximum was 7 kilometres, showing a mean distance of 2.92 Km. The average distance from the main market was 18.82 Km. Total minimum and maximum holdings were 2 and 77 acres, respectively. The minimum land rent in the areas was Rs. 22000, while the maximum land rent was Rs. 42000. Average land rent in the study area was Rs. 30704.26.

Table 2. Distribution of respondent farmers by their farm size.

Farm Size	Frequency	Percentage	Average Yield
Less than 10	165	82.5	25.70
10-20	30	15.00	24.70
20-30	5	2.5	26.35
Total	200	100	

Source: Field Survey, 2020.

Table 2 shows that 82.5% of farmers had less than 10 acres of land with an average sunflower yield of 25.70 mounds. A few 30 farmers (15%) had 10-20 acres of land with an average yield of sunflowers at 24.70 mounds. Around 2.5% of farmers were having 20-30 acres with average sunflower yields of 26.35 mounds. The average farm size of sunflower farmers was 5.1 acres in Bahawalpur.

Descriptive statistics of different farm inputs

In this section, we discuss the cost of production of the sunflower which includes, land preparation cost, seed cost, fertilizers cost, weedicides and insecticides spray cost, harvesting and threshing cost and also transportation cost Descriptive statistics of land preparation costs which include raunies, ploughing, planking, disc ploughing, rotavator and laser levelling costs per acre and their frequencies are showing table 4.41. There was a minimum cost of raunies Rs.1000, maximum Rs. 3500, mean value Rs. 1646.01 and Rs. 556.07 deviated from the mean. The maximum cost of raunies was high because the farmer has done two raunies for sunflower farming. Recommended no. of raunies was 1-2 for sunflower. The minimum plough cost was Rs. 800 because farmers have their tractors so they included only oil cost, maximum cost of ploughing was Rs. 2800 because the farmers have done 4 ploughing for sunflower farming. The mean value and standard deviation are Rs. 1484.06 and Rs. 369.65. The minimum cost of plankingwasRs.200, maximum Rs.800, means Rs.541.54 and Rs.181.41 deviated from the mean point. This table shows 200 farmers performing planking in the field. Maximum Rs. 1400, the farmer has to pay for disc ploughing, minimum Rs. 500 because some farmers have owned tractor. There were only 10 farmers they had done disc ploughing from the preparation of land for sunflower crops. In Table 3 one

bag of seed is about 2 kg and recommended seed rate for 1 acre is 1.5 to 2 kg. Most of the farmers sow seed 2 kg. The minimum seed cost was 2800 Rs. because the farmer gets seed without a token of subsidy but the most cost of seed per bag per acre was 3000 Rs. which is almost equal to the mean value. The standard deviation from the mean is 31. 4332 Rs. and the maximum cost per 2 kg bag of seed was 3100 Rs.

Descriptive statistics of fertilizer costs and frequencies of how many farmers apply which types of fertilizer are shown in Table 3. There were 128 farmers those applied urea 1 or 2 bags per acre. The minimum cost of a urea bag is Rs. 1400, a maximum of Rs. 3000 for 2 bags means Rs. 1521.56 and the standard deviation is Rs. 323.60. Minimum cost of DAP was Rs. 2700, for 1 bag, the maximum cost was Rs. 5600 for 2 bags that were applied by the 126 farmers in the sunflower crop. The mean value of DAP is Rs. 2963.81 and the standard deviation is Rs. 322.12. 22 farmers applied Nitro-Phos, the minimum cost of Nitro-Phos was Rs. 1800 maximum cost was Rs. 2700 and the mean value was Rs. 2074.09. The maximum cost of potash was Rs. 5600 because the grower applied liquid potash which is much more expensive than simple potash fertilizer. The minimum cost for potash was Rs. 3200, the mean potash cost was Rs. 3752.70 and which deviated from the mean value is Rs. 380.05. 37 farmers applied potash in the sunflower crop to get more yield of sunflower. Some farmers around about 14 farmers applied farm yard manure (FYM). The trolley is the unit of farm yard manure. The minimum cost of FYM was Rs. 800 for one trolley; the maximum cost for FYM was Rs. 6000 because the farmer applied 5 trolleys on one acre, and the mean cost of FYM was Rs. 2485.71. Only 12 farmers applied other fertilizers like Sulfur, Single Super Phosphate (SSP), etc. the minimum cost was Rs. 450, the maximum cost was Rs. 4000, the mean cost was Rs. 1580.83 and the standard deviation from the mean point is Rs. 1286.98.

Table 3. Descriptive statistics of land preparation and seed, and fertilizers cost (Rs.).

Land Preparation	N	Minimum	Maximum	Mean	Standard Deviation
Rauni	200	1000	3500	1646.01	556.07
Ploughing	200	800	2800	1484.06	369.65
Planking	198	200	800	541.54	181.41
Disc Ploughing	10	500	1400	845	375.98
Rotavator	93	500	1800	1113.98	440.01
Laser Leveling	52	1100	3600	2075.96	712.53
Seed Cost per bag	200	2800.0	3100.0	3005.797	31.4332
Urea	128	1400	3000	1521.56	323.60
DAP	126	2700	5600	2963.81	322.18
Nitro-Phos	22	1800	2700	2074.09	217.69
Potash	37	3200	5800	3752.70	380.05
FYM (Trolleys)	14	800	6000	2485.71	1127.87
Others Fertilizers	12	450	4000	1580.83	1286.98

Source: Field Survey, 2020.

Economic Analysis of sunflower Crop

Revenue, gross margin, net income and benefit-cost ratio of sunflower growers as shown in Table 4. The total revenue calculated was Rs. 58886.15, the gross margin was Rs. 38193.72 and the net income was Rs. 26267.81. Benefit-cost ratio (BCR) was 1.81.

The results of the t-test analysis of low and high yielders cost physical inputs and output as shown in Table 4 only 20 respondents define as low yielders group which have yielded less than 20 mounds and 118 respondents from the total 138 sample size define as high yielders group which have a yield above 20 mounds. Mean differences are calculated by subtracting high-yielders from the low-yielders group. In this table, t-values are estimated by an independent sample t-test that was applied in the SPSS (Statistical Package of Social Sciences) in which equal variances are assumed or equal variances not assumed to types of t-values. If the F-calculated value is significant at less than 5 percent level of significance, we select the value of the t-test with unequal variance and if the F-calculated is non-significant then we select the value of t with equal variance.

Table 4. Revenue, gross margin, net income and benefit-cost ratio of sunflower growers.

Revenue, gross margin, net income and benefit-cost ratio	Per Acre
Total Cost (Rs.)	32618.34
Total revenue (Rs.)	58886.15
Yield per acre (Rs.)	25.57
Price per mound (Mounds)	2303.04
Gross margin (Rs.)	38193.72
Net income (Rs.)	26267.81
BCR (TR/TC)	1.81

There is a mean yield of low yielders of 17.93 mounds and a mean yield of high yielders of 26.86 mounds and the mean differences between these are 8.94 mounds. The t-value of the yield variable is 16.57 and it is highly significant at less than 1 percent level of significance with unequal variances assumed. The respondent farmer's age has a low mean difference that why the age of the respondents shows insignificant results with equal variance assumed. The mean difference of the farm sizes is 8.80 acres between low and high yielders which shows significant results at less than 1 percent level of significance with a 3.43 t-value. Selected random farmers are why the medium and large farmers are more in this study data and the reason for a high average yield of sunflowers is greater farm size and more resources. The family size means the difference is about 2 members and the t-value is 3.75 significant with less than 1 percent level of significance. If more family members of respondents are present then there will be more possibility of greater yield because of more free labour. Education is non-significant because the education of farmers mean difference is very nearer to each other and the average farmer's education is about 10 years of schooling in Punjab. Education is not important for the yield of sunflowers but experience matters. Sunflower farming experience means the difference between low and high yielders is 0.79 and the t-test value is 3.33 with less than 1 percent level of significance. The t-value of contact with government extension sources or with agri-extension department is -1.58 with non-significant results. If the level of significance is at 12 percent then the contact with the extension department will significant. The t-value of contact with Seed Company is 3.57. It is also highly significant because more farmers have contact with private extension sources.

No. of ploughings is also significant at less than a 10 percent level of significance with unequal variances. The t-value of No, of ploughing is 1.81. Those farmers applied recommended 2 to 3 ploughings they get more yield. The minimum mean difference in the seed rate is because the seed bag is 2 kg for one acre approximately all the farmers sown 2 kg sunflower seed in one acre that's why the seed rate shows an insignificant t-value. The sowing times of sunflowers are early, normal and late sowing. Most of the respondent farmers sown sunflowers at normal sowing time. The value of the t-test is 2.05 which is a sign at less than a 10 percent level of significance. Fertilizer urea shows non-significant results with the t-test value 0.44 with equal variance. And the fertilizer DAP is significant at less than 5 percent level of significance with a t-test value of 2.26. DAP is a more important fertilizer for the growth of sunflowers and for gaining more yield. The most of respondents' opinions on the quality of fertilizer were satisfactory. The t-test value is 1.77 which is significant at less than 10 percent level of significance. In pesticide sprays also significant at less than a 5 percent level of significance and the t-vale is 2.13. The total land preparation cost is not significant with an equal variance; the t-value of the land preparation cost is 1.36. There is the mean difference between low and high-yielder land preparation costs is Rs. -535.64. The seed cost is not significant with a 0.12 t-test value. There is a mean difference in fertilizer cost Rs. 550.14 and the t-value is 1.65. It is significant at less than a 12 percent level of significance if a 12 percent level of significance is assumed.

Irrigation cost was statistically significant ($P<0.01$) with a 3.02 t-test value. Recommended irrigations for the sunflower are 2 to 3 which were applied by most of the farmers. Some farmers owned tubewell which have less cost of irrigation and some farmers applied water to the sunflower with hired tubewell, which was more cost-intensive. Those farmers who have owned tubewell applied more irrigation that's why they get more yield. The harvesting method is also important for sunflowers, in manual harvesting chances of losses of seed yield are more

but with a combined harvester fewer chances of losses.

Above half of the farmers harvested the sunflower with a Combine Harvester, thus the use of a harvester was statistically significant (P<0.05). The cost of production is non-significant but revenue and profit are significant at less than 1 percent level of significance because there was the huge mean difference in revenue and profit of about 20 thousand rupees. Mode of sale and continued to grow sunflower in future are significant at less than 1 percent level of significance. The T-test value of the subsidy is 1.83 which is significant at less than a 10 percent level of significance. If there are more subsidies for sunflowers the overall production and yield of sunflower is likely to increase.

Table 6 shows that 133 farmers received 1st instalment and their average yield was 25.62 mounds the respondents who did not receive 1st instalment were 67 and their yield was 24.2 mounds. 119 farmers received the 2nd instalment, and their average yield was 25.82 mounds the respondents who did not receive the 2nd instalment were 81 and their yield was 24.76 mounds.

Table 5. T-test analysis of low and high yielder's costs, physical inputs and output.

Variables	Low Yielders	High Yielders	Mean Differences	T-test	Sig.(2-tailed)
Yield	17.93	26.86	8.94	16.57	.000
Age	46.20	45.61	-0.59	0.21	.834
Farm size	14.48	23.28	8.80	3.43	.001
Family size	6.20	8.53	2.34	3.75	.001
Education	11.25	11.1610	-0.09	0.13	.895
Sunflower farming experience	0.25	1.0424	0.79	3.33	.002
Contact with agri. /Extension department	0.80	0.92	0.12	1.58	.116
Contact with private seed Company	0.35	0.74	0.39	3.57	.000
Ploughing	2.10	2.25	0.15	1.81	.079
Seed rate	1.95	1.99	0.04	1.22	.225
Sowing time	0.75	0.96	0.21	2.05	.053
Urea	0.95	.99	0.04	0.44	.660
DAP	0.80	0.96	0.16	2.26	.025
Quality of fertilizer	1.85	1.69	-0.16	1.77	.087
Insecticides sprays	0.05	0.19	0.14	2.13	.038
Land preparation cost	5622.50	5086.86	-535.64	1.36	.175
Seed cost	3005.00	3005.93	0.93	0.12	.903
Fertilizer cost	5363.50	5913.64	550.14	1.65	.110
Irrigation cost	2914.00	1971.44	-942.56	3.02	.003
Harvesting method	0.30	0.54	0.24	2.11	.044
Revenue	40644.25	62029.94	21385.69	16.17	.000
Cost of production	32098.67	31227.32	-871.35	1.12	.266
Profit	8545.58	30802.62	22257.04	11.53	.000
Mode of sale	0.95	0.69	-0.27	4.12	.000
Subsidy	0.60	0.79	0.19	1.83	.069
Continue grow sunflower in Future	0.45	0.97	0.52	4.47	.000

Table 6. Distribution of respondent farmers by instalments of subsidy received.

Instalments Received		Frequency	Percentage	Average Yield
1st instalment	Yes	133	66.5	25.62
	No	67	33.5	24.2
2nd installment	Yes	119	59.5	25.82
	No	81	40.5	24.76

Table 7. Impact of subsidy program on area and yield of sunflower.

Area and Yield	Before	After	Difference
Area (Acres)	1.94	3.70	1.76
Yield (Mounds)	22.66	26.24	3.58

Table 7 shows that the average cultivated area under sunflower before the subsidy was 1.94 acres which increased to 3.70 acres post-subsidy showing a difference of 1.76 acres. Farmers obtained an average yield of 22.66 mounds before the subsidy and after the subsidy program, the average yield increased to 26.24 mounds reflecting a difference of 3.58 monds. Pertinent to this increase in area and production, 70% of farmed showed a willingness to continue growing sunflowers in the future (Table 8).

Table 8. Farmers' willingness to grow sunflower in future.

Perception	Frequency	Percentage	Average Yield
Yes	140	70	27.70
No	60	30	20.35
Total	200	100	

Table 9. Results of regression analysis.

Variables	Coefficient	S.E	p
(Constant)	-66.835	37.271	.075
Experience with Sunflower Crop	.239	.239	.319
Farm Size	.029	.035	.404
Education	.233***	.132	.078
Family Size	.226**	.113	.048
Seed Cost	.029*	.012	.021
Land Preparation Cost	.000	.000	.206
Spray Cost	.001	.001	.113
Subsidy (Dummy)	1.599**	.864	.067

* Significant at 1% level of significance
N=200 F=32.029 $R^2 = 0.504$
**Significant at a 5% level of significance
*** Significant at a 10% level of significance

Regression analysis

Table 9 indicates that the experience of sunflower oilseed crop is positively related to sunflower production which was statistically insignificant because the sunflower farmers do not have good experience with sunflower crops. Farmers have minimum experience in sunflower crops such as farmers with no experience (farmers have cultivated sunflower the first time), and one and two-year experience. The coefficient of experience of the sunflower crop was 0.239. The positive sign shows that if there is 1 year more experience there will be more sunflower yield. Results also show that the coefficient of farm size is 0.029 with a standard error of .035. It has a positive sign and is statistically insignificant. The positive sign shows that if there is a 1-acre increase in the farm size then there will be an increase in the overall production of sunflowers. The sunflower is a minor crop that's why the farmers have not been cultivating sunflowers. They were focused on the major crops. Results indicated that education is positively related to sunflower production which was statistically significant at $\alpha < 0.10$. If there is a 1 percent increase in the level of education has been increased by 0.233 percent per acre yield of sunflower. Family size is also statistically significant at less than a 5 percent level of significance with a positive sign.

Results indicated that the seed cost of sunflower was

positively related to sunflower productivity which was statistically significant at $\alpha < 0.05$. Results indicated that by increasing 1 percent seed cost of sunflowers has increased .029 percent per acre yield of sunflowers that were statistically significant at less than 0.05 level. Because when the cost of seed increases the quality of seed is also good that's why the yield of sunflowers is also increased. Results indicated that the land preparation cost of sunflowers is statistically not significant with a positive sign. Spray cost is also statistically insignificant with a positive sign and the t-statistic is 1.594. The subsidy is positively related to sunflower yield which was statistically significant at less than a 10 percent level of significance. There will be an increase in sunflower yield, the area under cultivation and the overall production of sunflowers if more subsidies are given to the farmers by the government (Levine and Renelt, 1992) also calculated a low R2. The value of the F-statistic was 2.95 at a 0.5 percent ($\alpha = 0.005$) level of significance and the critical F value is 2.74. The calculated value of the F test is greater than the critical value. That's why the overall model is significant.

CONCLUSIONS AND RECOMMENDATIONS

Pakistan is in 3rd position in the import of edible oil and sunflower is the 3rd biggest source of edible oil after soybean and palm oil in the world. Pakistan ranked 14th in the world's sunflower production. The average sunflower yield is incredibly low compared to its production potential. The average production of sunflowers is about 25 mounds. Some farmers keep some mounds of sunflower for home consumption. The average market price of sunflower was Rs. 2303. There are only 40 farmers cultivated sunflower in the previous year. Results revealed that the average yield of low yielders of sunflowers was 22.06 mounds and high yielders got an average sunflower yield of 28.78 mounds. The average yield of sunflower growers was 25.57 mounds. Results also indicated that the average cost of production of sunflower was Rs. 32618.34, the average revenue generated from one acre was Rs. 58886.15 and the average profit of sunflower growers was Rs. 226267.81. Economic analysis showed that the benefit-cost ratio was 1.81 for sunflower growers. This study concludes that the subsidy program should be continued and also extended to other oil potential oilseed crops. This is an indication of poor governance or an element of corruption. Awareness campaigns to popularize the judicious use of inputs through extension departments should be initiated. Both public and private should be ensured to increase the area, yield and production of sunflower crops in Punjab. A strict check on the market must be ensured by the government so that farmers can get a price for this sunflower production as chosen as to the announced market price.

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