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Determinants of Sunflower Area and Yield in Districtss Swabi and Mardan of Khyber Pakhtunkhwa, Pakistan

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Abstract | This research study was conducted to find out to the determinants of sunflower area and yield in districts Swabi and Mardan of Khyber Pakhtunkhwa during 2016. The study was conducted in two selected districts through purposive sampling for 100 farms in different locations of selected districts. The objective of the study was to estimate determinants of sunflower area and yield in the study area. To determine the role of different factors that were affecting the area and yield of sunflower in Khyber Pakhtunkhwa, multiple regression analysis was applied. The model pointed out that the area under sunflower have opposite relation with the seed cost, land rent, area under tobacco, area under sugarcane and price of sunflower seed, while positively related to the area under sunflower with the variables such as total operational holding, sunflower yield and sale price of sunflower. In case of determining yield of sunflower use of DAP and organic manure were significant and positively correlated.

Introduction

Khyber Pakhtunkhwa (KP) has a unique agricultural environment where cultivation of two crops of sunflower in a year are possible by adopting suitable cultural practices. Agriculture in Pakistan and particularly in Khyber Pakhtunkhwa is limited, where other remunerative crops like sugarcane, tobacco and cereals are given preference. In Khyber Pakhtunkhwa, vast acreage of irrigated and dry land in the high rainfall areas is available for sunflower cultivation during the month of June till October. Some land remains fallow after harvest of tobacco, wheat, barley, rape and mustard. Sunflower is a suitable alternative which can fill up this gap because hybrid varieties of sunflower get mature in 95-110 days (Jariko et al., 2011; Bakht et al., 2006).

Sunflower was introduced in KP in the year of 1976 but it was commercially adopted only by 1990's. During the year 1990 there was increasing trend of cultivating sunflower up to the year 1999. During 1990, the area under sunflower in Khyber Pakhtunkhwa (KP) was 2562 hectares with upward and downward trend it reached 5096 hectares during 1999. While, after 1999 there was a continuous decreasing trend in adoption of sunflower where it decreased down to just 527 hectares in the year 2010 (GOP, 1995-96; GOP, 2005-06; GOP, 2009-10).

It is, a pity, that despite having rich lands, best canal system in the world, and an agriculture-based economy, Pakistan has yet to depend on imported edible oil. The domestic production of oilseeds is lower than its demand in the country (Ahmad et al., 2001; Re-

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hman, 2011). The country is unable to produce sufficient amount of edible oil and hence a large amount of foreign exchange is spent on the import of edible oil (Khoso, 1992; Alam, 2002).

Keeping in view yield potential of sunflower, the growers from KP have harvested almost equal quantity with Punjab and even higher than Sindh for the last ten years. Despite enormous potential of the crop, the province is still far behind both of the provinces (Punjab and Sindh) in bringing area under sunflower crop (GOP, 2005-06; GOP, 2009-10). Currently, Dera Ismail Khan (DI Khan), Swabi and Mardan come under leading districts with respect to area under sunflower crop and overall production in KP province. Considering major producing areas, Swabi and Mardan districts were focused for this study. The average yield of sunflower in D. I. Khan, Swabi and Mardan districts was 602, 660 and 655 kg/ha in the year 2009 (Govt. of KP., 2009). A number of hybrid sunflower varieties such as Hysun 33, SF 187, NKS 278 and NK 265 have been introduced and grown in major sunflower growing districts of KP (Govt. of KP., 2011). Although, number of hybrid varieties have been reported in these districts, but the production and productivity statistics indicate that the adoption of hybrid is unsatisfactory. People used low standard seed that resulted in low productivity despite the fertile land and sufficient water availability. The current study designed to investigate the main determinants of sunflower area and yield in selected districts of Khyber Pakhtunkhwa.

Materials and Methods

The study based on the primary field observation source in 2016. Swabi and Mardan districts of Khyber Pakhtunkhwa were selected for data collection. Swabi district lies between Kabul River and Indus River in Khyber Pakhtunkhwa. Swabi was tehsil of Mardan district up to 1980. Mardan is the second largest city of Khyber Pakhtunkhwa. Swabi and Mardan districts are blessed with fertile agricultural land; therefore, most of the people are associated with farming activities of agriculture. Primary data was collected from the sampled farm areas under the study. A purposive sampling technique was applied and data from100 farms was recorded from Swabi and Mardan districts of Khyber Pakhtunkhwa.

Data analysis

For determining different factors for sunflower area and yield multiple regression models were applied.

Regression model for determination of sunflower area and yield

To determine the role of different factors for area under sunflower the following regression analysis was used on similar lines as other used like Akhtar et el., 2006 and Kaleem and Hassan, 2010.

$$SFAREA = \beta_0 + \beta_{1S} cos + \beta_2 hoing C + \beta_3 Lrent + \beta_4 Opr. Holding + \beta_5 tobacco + \beta_6 sugarane + \beta_7 SFYield + \beta_8 Pr icesf + \varepsilon$$

Where; SFAREA: Area of sunflower (dependent variable); Scost: Seed cost per acre; Hoing C: Hoeing Cost; Lrent: Land rent per acre; Opr holding: Total Operational Holding of the espondent (acres); Tobacco: Area under tobacco crop of the respondent (acres); Sugarcane: Area under sugarcane crop of the respondent (acres); SFyield: sunflower yield (mound/acre) in last year; While ε is the error term.

The regression model for the factors affecting the sunflower yield is as under;

$$SFY = \beta_0 + \beta_1 Plog hung + \beta_2 seedrate + \beta_3 urea + \beta_4 dap + \beta_5 organicamanu + \varepsilon$$

Where; SFY is dependent variable and it indicates sunflower yield; Ploghng: Number of ploughing (per acre); Seedrate: seed rate in kg per acre; Urea: Number of urea bags used per acre; DAP: Number of DAP bags used per acre; Organicmanur: Number of organic manure trolley used per acre; While ε is the error term.

Results and Discussion

Determinants of sunflower area

To quantify the role of different factors multiple regression model had been employed at the farm level. The value of R^2 is 0.61 indicating that the explanatory variables; seed cost per acre, hoeing cost, land rent per acre in last year, total operational holding of respondent, area under tobacco, area under sugarcane, seed rate of sunflower in kgs., sunflower yield and price of sunflower explains 61 percent of the variation in the determination of sunflower area. Determinants with negative signs have inverse relation with the area under sunflower. Seed rate has coefficient of -0.31 with the negative sign and insignificant t-value of 0.92 indicates that increase of one unit in the mean level of seed cost will reduce the sunflower area by 0.31 units. Hoeing cost has coefficient of 0.28 with the positive sign and insignificant t-value of 0.51. Land rent in

previous year plays an important role but in case of land rent of previous year plays negative role one percent increase in the mean level of land rent will cause a decline in area under sunflower by 0.17 units with insignificant t-value -0.05. Total operational holding has significant negative coefficient of 0.37 with the t-value of 9.8 indicates that increase of one percent in the mean total operational holding area will decrease by 0.37 units significant at 1 percent significance level. Area of tobacco has negative coefficients of 0.81with significant t-value of -1.71 indicates that one unit increase in area under tobacco will cause a decrease under sunflower area by 0.81 units and significant at 10 percent level of confidence. Area of sugarcane has negative coefficient of -0.28 with insignificant t-value of -0.32 indicates one unit increase in area under sunflower will decrease area under sunflower by 0.28 units. Sunflower seed rate has also negative coefficient with the insignificant t-value will result in the decrease in area under sunflower if the price of sunflower seed increased by one unit. Sunflower yield has positive coefficient of 0.07 with significant t-value 8.34 indicates one unit increase in yield of sunflower will increase area under sunflower by 0.07 units at 1 percent level of significance. Sale price of sunflower has also positive coefficient of 0.08 with significant t-value of 11.34 if one unit increase in sale price of sunflower area under sunflower will increase by 0.08 units at 1 percent level of significance. Determinants of sunflower area are given in the Table 1.

Table 1: *Determination of sunflower area.*

Variables	Coeffi- cient	Std error	t-val- ue
Dependent: Area under Sunflower			
Seed Cost per acre	-0.31	3.30	-0.92
Hoeing Cost per acre	0.28	6.74	0.51
Land rent of previous year	-0.17	3.721	-0.05
Total operational holding (Acre)	-0.37***	0.04	-9.28
Area of tobacco	-0.81*	0.94	-1.71
Area of sugarcane	-0.28	0.01	-0.32
Sunflower seed rate	-7.98	6.09	-1.30
Sunflower yield/ Acre	0.07***	0.01	8.34
Sale price of sunflower (Rs/ Mound)	0.08***	0.01	11.34
Constant	-1.09	1.75	-0.05

R^2: 0.61, Adjusted R^2: 0.64.
***Statistically significant at 1% level,**statistically significant at 5% level, *statistically significant at 10% level.

Determinants of sunflower yield (mounds per acre)

The role of different factors has been quantified by employing multiple linear regression models at the sunflower yield. The value of R^2 is 0.54 shows that the independent variables number of ploughing, seed rate, number of urea bag, number of DAP bag and number of organic manure trolley are responsible for the 54 percent variation in the sunflower yield model.

Number of ploughing has positive coefficient of 0.15 with insignificant t-value of 0.98 indicates one unit increase in number of ploughing will cause an increase of sunflower productivity by 0.15 units. One unit increase in the seed rate of sunflower will decrease sunflower yield 0.37 units significant at 5 percent significance level. Number of urea bag has positive coefficient of 0.04 with insignificant t-value of 0.19 indicates that one unit increase in urea bag will increase yield of sunflower by 0.04 units. Number of DAP bag used has positive coefficient of 0.43 with t-value of 1.69 indicates one unit increase in dap bag will increase sunflower yield by 0.43 units significant at 10 percent significance level. Number of organic manure trolley has also positive coefficient of 0.39 and significant t-value of 2.54 indicates one unit increase in organic manure will increase sunflower yield by 0.39 units significant at 1 percent level of significance. Details are presented in the Table 2.

Table 2: *Determination of sunflower yield.*

Variables	Coeffi- cient	Std error	t-val- ue
Dependent: Sunflower Yield (mounds per acre)			
No of ploughing per acre	0.15	0.03	0.98
Seed rate per Kg/Acre	-0.38**	0.76	-1.97
Urea bag (No/Acre)	0.04	0.21	0.19
DAP bag (No/Acre)	0.43*	0.15	1.69
Organic manure trolley (No/Acre)	0.39***	0.56	2.54
Constant	2.01	1.05	1.49

R^2: 0.54, Adjusted R^2: 0.51
***Statistically significant at 1% level, **statistically significant at 5% level,*statistically significant at 10% level.

To determine the role of different factors that were affecting the area and yield of sunflower in Khyber Pakhtunkhwa, multiple regression analysis was applied similar work was also done by Akhtar et al., 2012 and Kaleem and Hassan, 2010. The model pointed out that the area under sunflower have opposite relation

with the seed rate, land rent, area under tobacco, area under sugarcane and price of sunflower seed, while positively related to the area under sunflower with the variables such as total operational holding, sunflower yield and sale price of sunflower. Price of seed effect the adoption of sunflower similar result was found by Badar et al., 2002. In case of determining yield of sunflower use of DAP and organic manure were significant and positively correlated. A similar positive and significant relation has been found by Javed et al., 2001 and Khan et al., 2005.

Conclusions and Recommendations

Sunflower is an important oil seed crop of Pakistan. At present its area is 877 thousand acres and production are 473 thousands tones. Sunflower area and production is subject to quantitative and qualitative decreasing due to many factors in Pakistan and specifically in Khyber Pakhtunkhwa. This study was conducted with the aim of estimating the factors affecting the area and yield of sunflower and to give suggestion for the policy makers subject to increase the area and yield of sunflower. Respondents of the study reported that the major hurdle for sunflower was that they were earning more profit from tobacco and sugarcane meant on economic basis they were non-adopting sunflower on their farms. Technically cultivation of sunflower in these areas is only possible if government provides incentives in form of economic benefit and provide market structure for sunflower output subject to the promotion of sunflower in Khyber Pakhtunkhwa. Farmers are not fully aware of the production proficiency of the sunflower which affects yield of sunflower. Therefore, extension department should deliver technical assistance to the farmers concerning to the production technology.

Author's Contribution

Nusrat Habib initiated and finalized this paper. Safeena Inam has collected data and analyzed agronomic perspective and Aisha Siddiqua has done review literature section.

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