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Assessing the factors affecting the yield of Chickpea in Thal Punjab, Pakistan

Omar Zarar khan¹, Asad Naseer¹, Moeen Shahbaz¹, Shoaib Akhtar², Muhammad Faisal², Khalid Mushtaq^{1*}

¹) Institute of Agricultural & Resource Economics, University of Agriculture, Faisalabad, Pakistan

²) College of Economics and Management, Huazhong Agricultural University Wuhan 430070, China

*Corresponding Author: Khalid Mushtaq

Institute of Agricultural & Resource Economics, University of Agriculture, Faisalabad, Pakistan

Email: zarar162@gmail.com

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ABSTRACT: Chickpea is a high nutritional value crop and contributes a considerable part to the economy of Pakistan. There will be an ominous need to conduct a study to determine the basic factors which are affecting on pulse (chickpea) yield. The major factors for low productivity and instability may be due to low rainfall. Thus, this study has been designed to fill the research gap regarding the factors affecting the pulse (chickpea) productivity. A total sample of 120 respondents was interviewed. The regression results for chickpea growers were following. The value of R^2 was 0.398. Benefit cost ratio in the sample area was 1.18. There is dire need to strengthen the coordination between agriculture researchers and extension department to guide the farmers about the efficient utilization of agriculture resources and motivate the farmers to make the small dam to fulfill desire need. Pure and healthy seed contributes much to increase the yield of the crop.

KEYWORDS: Yield; BCR; Chickpea; Punjab

INTRODUCTION

Pakistan is undergoing many structural changes in its economy as it is shifting from agricultural to the services sector. Despite these changes, the largest sector of Pakistan's economy is still agriculture. Although the share of agriculture in the country's GDP is declining, still it contributes a big share of 20.9 percent in its GDP. Almost 43.5 percent population of Pakistan receives employment from this sector (GoP, 2016a)

Grains production had been increased worldwide during last 50 years mainly due to the adoption of modern technologies and soil intensification. Demand for food grain is expected to be increased which may be fulfilled by better management practices and agricultural intensification rather than increase in area under the agriculture (Neumann et al., 2010). The presence of wide yield differential has been demonstrated in several yield gap studies. In Pakistan, there is as much as 40-50 percent of yield gap in wheat production that is believed to exist (Salam, 2012). There exists wide productivity gap in different crops.

Pakistan is the second largest country in the world in the area and third largest in the production of chickpea (World Bank, 2011). Annual production of dry seed is seven lacks sixty thousand million tons that are obtained from an area of 1.094 million hectares, this contributes about 4.7 percent in the national economy of the country (GOP, 2016b) Per capita

per day availability of chickpea in the world is 3.4 gram while in Pakistan it is 16.23 gram. Pulses are the primary source of vegetable protein. The total cropped area on which they are cultivated is five percent. Demand for pulses is increasing day by day due to overriding increase in population. There is a dire need to invent new high yielding varieties of pulses and use of better management practices to respond the increasing demand for pulses. In Pakistan, chickpea, lentil, mung bean, black gram or mash and khesari are the mainly grown pulses (Vijayaprakash and Dandin, 2005).

Punjab province is the major chickpea producing area in Pakistan which is considered the home of chickpea in Pakistan. It contributes 80% to the production of chickpea (Hassan and Khan, 1991).

The cultivation of the chickpea area rose to 943 thousand hectares to 945 thousand hectares, Production of chickpea is 312 thousand tonnes, showing a decreasing in production 17.7% from the previous year it was 379 thousand tonnes. Due to high contents, the cheap protein it is highly consumed by the poorer section of people. The normal use of Chickpea maintains a good digestion and control cholesterol level in the human body. It is used as medicine for treatment of snake bite, sunstroke, bronchitis, leprosy, skin diseases, blood disorder and bilioussness etc. In the desert areas of Punjab,

that includes Thal, chickpea is the main resource for their living and earning for themselves.

But the production of chickpea is solely dependent on the concentration of rain falls. In the region on Thal in Pakistan, this crop is produced in bulk quantity. With the passage of time, the agricultural produce of chickpeas declined. As we all know that regions of Thal are dry, they have low soil productivity; Like other crops chickpea is also exposed to the dangers of various epidemics such as pests, diseases, lodging by winds and grain shriveling due to a sudden rise in temperature at grain maturity stage (Andrieu et al., 2015). An experienced farmer can easily anticipate the extent of loss in output caused by these problems. According to farmers' perceptions attack of aphids/jassids, wind blow were the main causes of yield decline in the area. Low temperature, water shortage, and disease attack also contributed to yield decline. According to farmers, the pesticides companies were suggesting pesticides for aphids/jassids control, whereas, the extension department was against the spray at this stage (Akhtar et al., 2015).

Yield gaps are also classified according to constraints like agronomic gaps which is mainly due to physical and biological constraints, socioeconomics gaps which are mainly due to socioeconomic constraints, institutional gaps which are due to institutional constraints and mixed gaps which are due to above-mentioned gaps (Maik et al., 2015). The chickpea productivity remained different among farmer, the efforts are required to evaluate the factors which cause the variation in productivity. Therefore, this study has been designed to fulfill the following objectives: To examine the farm management practices and to conduct economic analysis. To estimate the impact of several factors affecting the yield of chickpea. To give suggestions to improve chickpea productivity.

MATERIAL AND METHODS

Study Area: The Thal region comprised of districts Khushab, Mianwali, Chakwal, Bhakkar, Layyah, Faisalabad, and Jhang (Punjab Province). The climate of Thal region is very hot. The soils are sandy. During chickpea growing period maximum temperature is 20-37°C and minimum is 6-17°C of this area.

Sampling Strategy: A sample of 120 respondents was selected and data were collected from one Tehsil of District Layyah and that tehsil was choubara. Further, 8 to 10 villages of tehsil were taken randomly and 10 respondents from each village were selected. The primary data set was collected through a well-structured questionnaire to get the information related to the chickpea production. For the selection of respondents, multistage random sampling procedure was used.

Methodology: Following methodology was implemented to find the cost of various farm inputs and their allocation to chickpea crop and to estimate the economics of chickpea production and variation in yield Benefit Cost Ratio (BCR) will be used (Ahmad and Chaudhry, 1988).

$$(1) \Pi = PY - TC$$

The mathematical form of the Model: As described above, Cobb-Douglas type of production function was found to be the best for analysis. The function was estimated by using stepwise regression procedure. The equation 2 which is used for analysis is as under:

(2)

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \mu_i$$

Where Y = yield (mound), β_0 = intercept, β_1 = Age of farmer (Years), β_2 = Education of farmer (Years), β_3 = Farm experience, β_4 = Area (acre), β_5 = Family size (Number), β_6 = permanent workers (Number), β_7 = Seed Quantity (kg).

RESULTS AND DISCUSSIONS

Descriptive Statistics of chickpea growers: Table 1 shows the descriptive analysis of the chickpea growers. Mean age of farmers growing chickpea was 44.08 years, mean education of farmers were 3.18 years and mean Farming Experience of farmers were 20.55 years. Mean chickpea farming experience was 20.57 which shows mean farming experience and chickpea experience was same. Similarly, a mean area owned by the chickpea farmers was 42.45. Average family size of the farmers growing chickpea was 8.50, mean permanent workers was 0.75 and mean yield of the farmers were 3.60 mounds per acre.

Table 2 shows the cost of production of chickpea in which different variable and fixed costs calculated. All costs are explained below: Land preparation cost consists of planking cost, rotavator cost, and ploughing cost. All three costs would be added and then took the average of these costs and as a result land preparation cost is estimated which was 514 Rs/acre. The average numbers of weedicide used can be estimated and then multiplied by the average price of the weedicide which was 2835 rupees per acre on average. As we know that chickpea is not a water-loving crop that's why it depends on rainfall. Many persons hired to perform different farm activities can be estimated and then multiplied by the average wage given to them, this is included in the labor cost. It is the cost which is fixed for the long term and cannot be changed over a long time. Here the rent of land was included in the fixed cost. Variable costs are those costs which can be changed along the period e.g. as mentioned above i.e. irrigation cost, labor cost, weedicide cost etc. The variable cost of chickpea production was 9795 Rs. per acres on an average. Fixed cost in chickpea production was 3250 Rs per acres on an average. The sum of fixed costs and variable cost is called total cost and it can be calculated by adding them and that was 13045 Rs per acre. Revenue for each crop was calculated by multiplying the total production of chickpea crop in kg with per kg price of the product, which was 15376 Rs per acre.

Revenue (Rs.) = Total Production (Kg) x Price (Rs. /Kg)

Gross marginal analysis helps the individual to check the status of the farm enterprise. It is an important indicator to find the profitability of different crops and livestock. Benefit cost ratio in the sample area was 1.18.

Factors affecting the yield of chickpea: The regression results for the chickpea growers are given in Table 3. The value of R^2 was 0.398 while adjusted R^2 was 0.223 while the value of F-test was 2.470, which is significant at 0.043 level of significance. Several factors affecting the chickpea yield under this category have been listed with their relative quantities. The variable of education has a significant impact on per acre yield chickpea. Its elasticity was 0.02 meaning that 1 percent increase in education had a positive impact of 0.02 on chickpea yield. The variable age has a significant effect on chickpea yield. The coefficient represents the elasticity of production with respect to the input variable 'Age' which is 0.01. It implies that a 1 percent increase in age causes an increase the yield of chickpea by 0.01 percent. Findings are related to (Akhtar et al., 2015). The variable for chickpea experience was 1.18 coefficient and has a significant impact on yield. The variable for the household size was significant and its elasticity was 0.03 meaning that 1 percent increase in the number of household size increased the yield by 0.03 percent but this result is significant at 5 percent level of significance. The seed rate of chickpea crop has a significant positive impact on yield of chickpea. Its elasticity is computed 0.75 which means that a 1 percent increase in seed rate has a positive impact of 0.75 on chickpea yield our findings are like to (Maik et al., 2015). The increase in yield is due to increase in chickpea seed. Area size of the chickpea crop had a significant impact on chickpea yield with elasticities of 0.09. A unit percent increase in area size of the chickpea will increase the yield by 0.09 percent, respectively. The coefficient of 'permanent worker' is insignificant at 10 percent level of significance. This coefficient represents the elasticity of production with respect to the input variable 'permanent worker' which is 0.02. It implies that a 1 percent increase in permanent worker increases the yield by 0.02 percent results are alike to (Khan and Ghafar, 2013).

CONCLUSION

Chickpea is a high nutritional value crop and contributing considerable part in the economy of Pakistan. The study shows that wide gap is existing in the per acre yield of chickpea in Pakistan as compared to many other countries of the world. Following policy recommendations are made to bridge this yield gap and improve the economic conditions of the farmers as well as the whole economy. Adoption of modern farming practices by small farmers is critically dependent upon the availability of adequate institutional credit and effective extension services. Therefore, maximum

credit should be disbursed at the minimum interest rate and in easy installments especially for small farmers. Average yields of the farms can be improved by promoting the use of machinery in agriculture to a considerable extent. For this, farmers need to be taught the importance and prerequisites of using machinery. Yield per hectare can be increased by protecting crops against diseases and attacks of different insects and pesticides. For the sake of fulfillment of the above stated objective government can make use of electronic media for promotion of new improved techniques technologies, educating farmers and motivates the farmers to makes the small dam to fulfill the demand of water in the absence of rainfall to enhance the productivity of chickpea.

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AUTHORS CONTRIBUTION

All authors contribute extensively to this work.

COMPETING INTERESTS

Authors declare that they have no competing interests.

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Table 1. Descriptive Statistics

Variables	Minimum	Maximum	Mean	Std. Deviation
Age	27	68	44.08	7.02
Education	0	12	3.18	2.98
Experience	7	35	20.57	6.09
Area	7	2845	42.45	260.35
Family Size	5	14	8.50	1.65
Permanent Workers	0	3	0.75	0.74
Seed Quantity	3	4	3.60	0.47

Table 2. Average Cost of production of chickpea

Operations/ Inputs	No of unit/ acre	Rate/ unit (Rs.)	Cost/ Acre (Rs.)
Land preparation	-	-	514
Seed (Kg)	24	120	2880
Pesticides/Weedicides (Ltr)	9	315	2835
Irrigation		Depends on rainfall	
Labour (person)	3	515	1545
Harvesting			1844
Transportation			177
Total Variable Cost			9795
Fixed Cost			3250
Total Cost (F. c+V.c)			13045
Yield (mounds)			3.6
Price/Mounds			4271
Total Revenue (Price × Yield)			15376
Gross Margin (TR- TVC)			5581
Net Income (TR-TC)			2331
BCR (TR/TC)			1.18

Note: Pakistani currency is denoted by Rupees (Rs); 1 mound is equal to 40 kg

Table 3. Summary statistics for chickpea growers

Variables	Coefficients	Std. Error
Constant	3.49***	0.0019
Age	0.01**	0.011
Education	0.02**	0.021
Experience	1.18**	0.210
Area	0.09*	0.052
Family Size	0.03**	0.030
Permanent Workers	0.02	0.060
Seed Quantity	0.75**	0.020

Note: * significant at the level 0.10 **Significant at the level 0.05; ***Significant at the level 0.01