ECONOMICS OF CHICKPEA PRODUCTION AND EMPIRICAL INVESTIGATION OF ITS YIELD DETERMINANTS IN LOW INTENSITY ZONE OF PUNJAB, PAKISTAN

Mazher Abbas, Irfan Mahmood, Arshed Bashir, Tahir Mahmood**,
M. Ather Mahmood and Sonila Hassan**

ABSTRACT

This research work was designed at Social Sciences Research Institute (PARC), AARI, Faisalabad during the year 2015. The objective was to calculate chickpea cost of production in Bhakkar and Layyah districts of low intensity zone and also to investigate the factors responsible for low chickpea yield in selected districts. A sample of 80 farmers was selected through purposive sampling technique and a well developed interview schedule was used for data collection. Chickpea cost of production was estimated at Rs. 13688 with the gross returns of at Rs. 19958. Net income received by the farmers was noted as Rs. 6270 showing benefit cost ratio of Rs. 1.00:1.50. The results of the regression model indicate that farming experience, seed cost, ploughing and harvesting cost show significant effect on chickpea yield. The coefficient for experience, seed cost, ploughing cost and harvesting cost showed positive impact on yield indicating that 1 percent increase in these variables will bring 0.03, 0.44 and 0.85 percent increase in chickpea yield. The paper concluded that use of improved and high yielding seed alongwith better management practices like proper land preparation, weeding, etc. can help increase the per acre yield of chickpea in low intensity zone.

KEYWORDS: *Cicer arietinum;* **chickpea; production; determinants yield; benefit cost ratio; Punjab; Pakistan.**

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is widely grown in all areas of Pakistan especially desert areas and contribute for mass production. This crop serves as major source of livelihood for rural people in the area. Its production entirely depends upon the distribution and intensity of rainfall. Two varieties of chickpea are commonly grown, distinguished by seed shape, size and colour. The one is called *desi* with relatively small seed and second with

*Social Sciences Research Institute (PARC), AARI, Faisalabad. **Department of Economics, PMAS Arid Agriculture University, Rawalpindi, Pakistan.

large seed called *kabuli*. *Desi* variety is commonly cultivated in the Indo-Pakistan subcontinent. Chickpea stands third among various pulses in Pakistan, after soybean and pea. This crop accounts for 15 percent of the entire world pulses production (3). In Pakistan, chickpea covers largest area among rabi pulses crops and occupies 5 percent of rabi cropped area. In year 2015-16. This crop was grown on area of 945 thousand hectares with the production of 312 thousand tonnes showing decreasing trend of 17.7 percent compared to last year. Overtime productivity of chickpea decreased from 439 to 330 kg per hectare during 2001-2015(4).

The overtime decline in production of chickpea is mainly because of various factors like, cultivation of other crops like wheat, low rainfall in desert area, lack of education, non-availability of latest chickpea's varieties, lack of certified seed, no support price by the government and diseases attack in Pakistan. Lethal epidemic of diseases in chickpea has been voiced by various studies (12, 13, 15, 16). Fusarium wilt is a serious disease of chickpea mainly prevailed in India, Pakistan, Burma, Nepal, Mexico, Spain, and Tunisia. In Pakistan, disease is responsible for 10-50 percent loss every year (14).

Chickpea is mainly drought resistant crop that is successfully grown by subsistence farmers in various areas of Punjab under rainfed and irrigated conditions. For rural premises, in Thal wasteland of Punjab, chickpea is a major source of livelihood for the residents (18). Indesert area of Layyah and Bakhar districts of Punjab, where other crop not successfully grown, it plays vital role in the food security of subsistence farmers and fit in cropping systems (4). Only Punjab contributes 80 percent in chickpea production within Pakistan and it is grown nearly 90 percent under rain-fed conditions (10).

In the past considerable progress has been made in developing new varieties of chickpea specifically for rainfed regions that fits in cropping pattern. Many interventions brought into consideration like bring fallow rainfed area under chickpea cultivation but large scale production could not be sustained due to various technological, socio-economic constraints and environmental factors. Overtime low productivity of this crop has resulted in stagnant or declining per capita availability of chickpea in the major producing belts.

Keeping in view the declining chickpea yield in low intensity zone of Punjab in recent years, the present study was planned to explore the existing production practices, cost of chickpea's production and returns at farm level

and the factors contributed towards low yield of chickpea. The previous studies on chickpea only identify the net returns from this crop. This study first time will attempt to highlight various factors responsible for chickpea yield.

MATERIALS AND METHODS

This study was conducted at Social Sciences Research Institute (PARC), AARI, Faisalabad, Pakistan during the year 2015. A sample of 80 farmers from two districts of low intensity zone viz. Bhakkar and Layyah was taken. The purposive sampling technique was used for sample selection and data were collected through well-developed interview schedule. The survey was conducted in the months of March 2015 in Karror Laal Eson tehsil of district Layyah and Bhakkar tehsil of district Bhakkar. From each district 40 chickpea growers were interviewed. The analysis was done by using SPSS 17. The mean and standard deviations of socio-economic indicators and cost-benefit parameters is accounted through descriptive statistics application. Simple budgeting technique was used to derive the cost benefit estimates and economic analysis of chickpea. Total cost was estimated by summing up all variables and fixed costs whereas gross returns were estimated by multiplying price per maund of chickpea received by growers to total yield per acre. Hence net income was estimated by subtracting total cost from gross revenue stated as;

$$Net\ Income\ (NI) = GR - TC$$

Furthermore, to estimate benefit cost ratio the gross revenue is divided by total cost the formula stated as;

$$Benefit\ Cost\ Ratio\ BCR = GR/TC$$

To empirically investigate the factors influencing per acre yield of any crop the Cobb-Douglas production function is widely used by agricultural economists for analysis (7). Various studies (4, 5, 17, 20) used this functional form for the coefficient of every explanatory variable measures the elasticity of dependent variable in proportional to that variable. This model is used for its simplicity, easily computation, understandable and simply interpretation (9). Furthermore, logarithmic transformation of this model into linear form made Cobb-Douglas production function easy to estimate (6). Generalized form of normalized Cobb-Douglas type production function used for chickpea crop in the study area was as follow:

$$\ln Y = \beta_0 + \beta_1 \ln Edu_i + \beta_2 \ln Exp_i + \beta_3 \ln seed_i + \beta_4 \ln ploughing_i + \beta_{5i} \ln harvesting + \mu_{it}$$

Where

lnY	=	Natural log of average Chickpea yield of the farm (maunds/acre)
In exp *i*	=	Natural log of experience of the i-th farmer in years
Ledui	=	Natural log of years of schooling of the i-th farmer
In *seed*	=	Natural log of average seed rate of the i-th farm for chickpea crop (Rs/acre)
In *ploguhing*	=	Natural log of average ploughing cost of the i-th farm for Chickpea crop (Rs/acre)
In *harvesting*	=	Log of average harvesting cost of the ith farm for chickpea crop (Rs/acre)
μ_{it}	=	Disturbance term

RESULTS AND DISCUSSION

Personal characteristics of respondents of study area

The information regarding socio-economic characteristics of the sample farmers is presented in Table 1. Average age education and farming experience were estimated at 47.7, 5.8 and 22.76 years, respectively. The average age of the respondents of Bhakkar dsitrict was about 48.33 years, on the other hand average age of Layyah district respondents was 47.32 years. The average formal education of the respondents of Bhakkar and Layyah districts was 6.36 and 5.32 schooling years, respectively. On an average, the respondents of Bhakkar and Layyah districts had farm experience of 25.39 and 20.61 years, respectively. Table 1 also explains the tenancy status of the sample chickpea growing respondents. In Bhakkar all the respondents (100 percent) were owners while in case of Layyah district 97 percent were owners. Overall 1.3 percent respondents were owner-cum-tenant in the study area. In both Bhakkar and Layyah districts, majority of chickpea growers (75%) involved full time in farming, while the about 25 percent involved as part time in farming.

Table 1. Personal characteristics of respondents of study area

Particulars	Bhakkar	Layyah	Overall
Age (years)	48.33	47.32	47.78
Education (years)	6.36	5.32	5.79
Farm experience (years)	25.39	20.61	22.76
Tenancy status (percent)			
Owners	97.2	100.00	98.8
Owner –cum-tenant	2.8	0.0	1.3
Level of involvement (percent)			
Full Time	75	75	75
Part Time	25	25	25

Chickpea cost and return analysis

Table 2 explains the cost of production of chickpea in rainfed conditions. In land preparation ploughing cost was reported as Rs. 935/acre followed by planking cost Rs.250/acre. Among other input costs, weeding cost was

Table 2.   Cost and return analysis of chickpea

Practices	Units	Total units	Per unit price (Rs.)	Amount (Rs.)
Ploughing	No.	1.65	567.04	935.616
Planking	No.	1	250.00	250.00
Sowing cost (drill)	No.	1	602.27	602.27
Seed	Kg	24.43	51.02	1246.419
Weeding	No.	1.75	1337.0	2339.75
Harvesting	No.	1	1533.39	1533.39
Threshing	No.	1	1063.63	1063.63
Land rent	Rs./acre	1	4954.55	4954.55
Mark up @12 percent	Rs./acre	1	763.0	763.00
Total cost	Rs./acre	-	-	13688.62
Grain yield	Mds/acre	9.16	1802.27	16508.79
Dry stalk yield	Mds	23	150.0	3450.00
Gross returns	Rs./acre	-	-	19958.79
Net benefits	Rs./acre	-	-	6270.169
BCR		-	-	1.00:1.50

reported to be highest (Rs.2339/acre) followed by seed cost Rs. 1246/acre. Harvesting and threshing cost was calculated as Rs.1533 and Rs.1063/acre, respectively. Total cost incurred in chickpea production was Rs.13688/acre with the gross returns of Rs. 19958/acre. Net income received by the farmers was estimated as Rs.6270/acre showing benefit cost ratio Rs.1.5/rupee investment.

Empirical analysis: Identification of factors responsible for low chickpea yield

The empirical analysis was conducted to identify the factors responsible for low chickpea production in study area. The estimates of model revealed that coefficient of the experience was statistical significant and directly related to the output. The coefficient of farming experience of the respondent was 0.08, depicted that 1 percent change in experience of the respondent will increase average chickpea yield by 0.08 percent (Table 3). The coefficient for education was insignificant and had the positive sign. These results were in-line with Asfaq *et al*. (5), who estimated that education and farming experience had direct relation with farm diversification. Abrha (2) concluded that above mentioned two variables, had direct relation with production in birr.

As far as the cost variables are concerned, the analysis indicate that one percent increase in cost of seed, ploughing and harvesting brought 0.44, 0.31 and 0.85 percent changes in the average chickpea yield, respectively.

Table 3.   Factors affecting chickpea yield

Variables	Coefficient	T-statistics
Cons	-2.216	-0.881
Lexp	0.08	1.703*
Ledu	0.028	1.303
Lnseed	0.442	2.794***
Dumy	0.252	5.921***
Lnplo	0.314	1.964**
Lnharvestng	0.855	2.511**
R^2= 0.62	Adjusted R^2=0.588	F. Statistics= 19.824***

Source: Author's Survey 2015, ***, ** and * shows 1, 5 and 10 percent level of significance

Result of seed cost are in line with those of Semerci *et al.* (7), who concluded that seed cost had direct relation with the wheat production. Overall, Cobb Douglas function was significant having F-value 19.824 and value of R^2 indicate that 62 percent variance in dependent variable is explained by explanatory variables included in the model. The model was tested for heteroscedasticity using the Breusch-Pagan test (BPG) which is designed to detect any linear form of heteroscedasticity (8) and adjustments were made by using robust standard error.

CONCLUSION AND RECOMMENDATIONS

The results clearly indicate that seed and ploughing cost contribute positively to enhance chickpea yield alongwith experience and education of the chickpea growers. The use of improved and high yielding seed alongwith better management practices like proper land preparation, weeding, etc. can help to increase the per acre yield of chickpea in low intensity zone. Due to the use of conventional management practices as obvious from the cost indicators is the major obstacle to enhance chickpea yield in study area.

To increase the per acre productivity of chickpea there is a need to motivate and encourage farmers to grow recommended high yielding and disease resistant varieties, to adopt improved cultural and management practices. Farmers had a little bit knowledge about seed management. If the farmers keep improved variety seed by their own traditional method then a great risk is there in losing its viability. Farmers should be trained regarding seed management and seed production. Government should encourage the farmers by good price of their produce; give them subsidies so that they willingly increase the investment for this crop in the form of improved seed and management practices that will lead to increase per acre productivity. Farmers should be trained in seed production and storage management techniques so that its viability is maintained.

REFERENCES

1.	Abbas, M., T. Mehmood, A. Bashir, M. Zafar and A. Afzal. 2012. Economics of *Lallemantia royleana* (tukham-e-balangoo) production in the low intensity cropping zone of the Punjab, Pakistan. Pak. J. Agric. Res. 25:110-119.

2.	Abrha, B.K. 2015. Factors Affecting Agricultural Production in Tigray Region. Dept. of Development Studies. Northern Ethiopia (Doctoral Dissertation). University of South Africa.

3.	Anon. 2010. Agricultural Production, Food and Agriculture organization of the united nations (FAO). Year Book/or http://faostat.fao.org.

4.	Anon. 2016. Economic Survey of Pakistan, 2015-2016. Economic Advisor's Wing Governments of Pakistan, Finance Division, Ministry of Finance. Islamabad. Pakistan.

5.	Ashfaq, M., S. Hassan, M. Z. Naseer, I. A. Baig and J. Asma. 2008. Factors affecting farm diversification in rice-wheat. Pak. J. Agri. Sci.45:91-4.

6.	Beattie, B. R. and C. R. Taylor.1985. The economics of production. Malabar, FL: Robert E. Kreiger Publishing Company.

7.	Debertin, L. D. 1986. Agricultural Production Economics. McMillan Publishing Comp., New York. USA.

8.	Gujarati, D. N. 2009. Basic Econometrics. Tata McGraw-Hill Education.

9.	Heady, E. O. and J. Dillon. 1961. Agricultural Production Functions. Ames: Iowa State University Press.

10.	Hussain, N., M. Aslam, A. Ghaffar,M. Irshad and N. U. Din. 2015. Chickpea genotypes evaluation for morpho-yield traits under water stress conditions. J. Ani. & Plant Sci. 25:206-211.

11.	Pankaj, K., P.S. Deshmukh, S.R. Kushwaha and Sunita-Kumari. 2001. Indian Society of Agricultural Science. Annals of Agricultural Research. Division of Plant Physiology, Indian Agricultural Research Institute, New Delhi, India. p. 110-112.

12.	Kausar, A.G. 1965. Epiphytology of recent epiphytotic of gram blight in West Pakistan. Pakistan J. Agri. Sci., 2:185-195.

13.	Malik, B.A. and M. Tufail. 1984. Chickpea production in Pakistan. *In:* Ascochyta Blight and Winter Sowing of Chickpeas, M.C. Saxena, K.B. Singh. M. Nijhoff and W. Junk (eds.). The Hague, The Netherlands, p. 229.

14.	Nazir, M.A., M. A. Khan and S. Ali. 2012. Evaluation of national and international chick pea germplasm for resistance against Fusarium

wilt (*Fusarium oxysporum* f. sp. Ciceris) in Pakistan. Pak. J. Phytopathol. 24:149-151.

15. Radulescu, E., E. Capetti, E. Schmidt and A. Cassian. 1971. Contributions to the study of anthracnose of chickpea (*Mycosphaerella rabiei* Kov.), Lucrari Stuntifice, 14:311-321.

16. Sattar, A. 1933.On the occurrence, perpetuation, and control of gram (*Cicer arietinum* L.) blight caused by *Ascochyta rabiei* (Pass) Labrousse, with special reference to Indian conditions. Annals of Applied Biology. 20:612-632.

17. Semerci, A., A. Mazid, K. N. Amegbeto, M. Keser, A. Morgounov, K. Peker, A. Bagci, M. Akin, M. Kucukcongar, M. Kan, S. Karabak, A. Altikat and S. Yaktubay. 2012. The production functions of wheat production in Turkey. Bulgarian J. Agri. Sci.18:240-253.

18. Shah, N.A., K. M. Aujla, M. Abbas and K. Mahmood. 2007. Economics of chickpea production in the Thal desert of Pakistan. Pak. J. Life Soc. Sci., 5:6-10.

19. Sharif, M. 2004. Wheat yield Gap Analysis: Future Options for Pakistan: A Report submitted in partial fulfilment of the requirement for internship programme in Agricultural Economics. B.Sc. (Hons.) Agriculture.

20. Sher, F. and E. Ahmad. 2008. Forecasting wheat production in Pakistan. Lhr. J. Eco. 13:57-85.

***

CONTRIBUTION OF AUTHORS:

Mazher Abbas	:	**Conceived research idea**
Irfan Mahmood	:	**Statistically analysed the data**
Arshed Bashir	:	**Checked data analysis**
Tahir Mahmood	:	**Collected data and entered in SPSS**
M. Ather Mahmood	:	**Prepared writeup of introduction, methodology and references**
Sonila Hassan	:	**Overall management of the article**