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DETERMINANTS OF VARIOUS FACTORS FOR WHEAT PRODUCTION

Muhammad Iqbal, Muhammad Fahim Khan**, Muhammad Suhail and Qamruz Zaman**

ABSTRACT

A study to determine various risk factors for wheat production was carried out in the Department of Statistics, University of Peshawar, Peshawar, Pakistan during the year 2012-13. In this study, modified type of Cobb Douglas function was performed to examine relationship between wheat production and various risk factors i.e. fertilizer, farm yard manure (FYM), land preparation, pesticides/weedicides, irrigation and labor days. Data were collected from three villages namely Regi, Lakaray and Putwar of District Peshawar. A total of 234 respondents were examined from above mentioned three villages. In this research the empirical analysis showed that wheat production was significantly affected by the independent variables including fertilizer, FYM, land preparation, pesticides/weedicides, irrigation and labor days. All factors, which were included in the given model, have a positive relationship with the production of wheat. The parameters coefficients estimates for fertilizers, pesticides/weedicides and irrigation were 0.231, 0.300 and 0.183 respectively, which were highly significant. Coefficients for FYM, land preparation, seed and labor were 0.014, 0.023, 0.095 and 0.227, respectively which were insignificant. Based on the findings, it was concluded that there was a strong relationship between wheat production and three risk factors namely fertilizer, pesticides/weedicides and irrigation.

KEYWORDS: ***Triticum aestivum;*** **wheat; determinants production factors; weedicides; Pakistan.**

INTRODUCTION

Pakistan is an agricultural country and agriculture is the mainstay of our economy. Pakistan economy has undergone considerable structural changes over the past few years, yet agriculture is the largest sector of the economy. It contributes 21.8 percent to GDP, employing 44.7 percent of the total work force. More than two-third of country population lives in rural areas and their livelihood continue to revolve around agriculture and allied activities. Like

***Department of Statistics, University of Peshawar, Peshawar, **Allama Iqbal Open University, Islamabad, Pakistan.**

other developing countries, poverty in Pakistan is largely a rural phenomenon. Therefore, development in agriculture sector will be a principal vehicle for alleviating rural poverty. Agricultural provides food and fibre to the growing population. It also provides raw material to agribusiness and industrial sector (2).

Wheat belongs to family Poacae, played an important role in the development of man civilization in many countries including Pakistan. It covers two third of the acreage under cereals crops in the world. Wheat is a staple food and major source of nourishment of people in Pakistan, it ranks first in acreage, production and consumption among all food crops. It contributes 12.5 percent to the value added in agricultural and 2.6 percent to GDP (3). There is an extensive yield gap between progressive farmers and common farmers which is due to lack in seed rate, poor method of weeds control, improper use of irrigation water, insufficient dosage of chemical fertilizers, etc. The awareness of farmers to optimal dose of various inputs and their marginal productivity is essential for making managerial decisions (7).

With the control over wheat production and marketing factors wheat production price was brought closer to the international levels. As a result, there was a remarkable increase in wheat crop area and yield, causing a triple increase in wheat production from 1961 to 1980 (9). However, national yield of wheat is still low and instable against the world major wheat growing countries. The major reasons for low yield and instability includes delayed harvesting of kharif crops like cotton, sugarcane and rice, and consequent late planting of wheat, non-availability of improved inputs like seed, inefficient fertilizer use, weed infestation, shortage of irrigation water, drought in rainfed and terminal heat stress and soil degradation. Moreover, farmers are not aware of modern technologies because of weak extension services system.

The area, production and yield of wheat in Khyber Pakhtunkhwa Province for last nine years are shown in the Table 1. The data show that the average area and production of wheat in KPK for the last seven years is 746.23 thousand hectares and 1113.79 thousand tons, respectively. The area under wheat in KPK from 2004-05 to 2010-11 decreased from 748.5 to 724.5 thousand hectares. However, the production of wheat during the same period increased from 1091.0 to 1155.8 thousand tons.

Due to low or negative net returns from food grains (wheat), farmers shifted away from food grain towards high value crops as export crops. Since with

Table 1. Area, Production and yield of wheat in KPK

Year	Area ('000' hectares)	Production ('000' tons)
2004-05	748.5	1091.0
2005-06	721.3	1100.6
2006-07	754.2	1160.4
2007-08	747.3	1071.8
2008-09	769.5	1204.4
2009-10	758.3	1152.5
2010-11	724.5	1155.8
Average	746.23	1113.79

Source: Govt. of KPK, 2010-11.

existing population growth about 1.3 percent, demand for food commodities increases at faster rate. In such situation, there is need whether or not to shift food grain area towards high value crops or extension effort must be made to promote or transfer improved cultural and intensive management practices to increase yield (1).

In this study, modified type of Cobb Douglas function was performed to examine the relationship of wheat production with various risk factors.

MATERIALS AND METHODS

Study area and sampling

The study was conducted in the Department of Statistics, University of Peshawar, Peshawar, Pakistan during the year 2012 to determine the effects of various risk factors on wheat production. This study based on the data obtained from three villages namely Regi, Lakaray and Putwar of district Peshawar. The total population of farmers in selected areas was approximately 600, out of which 350, 160 and 90 was from Regi, Lakaray and Putwar, respectively. The above information was collected through personal communication with local revenue officers (Putwari) and owners of the land in the respective villages of study area.

The sample size determination table of Sekaran and Bougie (12) was used to obtain a good representative sample of the target population. So by using this table, sample size 234 was taken, a good representative of the target population. The sample size 234 was then distributed among three villages by using **Proportional allocation sampling technique**, i.e. 137, 62, 35 for Regi, Lakaray and Putwar, respectively. The respondents of size 137, 62 and

35 from Regi, Lakaray and Putwar villages were then selected by using the **simple random sampling technique**. The data were collected during November 2012 to January 2013 through a structured questionnaire where farmers were interviewed through face to face meeting at their field/home/hurja.

Estimation procedure

The associations of various risk factors with the production of wheat were determined through the statistical technique of Cobb Douglas function. The statistical analysis was performed through SPSS software package. The details are as follow;

Cobb douglas function

The wheat production function was statistically estimated to ascertain how different factors i.e. seed rate, ploughings, number of irrigation, total fertilizer nutrients applied, FYM number of labor days, and pesticides/weedicides contribute towards higher wheat yield.

The Cobb-Douglas production function, in its stochastic form, may be expressed as

$$Y = \beta_* X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} e^{u_i} \qquad (1.1)$$

The above Cobb-Douglas production function in logarithmic form can be written as

$$LnY = \beta o + \beta_1 Ln\, X_1 + \beta_2 Ln\, X_2 + \beta_3 Ln\, X_3 + \beta_4 Ln\, X_4 + \beta_5 Ln\, X_5 + \beta_6 Ln\, X_6 + \mu_i \qquad (1.2)$$

The model specified above will be empirically estimated using Ordinary Least Squares (OLS) estimation technique (5).

Production function indicates the technical transformation of inputs into outputs. However, no production function in agriculture can completely describe the nature of production process. Therefore, the purpose of applying any production function is to approximate the actual production function/process efficiently. In this respect there could be a number of functional forms, however the following function is estimates in this research effort.

$$Y = \beta_* X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} e^{u_i} \qquad (1.1)$$

Where Y is the wheat yield in kg per acre considered as dependent variable and X_1, X_2, X_3, X_4, X_5, X_6, and X_7 are the land preparation per acre, fertilizers in nutrient use in kg per acre, quantity of FYM used per acre, pesticides/weedicides used in litre per acre, number of irrigations per acre, quantity of seed use in kg per acre, and number of labor days per acre, respectively, considered as independent variables.

RESULTS AND DISCUSSION

A modified type of Cobb Douglas function was used in this study using the ordinary least square (OLS) method. In Table 2 the value of R^2 is 0.65 which can be regarded as a quit good fit in respect of cross sectional data involved in the study. Therefore, it implies that 65 percent of variation is explained by the independent variables included in the study.

Table 2. Roles of various factors in wheat productions

Model	Unstandardized coefficients	Significance	Collinearity statistics (VIF)
Constant	4.275	0.000	
Fertilizer	0.231	0.000	1.519
FYM	0.014	0.845	1.058
Pesticides/ Weedicide	0.300	0.000	1.561
Irrigation	0.183	0.000	1.348
Land preparation	0.023	0.422	1.127
Seed	0.095	0.281	1.126
Labor	0.227	0.112	1.086

Dependent Variable: Yield, R^2 = 0.65 Adj. R^2 = 0.639, F = 59.84 Durbin-Watson = 1.88

The Variance Inflation Factor (VIF) technique was used to check the effect of multicollinearity in the model. The result shows that the value of VIF for all variables included in the model were less than 10 which indicate that there is no problem of multicollinearity in the model. The Durbin Watson statistics was used to detect the autocorrelation. The results showed that value of Durbin-watson statistics was 1.88 which is close to 2. Therefore, the model had no autocorrelation problem (5). The influence of other factors on wheat yield is discussed as under:

Fertilizer aggregates all types of chemical fertilizer use on per acre area. Fertilizer is the most important and expensive input in agricultural production. The influence of balanced fertilizer use in the direction of increased yield varies from 30 to 60 percent in different crop production areas of Pakistan. One kg of fertilizer nutrient produces about 8 kg of wheat (3). The coefficient of fertilizer (0.231) is highly significant (second column of table 2). It shows that one percent increase in fertilizer quantity the wheat yield is increased by 0.231 percent.

Weeds are the most common problem for the farmers of study area especially in flood affected area. Most of the farmers take guidance from nearby government authorized dealers about weeds control chemicals. Rajaram *et al.* (10) recorded that 10 percent increase in wheat yield can be attained by efficiently controlling weeds. The coefficient of pesticides/weedicides (0.30) is statistically highly significant. It shows that a percent increase in the quantity of pesticides/weedicides the wheat yield is increased by 0.30 percent.

Maximum and minimum grain yield of 3100, 4300, 4500 and 4600 kg per hectare can be obtained for zero, one, two and three irrigation treatments, respectively (6). This shows that irrigation plays important role in higher wheat yield obtained. The coefficient of irrigation (0.183) is also highly significant. It shows that one percent increase in the amount of irrigation the wheat yield is increase by 0.18 percent. Our results are in complete agreement with Shah *et al.* (11) who also found significant effect of number of irrigation on wheat yield.

CONCLUSIONS AND RECOMMENDATIONS

The empirical analysis showed that wheat production has been significantly affected by the independent variables included in the analysis i.e., fertilizer, FYM, land preparation, pesticides/weedicides, irrigation and Labor days. All factors of production included in the model had a positive relationship with the production of wheat. The coefficients of fertilizer, pesticides/weedicides and irrigation were found highly significant.

On the basis of results of the research study the following recommendations are forwarded:

- It is suggested that the farmers should be trained by experts and extension personnel towards the use of agronomic practices for better yield of wheat.
- The farmers should be educated through expert trainers about weeds control system.
- Based on the findings, it is suggested that government should provide subsidized farm inputs to the farmers to encourage wheat production.
- Steps should be taken for stable input and output prices so that sustained agricultural growth can be achieved.

REFERENCES

1. Akhter, M.R. 1999. Effect of trade liberalization and agriculture in Pakistan. Commodity aspert. The regional coordination, Center for Research and Development of Coarse Grain, Pulse roots and tuber crops. UU/ESCAP, working paper series 44.

2. Anon. 2011. Agriculture Statistics of Pakistan 2010-11, Ministry of Food, Agriculture and Livestock, Government of Pakistan, Government of Pakistan, Islamabad, Pakistan.
3. Anon. 2012. Agriculture Statistics of Pakistan 2011-2012, Economic Survey of Pakistan, Government of Pakistan.
4. Anon. 2010. Crop statistics in KPK (NWFP), Crop Reporting Center, Government of KPK, Peshawar.
5. Gujarati, D.N. 2003. Basic econometric*.,* (4th Ed.).McGraw Hill, 1002.
6. Haider, G., A. Bashir, M. S. Tabassam and M. S. Tabassam. 1997. Consumtive Use of Water by Wheat under Optimum Management Conditions. P. Annual Progress Report WMRP CSU 114.
7. Hassan, I., M.B. Chattha, T.H. chattha and M.A. Ali.2010. Factors affecting wheat yield: a case study of mixed cropping zone of Punjab. J.Agric. Res., 48(3):353-359.
8. Iqbal, M., M. A. Khan and M. Ahmad. 2001. Determinants of higher wheat productivity in irrigated Pakistan, The Pakistan Development Review, 40(4), 753-766
9. Kherallah. N. Minot and P. Gruhn. 999. Adjustment of wheat production to market reform in Egypt: Markets and Structural Studies Division. International Food Policy Research Institute (IFPRI) 2033 K Street, NW Washington, DC 20006. MSSD Discussion Paper No. 32
10. Rajaram, S., P. R. Hobbs and P. W. Heisey. 1988. Review of Pakistan's wheat and maize research systems: Report submitted to Pakistan Agricultural Research Council, Pakistan.
11. Shah, M., M.M. Khan, and M.A. Atta. 2005. Comparative study of wheat production before and after Chashma Right Bank Canal. J. Manage. Sci. 4(1):97-105.
12. Sekaran, U. and R. Bougie. 2005. Research Method for Business. (5th Ed.). John Willey and Sons (Pvt). LC. 293-294.

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CONTRIBUTION OF AUTHORS:

Muhammad Iqbal	**:**	**Prepared conceptual design of research work, determined sample size**
Muhammad Fahim Khan	**:**	**Approved questionnaire and critically reviewed the article**
Muhammad Suhail	**:**	**Collected data from the respondents and entered in SPSS**
Qamruz Zaman	**:**	**Collected data from the respondents**