Comparative Study of Wheat Production before and after Chashma Right Bank Canal

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Abstract

This paper is a comparative study of the wheat production before and after the construction of Chashma Right Bank Canal (CRBC). Stage II of CRBC is taken for study. Survey data was collected for five selected villages. The study has assessed and compared the per acre yield of wheat and area under wheat production before and after CRBC. Two approaches have been used for the analyses, which are t-statistics and regression analysis. The results shows that there is a significant change (increase) in per acre yield and area under cultivation of wheat in the study area due to irrigation facility. It shows that CRBC has played a crucial role in increasing the per acre yield of wheat in the command area of CRBC.

Keywords: Wheat Production, Irrigation, Chashma Bank Canal, CRBC, Pakistan

Introduction

Agriculture is the lifeblood of Pakistan's economy. Although its relative importance has declined over the past few years, as a result of the development strategy aimed at diversifying the economy the sector still holds the key to the economy's future. In fact, Pakistan's comparative advantage in certain agricultural and agriculture based activities implies that the country's economic prospects will remain certainly dependent on maintaining and deepening the growth of the farm sector. Yields of Pakistani major crops have indeed increased in the last few decades following the introduction of new high yielding varieties of seeds and improved access to water. Yield per acre of all the major crops has increased many times as compared to 1949-50. (Mustafa, 1989)

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Wheat is the main staple diet of country's population and largest grain crop of the country. It contributes 14.4 % to the value added in agriculture and 3.0 % to GDP. The performance of agriculture remained weak during 2005 – 06 because its crop sector particularly major crops could not perform up to the expectations. Growth in the agriculture sector registered a sharp recovery in 2006 – 07 and grew by 5.0 % as against the preceding year's growth of 1.6 %. Major crops posted strong recovery from negative 4.1 % last year to positive 7.6 %, mainly due to higher production of wheat and sugarcane. Wheat production of 23.5 million tons is highest ever in the country's history, registered an increase of 10.5 % over the last year. (Govt. of Pakistan, 2007)

In Pakistan, production of wheat has experienced sharp fluctuations, with periods of near self-sufficiency in wheat followed by periods of unsatisfactory performance. These fluctuations have been caused mainly by the vagaries of weather, which, in spite of a highly developed irrigation network in the Indus Basin, casts a long shadow on the fortunes of the agricultural sector. Nevertheless, the introduction of better agricultural technology – e.g. improved varieties of seeds, a more intensive use of fertilizer and assured water supply through tube wells and canal irrigation – has helped to raise the level of wheat production through an increase in area and improvement in the yield per acre. (Cornelisse and Naqvi, 1987)

Irrigation has proved beneficial to the agricultural development of a country. In fact, irrigation forms the lifeline for sustained agriculture. It alleviates suffering, preserves life, averts famine and advances the material prosperity of the country. (Reddy, 1995)

Government of Pakistan is trying its level best to improve the agriculture sector of the economy by achieving the maximum production of crop through sustained irrigation system by protecting the land from water logging and salinity, and also by controlling floods and soil erosion. In this regard the government of Pakistan is giving top priority to the development of irrigation system. To achieve these objectives government of Pakistan is working on the proper management of the water resources through the construction of medium and large scale dams and canals. (Govt. of Pakistan, 2004)

D.I. Khan is one of the southern districts in KP where majority of people live below poverty line. Literacy rate is low. Unemployment is widespread. Per hectare yields of crops is low. Area under cultivation is also low. The agricultural economy of the area has transformed a lot after the construction of Chashma Right Bank Canal (CRBC) because it has brought more area under cultivation than before and the yields of crops have increased manifold. The Chashma Right Bank Irrigation Project

(CRBIP) has a major role contributing to the agriculture sector of KP and Punjab. (Sheladia Associates, Inc., 2001).

Objectives of the Study
The main objectives of the study are as follows:
1) To examine the area cultivated by wheat before and after the construction of CRBC.
2) To assess and compare the per acre yields of wheat before and after the CRBC. CRBC is a gigantic project and has multidimensional objectives. That includes ambitious targets of achieving the level of socio-economic development as well as development of agriculture with a view to improving the lot of peoples residing in the project area of the district D.I. Khan.

Literature Review
Many studies have been conducted in Pakistan and other countries for the comparison of wheat production under the facility of canal irrigation and without canal irrigation. Some important studies in this respect are taken.

Kumar et al (1992) have used the Divisia - Tornqvist index for wheat growers in various Indian states as Haryana, Utter Pardesh and Punjab. A micro level data is used. The study concludes that the wheat production in these Indian states has increased due to canal irrigation. TFP results reveal that input index has increased and output index has increased more than that, due to increase in input and technological change (irrigation). Study states that TFP growth rates in the wheat sector in the Indian States during the period are much better than growth of TFP not only in Pakistan but also in US (Post war Agriculture).

Byerly and Derek (1994) studied the growth of various crops in Pakistan. They analyzed that large increase in the area under cultivation in Pakistan is mainly due to the availability of water (irrigation). Between 1960-61 and 1990-91 the availability of water doubled, while Rabi crops trebled and Kharif crop more than doubled.

Khan et al (1996) examined the factors behind low crop yield in Cholistan in Pakistan. Regression model is used for the analyses of wheat and cotton crops. Only capital, land and irrigation water has turned out to be significant constraints on production with positive coefficients.

Khan (1997) examines the growth experience of Pakistan. He states that the growth process in Pakistan is uneven not only between various regions but also between regions with and without irrigation. He concludes that due to increased availability of irrigation water the irrigation intensity increased by 40% and cropping intensity by 26 %. All

the inputs have doubled trebled or quadrupled, as the water availability has increased from 3.2 to 5.8 acre-feet per hectare.

Jehangir et al (1998) studied the area of Rechna Doab. He concluded that irrigation played a significant role in reducing not only the culturable waste area and increased cropping intensity but also due to this the production of wheat and cotton also increased manifold.

Iqbal et al (2001) analyzed empirically the various factors responsible for enhances wheat productivity during 1999-2000and provides basis for devising a strategy to sustain wheat production in future. A modified Cobb Douglas type production function is used for the analyses for 643 wheat growers. The results of the regression equation show that the coefficients of seed rate, numbers of irrigation and fertilizer nutrients are positive and highly significant.

A thorough review of the literature shows that increased productivity of wheat is closely related with sustained and continuous supply of water.

Research Methodology

Chashma Right Bank Irrigation Project consists of three stages, as Stage I, II and Stage III. A three stage sampling technique is used for the study. In the first step Stage II is selected, as it completed in 1995 and one can now analyze its impact. Secondly, this area is purely unirrigated as compared to Stage I, which was partially irrigated by PaharPur Canal. Thirdly, Stage II lies in the vicinity of D I Khan. Stage III lays partly in KP and partly in Punjab, which is why it is excluded. In the second step five villages were selected, namely, Gomal Kalan, Khutti, Gara Hayat, Kurai and Daraban Khurd. In the third step 139 households were selected in these sample villages. A questionnaire was collected in June – August 2004.

As this study is a comparative study so paired sample test is used to compare per acre yield of wheat and cultivated area before and after CRBC. This is given as follows:

$$t = \frac{\left(\overline{X}_1 - \overline{X}_2\right) - d_0}{\sqrt{\dfrac{S_1^{\,2}}{n_1} + \dfrac{S_2^{\,2}}{n_2}}}$$

Where $\overline{X}_1$ = mean value after the CRBC, $\overline{X}_2$ = mean value before the CRBC, d_0 = mean of the difference between paired observations, S_i^{2} = sub-sample variance and n_i = sub-sample size (Walpole, 1982).

To know the importance and contribution of water in the production of wheat the Cobb Douglas production function is used.

$$Y = f(I, A, F, L, E)$$

Cobb-Douglas production function is adopted in the following form.

$$Yi = e^{\beta 0} I^{\beta 1} A^{\beta 2} F^{\beta 3} L^{\beta 4} E^{\beta 5} e^{ui}$$

Applying natural logarithms (In) on both sides

$$In\ Yi = \beta_0 + \beta_1 In\ I + \beta_2\ In\ A + \beta_3\ In\ F + \beta_4\ In\ L + \beta_5 In\ E + u_i$$

Where

$In Yi$ = Natural logarithm of per acre yield of the ith crop,

A = area under crop in acres, L = labor used in man days during the entire crop season,

I = No. of irrigations, F = Use of Fertilizer in kilograms,

E = highest level of education gained by the farmer,

Ln = natural log, and β_0 are regression coefficients.

U_i = Random error term independently and identically distributed with zero mean and constant variance

The model is estimated by employing Ordinary Least Square (OLS) estimation method.

The dependent variable (Y) is natural log of yield of various crops in kgs. Data on various inputs (water, fertilizer, man days) have been collected on a per acre basis.

Among the independent variables, area (A) represents the total area under the ith crop. F is the fertilizer variable. It aggregates all types of fertilizers used on per acre area. Total fertilizer input at the farm level has been obtained by multiplying the per cropped acre fertilizer nutrient in kilograms with area under the said crop. In the irrigated area fertilizer is widely used and is an important input, while the use of fertilizer is zero in the un-irrigated (barani or rod kohi) area. Farm labor is an important input in the production function. Data on labor (L) have been collected in man days on a per acre basis for each crop. Data on I irrigation is collected from the surveyed farmers in number of irrigations per cropped acre. One irrigation on average equals 3 acre-inches of water. Multiplying the number of irrigation per acre with 3, and then multiplying the data in inches with total cropped area at the farm level obtain total irrigation input in acre-inches at the farm level. Another important determinant of agricultural productivity is level of education of the farmers. E in the model is the input of highest level of education of the farmers (Sahibzada, 2002). The collected data is analyzed by (SPSS).

Data Analysis, Results and Discussion
Main findings of the study areas follow

Impact of CRBC on Area under cultivation
The data in Table I show that area under cultivation has grown manifold
due to the construction of CRBC. The table reveals that in five villages
the area under cultivation has increased significantly.

Table1. Comparison of Area under cultivation in the Study Area (Acres)

Village	Before CRBC	After CRBC	t-stat
Khutti	235	460	2.45**
Gara Hayat	189	509	3.16*
Kurai	190	432	2.10**
Gomal Kalan	220	403	2.31**
Draban Khurd	253	768	4.29*

*Source: Survey (2004) Note: * and ** show statistical significance at 1% and
5%, respectively.*

Impact of CRBC on Wheat Yield
Wheat being a staple food crop and requiring a relatively easy production
technology is grown almost consistently in all sample villages. Table 2
gives a comparison of wheat yield before and after CRBC. The data
show that there has been a significant increase in wheat yield in the
villages, which are located in the CRBC command area. The results are
supported by the t-statistics.

Table 2. Comparison of Wheat Yield in the Study Area (kgs/Acre)

Village	Before CRBC	After CRBC	t-stat
Khutti	240	1835	3.45*
Gara Hayat	256	1827	3.12*
Kurai	260	1890	4.12*
Gomal Kalan	263	1870	3.45*
Draban Khurd	253	1790	3.29*

*Source: Survey (2004) Note: * shows statistical significance at 1% level.*

Estimated Results of Regression Models
The estimated regression equation is given in Table 3. The dependent
variable in this model is crop yield. The independent variables include
area under the crop, fertilizer, No. of irrigation, labour and education.
The results indicate that almost all the independent variables
significantly affect the wheat yield. All explanatory variables except
labour have statistically significant coefficients. The coefficient of

irrigation is highly significant at 1% level. The above analysis indicates that irrigation is one of the most significant factors affecting crop yield. Its statistical significance shows that irrigation positively changes crop yield and this been possible due to the availability of irrigation water through the CRBC. Thus CRBC has played a very significant role in enhancing wheat yield.

Table 3 Estimated Regression Equations

Variables	Constant	Area under Crop	Fertilizer	No. of Irrigation	Education	Labour	R^2	No.of Observations	F. Stat
Wheat	45.6	0.75* (2.10)	1.67** (2.64)	0.96** (4.10)	0.45* (2.13)	0.43 (1.63)	0.45	139	20.4

*Note: Figures in parentheses are t-ratios. * and ** shows significance at 5% and 1%, respectively.*

Conclusion
The main objectives of the study are to examine and compare the wheat area and the yield per acre of wheat before and after CRBC. Both the method used (the paired sample test and the regression analysis) verify the results that the area under wheat crop and the per acre yield of wheat has changed (increased) significantly. The result of the regression equation indicates that almost all the independent variables significantly affected the wheat yield. While irrigation is one of the most significant factor affecting wheat yield. It shows that irrigation positively changed wheat yield and this been possible only due to the availability of the irrigation water through the CRBC.

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