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ECONOMIC ANALYSIS OF MAJOR STAPLE FOOD-GRAIN CROPS, VARIETIES' INPUT-OUTPUT COMPARISON AND SIGNIFICANCE IN THE ECONOMY OF DISTRICT DERA ISMAIL KHAN

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Abstract

A study was conducted at Institute of Social Sciences, Gomal University, Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan during 2023 to make economic analysis of staple food grain crops i.e Wheat and Rice cultivation in district Dera Ismail Khan (commonly known as D.I.Khan). Three tehsils namely D.I.Khan, Parova and Paharpur were selected on the basis of purposive sampling technique. From each tehsil, three villages and five each wheat and rice varieties were selected. The Wheat varieties comprised of Khaista and Wadan, Pirsabak-15, Pirsabak-19, and AZRC-Dera, whereas, the rice varieties comprised IRRI-06, IRRI-09, KSK-282, KSK-133, and PK-385. Primary data were collected from 900 respondents (farmers) randomly selected through structured questionnaire. Sample size was allocated to these nine villages on the basis of proportional allocation method. For data analysis, benefit cost ratios, log-linear Cobb-Douglas production function and return to scale were estimated.

According to the results benefit cost ratio was noted for Khaista-2017, Wadan-2017, Pirsabak-2019, AZRC Dera-2020 and Pirsabak-2021 were 1.89, 1.99, 1.96, 2.19 and 2.14 respectively, thus the AZRC Dera-20 variety is the most profitable variety of wheat as compared to all other wheat varieties. The output elasticities of area, tractor hours, fertilizer, seed, labour and pesticides were observed as 0.3112, 0.0012, 0.5924, 0.6212, 0.5124 and 0.0013, respectively. The input-output relationship holds increasing returns to scale. The farmers should be advised to cultivate high yielding varieties like AZRC Dera-20 and Pirsabak-21.

As a result of rice varieties, the KSK-133 variety is the most lucrative rice variety when compared to all other rice varieties. The benefit cost ratio for PK-385, IRRI-06, IRRI-09, KSK-282, KSK-133, and PK-385 was recorded as 2.10, 2.70, 2.81, 2.93, and 2.38, respectively. The results showed that the area, seed, nursery, fertilizer, labor, pesticides and harvesting / threshing had production elasticities of 0.256817, 0.6157, 0.21684, 0.08719, 0.14278, 0.0033717 and 0.6264 respectively. Growing returns to scale are found in the input-output connection. It should be suggested to the farmers to grow high producing cultivars such as KSK-133 and KSK-282.

KEYWORDS: *Grain Storage; Wheat; Rice; elasticities; paharpur; Parova; rate of returns to scale; Dera Ismail Khan; Pakistan*.

INTRODUCTION

Pakistan's economy has always been based mostly on agriculture, which is essential to the nation's growth and survival. Pakistan's economy is largely dependent on its main crops, which employ a sizable section of the labor force. Pakistan's economy depends heavily on agriculture, which generates a sizeable amount of the country's GDP (Anam Azam and Muhammad Shafique, 2017). The agriculture sector is vital for ensuring food security, as it contributes significantly to Pakistan's economy by providing 37.4% of the nation's employment and 22.9% of its GDP. This sector not only feeds the population but also supports the industrial sector by supplying essential raw materials. The strong interdependence between agriculture and industry underscores the importance of maintaining and enhancing agricultural productivity. As highlighted in the Pakistan

Economic Survey 2022-23, the sector's role in the economy is fundamental, making it a key driver of both economic stability and growth. For a significant percentage of the population, especially in rural regions, it is their source of income. In Pakistan, the agriculture industry is a significant employer. Pakistan's economic growth, cultural legacy, and food security all depend on basic food crops. The Pakistani people's production and consumption of them are fundamental to their way of life, serving as both a source of food and a symbol of their country. The main basic crops are rice and wheat, with maize and sugarcane following closely behind. The staple crops of the country, they provide vital proteins, carbs, and other nutrients needed for human health (Special Section 2 (2017): The Status of Food Security in Pakistan).

Dera Ismail Khan, also known as D.I. Khan, is a division of Pakistan's Khyber Pakhtunkhwa Province and shares borders with Punjab, Balochistan and Sindh provinces. The city, along with four other tehsils known as Parowa, Daraban, Paharpur and Kulachi. According to the 2023 Census, the D.I.Khan division had a total population of 16,25,088 people (Sources: Pakistan Bureau of Statistics Censes Results 2023), making it the largest city in the southern part of Khyber Pakhtunkhwa. DIKhan has an arid, sub-mountain, subtropical, continental climate that is close to being semi-arid in the north. The region may be classified topographically into four groups: rainfed dry areas, reverine belts, Kanal irrigated, and Rod-Kohi spate irrigated. With 246,801 hectares of farmed land, 483,774 hectares of uncultivated land, and 3909 hectares of woodland, the district has a total area of 730,575 hectares (Crop Reporting Services, D.I. Khan).

Yaqoob., et. All (2022). The agriculture sector is a significant driver of economic growth and employment in many regions of the world. The demand for agricultural products is still influenced more by flavor, price, and nutritional value in the modern world than by climatic variation. This study investigates the level of grain productivity in Pakistan using data on farm inputs and important grain crops from 1960 to 2020. There are two sections to the study. To determine total factor productivity (TFP), we first aggregate production and input data for rice, corn, and wheat separately using the parametric Tornqvist-Theil index. The unit root test is then used to look at the variables' long-term trend and stationarity. The presence of co-integration in both the long and short runs among the variables.

Elahi et al. (2021) carried out research to ascertain the expenses and yields (profit) associated with rice farming in the D. I. Khan District, Province of Khyber Pakhtunkhwa in 2020. The idea that growing rice would only be viable for people or farmers if it improved their financial situation was the primary tenet of rice farming. It was computed that the average rice production (output) per acre was 1800 kg, and the results indicated that the average cost per acre was Rs. 31,220. Thus, the total return on rice output per acre was Rs. 70,500. Thus, the study shows that, on the one hand, the import cost of rice hurts rice production, while on the other hand, there is a positive relationship between the return price and rice export.

Elahi et al. (2020) assessed the expenses and advantages of wheat farming in Pakistan's Khyber Paktunkhwa Province's Dera Ismail Khan area in 2015. According to the study, producing one acre of wheat costs Rs. 35,680, while the yield is 1650 kg (42 mounds) per acre, or Rs. 63,600. By factoring in the value of family labor and owned land that is adequate to support a typical family, farmers' margins also increase. Furthermore, the study's conclusion indicated a positive relationship between wheat output and return price, but a negative relationship between cost and output was also seen. Land preparation (LP), seed and sowing (SS), farm inputs (FI), irrigation (Irr), pesticides (Pest), and harvesting/threshing (HT) have, in that order, output elasticity values of 0.1244587, 0.31244, 0.5874, 0.55461, 0.08248, and 0.65743.

Elahi, et al. (2018) computed the cost-benefit analysis and the appropriateness of the meteorological profile for wheat production in the seasons of 2015–2016 and 2014–2015. The cost of producing one acre of wheat was Rs. 35,680, but the yield was 1680 kg (42 mounds) per acre, or Rs. 63,600. In addition, the value of family labor and owned land enough to support a typical family raises the farmers' margin.

Furthermore, the study's conclusion indicated a positive relationship between wheat output and return price, but a negative relationship between cost and output was also seen. Land preparation (LP), seed and sowing (SS), farm inputs (FI), irrigation (Irr), pesticides / insecticides (Pest), and harvester threshing (HT) have the following relative output elasticity values: 0.12447, 0.31244, 0.5874, 0.55461, 0.08248, and 0.65743. From a climatic perspective, the district under study has computed cumulative rising degree days throughout the course of the two seasons, averaging around 2663.5 degree days. This is enough for the wheat variety that is grown here to push through the various growth phases and produce an economically viable crop yield.

Tian (2000) examined changes in China's rice production patterns between 1978 and 1995 as well as the variables influencing rice output. The output of rice had declined faster in affluent areas than in underdeveloped provinces.

Rehman et al. (2015) Agriculture serves as the cornerstone of Pakistan's economy, deeply reliant on its key crops. However, the nation grapples with substantial disparities between projected and actual crop yields, attributed to a lack of suitable technology, ill-timed input application, water and land utilization issues, and limited knowledge of insect pest management. This predicament detrimentally impacts both crop quality and quantity. Predominantly, farmers resort to synthetic insecticides for pest control, yet they often employ these chemicals erroneously. To cast light on the profound rift between expected and realized agricultural productivity, this study delves into the intricate relationship between Pakistan's agricultural GDP and the production of pivotal crops like wheat, rice, sugarcane, maize, and cotton over a five-year span. The significance of agriculture in the national economy cannot be overstated. This sector not only contributes significantly to the country's GDP but also provides livelihoods to a substantial portion of the population. However, the potential of Pakistan's agriculture sector remains largely untapped due to various challenges. One of the primary issues plaguing agriculture in Pakistan is the gap between projected and actual crop yields. Despite being blessed

The input-output connection and cost-revenue comparison of several wheat varieties in district D, I, Khan are the primary foci of the current study.

Objectives of the Study

The objectives of this study are as under:

- To compare the per acre cost and revenue of different varieties of wheat and rice in district D.I.Khan.
- To quantify the contribution of various inputs towards output of wheat and rice.
- To show the rate of return to scale
- To identify the pre and post harvest agro-economic practices undertaken in food grain crops cultivation followed by identifying the factors responsible for low yield per acre

in district D.I.Khan.

- To explore the significance of food grain crop cultivation in economic activities mainly labour force employment, capital employment, marketing, sources of income, credit and financing.

MATERIALS AND METHODS

The research is limited to district D.I. Khan's economic analysis of wheat and rice, a key staple food grains production. Three tehsils DIKhan, Parova, and Paharpur of the five tehsils in total have been chosen using the purposive sample approach since they are conveniently accessible. Additionally, these crops meet the majority of the requirements for the production of food grain crops. The regions that have been chosen are located along the CRBC Canal, where rice crops, in particular, are widely farmed together with other food grains. Three villages were chosen at random from each tehsil. The three villages were Himat, Ketch, and Shorkot from Tehsil DIKhan. Dhap Shumali, Lar, and Bhand Kurai were chosen from Tehsil Paharpur, and Malana, Lunda, and Naivela were chosen from Tehsil Parova.

Because the villages were fairly uniform in terms of cropping patterns, population, and agricultural activities, as well as land quality (field, soil type, and irrigation sources), a sample of nine hundred farmers was utilized, which makes sense and is sufficient. Using the following formula, the sample size was distributed across these nine communities based on the proportionate allocation method:

Where

SS = n_i (N_i/N)

SS = Total sample size used (i.e 900)

Ni = Population of particular village

N = Total population of the nine villages

As a result, 900 respondents from Tehsil DIKhan, Paharpur, and Parova, respectively, were chosen for each. In the tehsil DIKhan, 100 respondents were chosen from the villages of Himmat, Ketch, and Shorkot, respectively. There were one hundred responders from each of the three villages in Tehsil Pahapur: Dhap Shumali, Lar, and Band Kurai. 100 respondents were chosen in Tehsil Parova, one hundred from each of the villages of Malana, Lunda, and Naivela. Furthermore, because the farmers' farming practices and socioeconomic circumstances were essentially the same, a random selection of farmers was made from each hamlet to comprise the respondents.

It is commonly used to quickly assess the costs and revenues of several rice cultivars (Ahmad et al., 2005; Santana, 1993; Elahi et al., 2020 & 2021). The Benefit Cost Ratio for each variety has been computed using the following formulas:

Benefit Cost Ratio for wheat and rice varieties = TR / TC----------eq.1

where TC is the total cost of the wheat and rice varieties per acre in rupees and TR is the total income from the wheat and rice varieties per acre in rupees.

The contribution of different inputs to the output of food grains was determined using the Cobb-Douglas production function approach. In agriculture, this approach is commonly employed to ascertain the type of returns to scale. For the rice individually, the log-log Cobb-Douglas production function was used. Raviksh et al. (1997), Haq et al. (2002), Khattak & Anwar (2006), and Elahi et al. (2018) have all used this strategy; however, in the current work, a modified version of these models has been employed.

Estimation of Log-log Wheat Cobb-Douglas Production Function

To show the input output relationship of wheat crop, the Method of Least Square was used to estimate the following log-log model:

$\ln WP = \ln b_0 + b_1 \ln AREA + b_2 \ln TRATOR + b_3 \ln FERTILIZER + b_4 \ln SEED + b_5 \ln LABOUR + b_6 \ln PESTICIDE + b7 \ln HARVT/THRESHING + b8 \ln LAND\ RENT + e_1$ ----------.2

Where

P = Total wheat production (in kgs)

A = Area under wheat crop in acres

TRH = Tractor hours for cultivated area of wheat

SD = Seed in Kgs used for cultivated area of wheat

FERT = Total fertilizer used for wheat (in bags)

LABW = Total Labour used for cultivated area of wheat (in man days)

PSTW= Total pesticides/insecticides used for cultivated area of wheat (in Rs.)

HAVT/THRH= Harvesting / Threshing of Wheat

Land Rent = Land Rent of Cultivated land

b_1, b_2, b_3 , b_4 , b_5 , b_7 and b_8 are the output elasticities of WA, TRHW, FERTW, SDW, LABW, PSTW, HAVT/THREH and LAND RENT respectively.

b_0 = Shows the impact of innovations or technology.

E_1 = The residual term (absorbs the effect of those variables, which are notincluded in the model).

Estimation of Log-log Cobb-Douglas Production Function for Rice

To show the input-output relationship of rice crop, the following log-log model was estimated using the Method of Least Square.

$\ln P = \ln a_0 + a_1 \ln AREA + a_2 \ln SEED + a_3 \ln NURSERY + a_4 \ln FERT + a_5 \ln LABR + a_6 \ln PESTICIDE + a_7 \ln HART/THREH + e_2$ ----------eq.3

Where

P = Total Rice production (in kgs)

A = Area under Rice crop in acres

NUR = Nursery Establishment

SD = Seed in Kgs used for cultivated area of Rice

FERT = Fertilizer applied on Rice cultivated area

LAB = Total Labour used for cultivated area of Rice (in man days)

PST = Total pesticides/insecticides used for cultivated area of Rice (Rs.)

HAVT/THRH= Harvesting / Threshing of Wheat

b_1, b_2, b_3 , b_4 , b_5 , b_7 and b_8 are the output elasticities of WA, TRHW, FERTW, SDW, LABW , PSTW , HAVT/THREH and LAND RENT respectively.

b_0 = Shows the impact of innovations or technology.

E_1 = The residual term (absorbs the effect of those variables, which are notincluded in the model).

Determination of Returns to Scale

To check whether, the food crops are characterized by constant, increasing or decreasing returns to scale, Wald test has been used. The Chi-square statistic is equal to the F-statistic times the number of restrictions under test (Eviews, 1998). In this case, there is only one restriction i.e. the sum of exponents equal 1 for each crop. If the two test statistics are identical with the p-values of both statistics, this indicates that the null hypothesis of constant returns to scale can be decisively rejected.

In 2023, all variables were priced using the going rates in the market. Additionally, tabulation, basic arithmetic, averages, and categorization were employed as analytical tools. Utilizing statistical software like SPSS and E-views, the outcomes were obtained.

RESULTS AND DISCUSSION

Average cost and revenue of wheat varieties

Average per acre cost for all varieties became to Rs. 89,247, which included cost of seed (Rs. 5776), fertilizers (Rs. 32500), labour usage (man days) (Rs. 6460), transplanting (Rs. 4805), harvesting (Rs. 9000) in addition to other costs (Table 1). This cost is higher as compared to per acre cost computed by Hussain et al. (11) and Elahi, et al. (15). This is due to increasing trend of prices of inputs over time.

Table-1. Average Per Acre Costs of Wheat Varieties

S.No.	Inputs/Operation	Operation Price	Pre-Basic (Rs. Per Acre)
1	Land Preparation with Tractor	Ploughing No.s: 3 Rate/ Ploughing: avg 5-6 L/Ac for one plough	6000

2	Seed	Application per Acre: 49.2 kg Price of Seed: Rs. 154/kg	7576
3	Fertilize (Urea)	Urea : 2 bags/acre Price: Rs. 4500/bag	9000
4	Fertilizer (DAP)	DAP : 1 bag/acre Price: Rs. 15000/bag	15000
5	Fertilizer (SoP)	SOP: half bag/acre Price: Rs.17000/bag	8500
6	Fertilizer Application	Labour : 4 Wage / Labour: 961	3844
7	Insecticides	Herbicide: 1 packet /Acre Price: Rs. 2100	2100
8	Insecticides Application	Labours /Day: 2 Wage/Labour: 961	1922
9	Laborer charges for Irrigation	Total left irrigations: 4 Labour/ irrigation: 2 Wage/Labour: 961	6460
10	Abiyana	Rs. 640/cropping season	640
11	Harvesting & threshing	Combine Harvester @ Rs. 9000/acre	9000
12	Packing, loading, unloading, transportation, cleaning, grading, sewing, bagging and stacking	Labours /Day: 5 Wage/Labour: 961	4805
13	Gunny Bags	Bags: 16 per acre Price/bag: Rs. 150	2400
14	Land Rent (Half for six month crop)	Rs. 3000/- per Kanal. Rs. 24,000/- Acres (Half will be calculated for six month crop)	12000
Total average cost of production per acre			**89,247/-**

Source: Field Survey

Average wheat production for all varieties was calculated as 1570 kg from one acre area amounting to Rs. 172,700 (Table-2). Average amount of wheat straw from all varieties was Rs. 9,000 per acre. Thus total and net revenue from all varieties was calculated Rs. 181,700 (Table-2).

Table-2 Average Total and Net Revenue of Wheat Varieties

Item	Quantity (kg per acre)	Rate (Rs per 100 kg bag)	Total Amount (Rs.)
Wheat grain	1570	11,000	172,700/-
Bhusa	1 Acre	9000	9,000/-
Total average Revenue	**-**	**-**	**181,700/-**

Source: Field Survey

Average cost and revenue of rice varieties

The average cost per acre for all types is Rs. 87,179, which includes additional expenditures such as seed (3640/-), fertilizers (34,300/-), labor (15,479/- per man day), harvesting/threshing (4500/), and other expenses (Table 1). In comparison to the cost per acre calculated by Hussain et al. (11) and Elahi et al. (15), this cost is greater. This is a result of the ongoing upward trend in input prices.

Table-1. Average Per Acre Costs of Rice Varieties

Particulars/Inputs	Unit	Quantity/No	Rate (Rs)	Amount/Acre
Land preparation				
Harrow with tractor	Hour	1	1800	1800
Tiller with tractor	Hour	1	1400	1400
Rotavator	Hour	1	1400	1400
Raising Nursery				
Seed	kg	10.4	350	3640
Nursery bed preparation	Day	4	673	2692
Sowing Nursery	Day	4	673	2692
Nursery Transportation	Day	5	673	3365
Fertilizers				
DAP	No	1	15000	15000
SOP	No	½	17000	8500

Urea	No	2	4500	9000
Zinc	No	1	1800	1800
Transplanting				
Transplanting	Day	10	673	6730
Irrigation				
Abiyana	-	Rs. 1800/cropping season	1800	1800
Plant Protection				
Insecticides	No	2	1500	3000
Weedicides	No	2	700	1400
Harvesting and threshing	Day	1	4500	4500
Gunny Bags	Bags	16	150	2400
Land Rent				16,000
Total cost				**87,179**

Source: Field Survey

The average yield of rice across all kinds was determined to be 2164 kg from one acre of land, or Rs. 201,600 (Table 2). An acre of rice straw, regardless of variety, yielded an average of Rs. 4,000. Thus, Rs. 205,600 was determined as total and net revenue from all types (Table 2).

Table-2 Average Total and Net Revenue of Rice Varieties

Item	Quantity (kg per acre)	Rate (Rs per 100 kg bag)	Total Amount (Rs.)
Rice grain	2164	9,000	201,600/-
Bhusa	1 Acre	4000	4,000/-
Total Revenue	-	-	**205,600/-**

Source: Field Survey

Benefit Cost Ratios of Different

Wheat Varieties

To analyze the cost and revenues across different wheat varieties, Benefit Cost Ratios (BCRs) were computed for each. The BCRs for Khaista-2017, Wadan-2017, Pirsabak-2019, AZRC Dera-2020, and Pirsabak-2021 were 1.89, 1.99, 1.96, 2.19, and 2.14 respectively (refer to Table-3). Notably, AZRC Dera-2020 emerges with the highest BCR, indicating its superior profitability compared to the other varieties, aligning with economic principles.

Table-3 Benefit Cost Ratios for Different Wheat Varieties

Wheat Variety	**Total Wheat Revenue (In Pak Rs.)**	**Total Costof Wheat (In Pak Rs.)**	**Benefit Cost Ratios BCR = TR/TC**
Khaista, 2017	168,500	89,067	1.89
Wadan, 207	179,500	90,141	1.99
Pirsabak, 2019	174,000	88,601	1.96
AZRC Dera, 2020	196,000	89,371	2.19
Pirsabak, 2021	190,500	88,909	2.14

Source: Personal calculations

Estimation of Log-log Production Function for Wheat

The estimated log-log Cobb-Douglas production function is:

ln WP = ln b0 + b1 ln AREA + b2 ln TRATOR+ b3 ln FERTILIZER + b4 ln SEED + b5 ln LABOUR + b6 ln PESTICIDE +b7 ln HARVT/THRESHING+ b8 ln LAND RENT + e1 ----------eq. 4

Table-4 Regression Results of Log-log Production Function for Wheat

Dependent Variable: In WP				
Sample: 900				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1.990	0.13874	12.09659	0.0008
In Area	0.2904	0.1257	3.00056	0.0121
In Tract hrs	0.0014	0.00089	3.47127	0.0031
In Seed	0.2991	0.124810	4.39643	0.0254
In Fertilizer	0.4924	0.12657	3.52568	0.0063
In Labour	0.5479	0.18221	2.96443	0.0018
In Pesticide	0.1041	0.91124	0.11424	0.8862
In Hrvt/Threshing	0.0015	0.45001	0.00364	0.46203
In Land Rent	0.1220	0.009871	12.35964	0.0003
R-squared	0.65713	Durbin-Watson stat		1.19457
Adjusted R-Squared	0.65840			

The R-square and adjusted R-square values indicate a satisfactory fit. With an R-square value of 0.65, it's observed that 65% of the variations in the (log of) total wheat production are accounted for by the (log of) included explanatory variables. Furthermore, most of these explanatory variables demonstrate a robust relationship with the dependent variable.

Rate of Returns to Scale for Wheat Crop

In order to investigate the input-output dynamics, the log-log Cobb-Douglas production function (equation 2) was utilized, providing insight into the nature of returns to scale. The cumulative output elasticities amount to 1.85 (greater than 1), suggesting that wheat production exhibits increasing returns to scale.

Table-5: Wald-Test Results for Wheat Crop

Samples 150			
Null Hypothesis:	b1+b2+ b3+ b4+ b5 + b6 + b7 = 1		
F-statistics	12.354678	Probability	0.00674
Chi-square	12.354678	Probability	0.00675

Whereas, b1, b2, b3, b4, b5, b6 and b7 are the co-efficient of In WA, TRACT HRW, SDW, LABW, FERTR and CHW respectively.

Rice Varieties

Benefit Cost Ratios (BCRs) were calculated for each rice variety in order to examine costs and revenues across them. According to Table 3, the BCRs for the varieties PK-385, KSK-282, KSK-133, IRRI-06, and IRRI-09 were 2.10, 2.70, 2.81, 2.93, and 2.38, respectively. This table clearly shows that, according to the economic theory, variety KSK-133 is the most lucrative rice variety when compared to all other rice varieties since it has the greatest BCR value.

Table-3 Benefit Cost Ratios for Different Rice Varieties

Wheat Variety	**Total Rice Revenue (In Pak Rs.)**	**Total Costof Rice (In Pak Rs.)**	**Benefit Cost Ratios BCR = TR/TC**
IRRI-06	87679	184000	2.10

IRRI -09	86279	232800	2.70
KSK-282	87679	246000	2.81
KSK-133	87679	257000	2.93
PK	86279	205600	2.38

Source: Personal calculations

Estimation of Log-log Production Function for Rice

The estimated log-log Cobb-Douglas production function is:

ln WP = ln b0 + b1 ln AREA + b2 ln SEED+ b3 ln NUR+ b4 ln FERT+ b5 ln LABOUR + b6 ln PESTICIDE +b7 ln HARVT/THRESHING+ e1 ----------eq. 4

Table-4 Regression Results of Log-log Production Function for Rice

Dependent Variable: ln RP				
Sample: 900				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	2.652	0.13784	24.123	0.0010
ln WA	0.256817	0.013754	21.035	0.0073
ln SDW	0.6157	0.008157	16.723	0.0459
In NUR	0.21684	0.002549	19.374	0.0043
In FERT	0.08719	0.054871	34.0350	0.0005
ln LABW	0.14278	0.008543	24.86524	0.0461
ln PSTW	0.003717	0.0009213	5.1425	0.8642
ln HAR/TRHW	0.6264	0.01797	20.46935	0.0013
R-squared	0.691871	Durbin-Watson stat		1.92121
Adjusted R-squared	0.70125			

A good match is shown by the R-square and adjusted R-square values. With an R-square value of 0.69, it is seen that the (log of) included explanatory variables explain for 69% of the fluctuations in the (log of) total wheat output. Additionally, there is a strong correlation between the majority of these explanatory factors and the dependent variable.

Rate of Returns to Scale for Wheat Crop

The log-log Cobb-Douglas production function (equation 2) was used to study the input-output dynamics and provide light on the nature of returns to scale. The cumulative output elasticities are 1.94 (more than 1), indicating growing returns to scale in rice production.

Table-5: Wald-Test Results for Rice Crop

Samples 150			
Null Hypothesis:	b1+b2+ b3+ b4+ b5 + b6 + b7 = 1		
F-statistics	8.893986	Probability	0.007222
Chi-square	8. 893986	Probability	0.007201

Whereas, b1, b2, b3, b4, b5, b6 and b7 are the co-efficient of In AREA, SEED, NURSERY, FERTR, LABOUR, PST and HAR/TRH respectively.

CONCLUSION AND RECOMMENDATIONS

From the facts and figures it is clear that food grain represents the way of life and its cultivation is most closely connected with the socioeconomic conditions of food growers in District D.I.Khan. Any improvements in food grain cultivation will ultimately improve the standard of living of the local community and further will have a positive impact on sources of income, labour force and capital employment, woman participation, labour distribution within the villages, food grain marketing, credit and financing, consumption pattern, price fluctuations, poverty alleviation, self-sufficiency, extension of markets,strengthening fertilizer business, reduction in prices of food grain maden commodities, farm mechanization, reduction in food grain shortages, children education, reduction in the social problems, extension in

tractors and threshers market, prevailing brotherhood and increasing livestock production.

The yield (Kg/ha) is too low as compared to the provincial and national level. The area under cultivation played significant role in total productivity. The cultivated area under different food grain crops in the district is still low and needsto be extended so as to overcome the shortage of food grains in general and particularly of wheat in the study area.

The results showed that these two food grain crops are characterized by increasing returns to scale i.e. food grains' output increases more than their inputs.This provides a place for managing the food grain inputs efficiently so as to ensuretheir productivity as required.

REFERENCES

1. Ahmad, B., S. Hasan, K. Bakhsh and W. Ahmad. 2005. Profitability and various constraints in potato cultivation. Pak. J. Agric. Sci. 42(3): 68-73.
2. Azam, A., & Shafique, M. (2017). Agriculture in Pakistan and its Impact on Economy. A Review. Inter. J. Adv. Sci. Technol, 103, 47-60.
3. Crop Reporting Services, Government of Khyber Pakhtunkhwa, (2023), District, D.I.Khan
4. Cropping Reporting Services. (2006). Agriculture Research Station (Extension Services), Statistics Department, District Dera Ismail Khan.
5. Elahi, M, E, N. Inayat, N. Latif, M. Jamil, A. Khan, M. A. Khan, M. A. Ahmad and M. Kashan "Rice (Oryza sativa) Production Profitability in Dera Ismail Khan District" Ind. J. Pure App. Biosci. (2021) 9(2), 195-199
6. Elahi, M, E, M. Mansoor, and Asghar Ali (2020) "Wheat Crop Cultivation's Profitability Studies in Sugar Crop Dominated Area". Pak. j. sci. ind. res. Ser. B:boil. Sci.2020 63B(2) 67-70.
7. Elahi, M, E, M. Shah, M. Mansoor, N. Latif, N. Hussain, I. I. Sadek and Nagwa M. Ahmed "Profitability of Wheat Crop Cultivation in Sugar Crop Dominated Area: Economic and Climatic Study" Egypt. J. Agric. Res., 96 (1), 2018. Pages 275-285.
8. Elahi, M, E, M. Shah, M. Mansoor, A. Rashid, S. K. Marwat, N. Hussain, U. K. Saddozai, A. Ali and S. Hameed (2016) "Economic Analysis of Maize Cultivation under Agro-Climatic Conditions of District Dera Ismail Khan" American-Eurasian J. Agric. & Environ. Sci., 16 (4): 765-769, 2016.
9. Government of Pakistan (GOP), Economic Survey 2022-23, Economic Advisors Wing, Ministry of Finance, Islamabad.
10. Government of Pakistan (GOP), Economic Survey 2021-22, Economic advisors Wing, Ministry of Finance, Islamabad.

11. Government of Pakistan (GOP), Agricultural statistics of Pakistan (2022-23). Economic Wing Ministry of Food, Agriculture and Livestock, Islamabad.

12. Government of Pakistan (GOP), 2023. District Census Report 2023. Population Census Organization Statistics Division Islamabad.

13. Haq, Z. A., M. Khan and M. Ahmad. 2002. Role of farm size in input use and productivity of potato in Shigar Valley of Baltistan Area: An econometric analysis. Sarhad J. Agric. 18(2): 245-250.

14. Khattak, N.U. and A. Hussain. 2006. Role of farm inputs and rice productivity in district Swat: an econometric analysis. Sarhad J. Agric. 22(1): 163-167.

15. Pakistan Bureau of Statistics, Government of Pakistan, Announcement of Results of 7th Population and Housing (2023). https://www.pbs.gov.pk

16. Rehman, A., Jingdong, L., Shahzad, B., Chandio, A. A., Hussain, I., Nabi, G., & Iqbal, M. S. (2015). Economic perspectives of major field crops of Pakistan: An empirical study. Pacific science review b: humanities and social sciences, 1(3), 145-158.

17. Ravikash, S. (1997). Growth and Resource use Efficiency of Rice in Nagaland. Indian Journal of Hill Farming, 10, 1-2, 1-4.

18. Santha, A. M. 1993. A comparative analysis of cost and returns of paddy cultivation for different seasons in Trichur, Kerala. Madras Agric. J. 80 (2): 41-44.

19. Tian, W. (2000). China's Agriculture at the Crossroads. China: Macmillan Press Ltd.

20. Yaqoob, N., Jain, V., Atiq, Z., Sharma, P., Ramos-Meza, C. S., Shabbir, M. S., & Tabash, M. I. (2022). The relationship between staple food crops consumption and its impact on total factor productivity: does green economy matter. Environmental Science and Pollution Research, 29(46), 69213-69222.