

Research Article



Economic and Comparative Analysis of Wheat between Two Districts of Khyber Pakhtunkhwa-Pakistan

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Abstract | A survey research was conducted in two main districts (Peshawar and Mardan) of Khyber Pakhtunkhwa to make economic and comparative analysis of wheat crop. Furthermore, two villages were selected from each district i.e. Lakarai and Barbar Opazai of district Peshawar and Khawo and Shamshad Abad of district Mardan. A questionnaire was used to collect data proportionately from 93 sample respondents. Budget allocation technique is used for calculation of cost, revenue and profit and dummy approach is used for comparative analysis while multiple regression model is used to estimate the relationship between inputs and output of wheat. Per acre yield of wheat production in district Mardan was 1809.032 kgs. while in district Peshawar it was 2143.230 kgs. Total cost of wheat per acre in district Peshawar was more than that of district Mardan. The net revenue from per acre wheat production was high in district Peshawar as compared to district Mardan. The results revealed that all the inputs including seed, irrigation, labor, fertilizer, pesticides and tractor used in production of wheat were having positive relationship with the production. District Peshawar is more efficient in production of wheat which can be raised further by proper utilization of all the inputs.

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Introduction

Pakistan is an agrarian state and it forms the basis of economic growth and development as a whole. The 21 percent of Gross Domestic Product (GDP), is generated and accounts for over 36 percent of foreign exchange earnings and the rural sector are mainly dependent on agriculture sector for earning their livelihood and it is about of 60 percent (Khan, 2014). The expansion in agriculture provides food and fiber to the burgeoning population, stimulates domestic demand for industrial goods and services and supplies raw materials to agribusiness and manufacturing sector. Cotton, wheat, rice and sugarcane are the traditional crops. The nation has been the net exporter of cotton and rice, a net importer of edible

oil and tea and close to autarky in wheat and sugar. Pakistan ranks 6th area wise under Wheat cultivation, 7th in total production and 10th in average yield respectively among the major wheat producing countries in the world. Arifullah and Chishti (2008) analyzed that the agriculture sector was technically and financially efficient up to 2005. Comparative to the world average, Pakistan domestic crop yield were evaluated. The yield of major crops of Pakistan is less than of the world average yield. Sanaullah (2008) conducted a detailed study which showed that in last 40 years, 40 percent farmer were producing wheat while from last 20 years 30 percent farmers were producing wheat. There was great scope for farmers to expand their fields by introducing technologies to farmer communities. Sher and Ahmad (2008) analysed the future

prospects of production of wheat in Pakistan. The basic of separate (ARIMA) was used to estimate future value of each inputs that was previously calculated as a dynamic forecast. Quddus and Mustafa (2011) analyzed the relative efficiency of major crops and their comparative advantage in international trade as measured by ratio of Domestic Resource Cost in Punjab (Pakistan). Economic profitability analysis showed that Punjab have comparative advantage in wheat production to satisfy domestic needs but not for export purposes.

Farooq et al. (2007) studied wheat in three districts (Swat, Charsadda and Kohat) during July 2005. The average yield from different varieties were 728.625 to 1140 kgs. per acre. The farmers suffered from many seed related obstacles that resulted in lower average yield of the wheat. The cost, revenue and profitability of various crops were studied by different researchers at various locations (Zaman and Hasan, 2007; Khan et al., 2008; Nabi, 2009; Azam and Khan, 2010; Shah and Khan, 2010; Niranjana et al., 2011; Hussain and Saddozai, 2012; Ahmed et al., 2013; Mukul and Rahman, 2013; Shah and Ali, 2013) while comparative analysis of different products were also made by researchers in different countries of the world (Arif and Ali, 2012; Quddus and Mustafa, 2011; Ullah et al., 2011; Hasan, 2008; Sanchez-Groin et al., 2007).

Azam and Khan (2010) and Sher and Ahmad (2008) used Cobb-Douglas production function to obtain parameters and identify of various factors that influence production in the area of study while Hussain and Saddozai (2012) and Langemeier et al. (1999) used Linear regression method to determine the significance of main participating variables. Shah and Khan (2010) estimated that all the factors have significant effect on wheat yield in the study area. Nabi (2009) indicates that there are different factors such as seed rate, total irrigation, fertility inputs and number of tractor hours that affect the potato yield positively. The major constraints in production were high input prices, low grain price and lack of fertilizers. It was suggested that an organized marketing system and the supply of low price inputs was essential for production of wheat and the intercropping was also recommended.

The present study is framed to calculate the cost and revenue of wheat in both districts i.e Mardan and Peshawar and also compare it. The study also estimates

production function for wheat to know the effect of different inputs used in production of wheat in the mentioned districts.

Materials and Methods

In Khyber Pakhtunkhwa, two districts (Peshawar and Mardan) were studied for economic analysis and also comparison of both districts were made for the mentioned crop. Wheat is amongst the major crops of the province in term of production and consumption. The land and geographical conditions of the study area are suitable for wheat crop. Two villages were selected from each district i.e. Lakarai and Barbar Opazai of district Peshawar and Khawo and Shamshad Abad of district Mardan. Most of farmers in these areas were wheat growers. By applying Mawakaje formula (2013), we get a sample size of 93 farmers and interviewed on structured questionnaire.

$$n = \frac{N}{1 + Ne^2} \dots\dots\dots 1.1$$

Where;

N: Total Sample Size; N: Total Population; e: Margin of error = 0.0999

Proportional Allocation Sampling Technique is used to get the sample size in each location of the study area (Chaudhry, 1998).

$$ni = \frac{Ni}{N} \times n \dots\dots\dots 1.2$$

Where;

n_i : Number of Sampled Farmers in the Village; i : Number of Villages in the Study Area; n : Total Sample Size; N : Total Number of Farmers in the Research Area; N_i : Total Number of Farmer in the Village.

Table 1: Village wise distribution of sample farmers in the study area.

Districts	Villages	No. of Farmers	Sample Size
Peshawar	Lakarai	409	27
	Barbar Opazai	520	35
Mardan	Khawao	261	17
	Shamshad Abad	207	14
Total		1397	93

Source: Patwar Khana of the Respective District.

The distribution of sampled farmers that were selected from each village of the study is given in Table 1

Analytical techniques

The Multiple Regression model was used for wheat yield (Azam and Khan, 2010). It determines how applied seed rate, irrigation, fertilizer, insecticides and weedicide affect the particular crop yield.

$$Y_i = f(X_1, X_2, X_3, X_4, X_5, X_6) \dots \dots \dots 1.3$$

Where;

Y_i : Wheat Yield (Kgs per acre); X_1 : Seed Rate (Kgs/per Acre); X_2 : No. of Labor (Days per Acre); X_3 : No. of Irrigation (no/acre); X_4 : Fertilizer applied (bags/per Acre); X_5 : Pesticides Used (litters/per acre); X_6 : No. of Tractor (Hours per Acre).

Empirical modeling of determinants of yield

The following Ordinary Least Square (OLS) econometric valuation technique used to estimate the production function of wheat.

$$Y = \beta^0 + \sum_{i=1}^6 \beta_i X_i + e_i \dots \dots \dots 1.4$$

Where;

Y_i : Wheat Yield (kgs/per acre); β_0 : Constant; X_1 : Seed Rate (Kgs/per Acre); X_2 : No. of Labor (Days /per Acre); X_3 : No. of Irrigation (no/acre); X_4 : Fertilizer applied (bags/per Acre); X_5 : Pesticides Used (litters/acre); X_6 : No. of Tractor (Hours/acre); e_i : Error Term.

Net return of wheat

The farmers profit (Net Revenue) is equal to total revenue (TR) minus total cost (TC) (Debertin, 1986).

Hence:

$$II = TR - TC \dots \dots \dots 1.5$$

Where;

TR: $P \times Q$; TC: $V_i \times X_i$

Therefore, putting the values of TR and TC in equation (1.4), we get

$$II = PQ - V_i X_i \dots \dots \dots 1.6$$

Where;

II: Net Return; P: Output Price at Wholesale Level (Rs/Kg); Q: Output of Wheat; V_i : Price of In-

put Used in Production; X_i : Total Inputs Used; i: 1.2.3.....n

Comparing yield, cost and net revenue using dummy variable approach

The study used the dummy variable approach (Gujrati, 2003, p. 297) to see the difference between yield, cost and net revenue of Wheat in Peshawar and Mardan districts of Khyber Pakhtunkhwa.

$$Y = \beta_0 + \beta_1 D_1 + ei \dots \dots \dots 1.7$$

$$TC = \alpha_0 + \alpha_1 D_1 + ei \dots \dots \dots 1.8$$

$$NR = \mu_0 + \mu_1 D_1 + ei \dots \dots \dots 1.9$$

Where;

Y: Yield; TC: Total Cost; NR: Net Revenue; D: Dummy Variable; D1: 1 for District Peshawar and 0 otherwise (for Mardan).

Results and Discussion

The study divided cost of wheat crop into different components. Different cost components of wheat production specified by this study are land preparation cost, seed and sowing cost, labor cost, irrigation cost, fertilizer cost, pesticide cost, threshing and harvesting cost, marketing cost, land rent and marketing cost. The average total cost of wheat was Rs. 36633.90 and Rs. 32873.63 in Peshawar and Mardan districts respectively. Total cost of wheat is high in Peshawar because of high land rent and harvesting cost. The detailed description of the mention components of wheat crop are given in the Table 2.

Gross and net revenue from wheat crop

Higher yield be influenced by numerous elements i.e. availability and access to certified seed, sufficient irrigation water, chemical stimulant, pesticides solicitation and suitable sowing time i.e. from 1st to 30th November. The mean yield per acre of wheat in district Peshawar was 2143.23 kilograms while mean yield per acre wheat in district Mardan was 1809.032 kilograms. By product give benefits to farmers in two ways i.e. for earning extra amount and also for nourishment their livestock. The average of by product from wheat production in district Peshawar was Rs 12233.9 per acre. While the average value of by product from wheat production in district Mardan was Rs 8500 per acre. Table 3 depicts data regarding output of wheat production in district Peshawar and district Mardan.

Table 2: *Average per acre total cost of wheat production.*

Inputs/Items	District Peshawar		District Mardan	
	Mean	Percentag	Mean	Percentag
Land preparation cost	2594.85	7.08	2138.14	6.50
Rotator	1779.21	4.86	1459.11	4.43
Tractor	815.64	2.23	679.03	2.07
Seed and Sowing operation	2628.16	7.17	2197.9	6.68
Seed	2306.87	6.29	1915.48	5.83
Labour Charges	115.52	0.32	95.65	0.29
Transport Charges for Seed	76.45	0.21	74.19	0.22
Bund Making Charges	129.32	0.35	112.58	0.34
Irrigation	869.98	2.37	817.9	2.49
Irrigation Canal	700	1.9	700	2.13
Labour for Course Cleaning	169.98	0.46	117.90	0.36
Pesticide Cost	901.46	2.47	611.58	1.86
Pesticide/ Weedicide cost	760.81	2.08	544.52	1.65
Application on Pesticide	140.65	0.38	67.06	0.20
FYM	5123.96	13.99	4944.36	15.04
Farm Yard Manure	3430.65	9.36	3193.55	9.71
Transportation of FYM	1504.84	4.11	1587.10	4.83
Application on FYM	188.47	0.51	163.71	0.50
Fertilizers	7751.38	21.16	8067.25	24.54
DAP	3866.13	10.55	3996.45	12.15
Urea	3623.23	9.98	3848.39	11.71
Transportation of Fertilizer	76.45	0.21	21.29	0.06
Application on Fertilizers	185.57	0.51	201.12	0.61
Harvesting and Threshing	8805.01	24.03	7005.19	21.31
Harvesting	3446.45	9.40	2938.71	8.94
Threshing	4194.19	11.44	3400.19	10.34
Bagging Charges	725.18	1.98	329.03	1.00
Labour Charge	439.19	1.20	337.26	1.03
Land Rent	7166.94	19.56	6056.45	18.42
Marketing Cost	802.91	2.19	1038.71	3.16
Labour loading/unloading cost	228.39	0.62	306.45	0.93
Transport to Home/Whole Sale	574.52	1.57	732.26	2.23
Total	36633.70	100	32873.63	100

Source: *Field Survey.*

Table 3: *Gross and net revenue from wheat in district Peshawar and district Mardan.*

Particulars	District Peshawar			District Mardan		
	Output (kgs)	Price/Kg	Total	Output (Kgs)	Price/Kg	Total
Main product	2143.23	30.233	64794.93	1809.032	32.119	58105.16
Byproduct	---	---	12233.9	---	---	8500.00
Gross revenue	---	---	77028.8	---	---	66605.2
Total cost	---	---	36644.69	---	---	32877.5
Net revenue	---	---	40384.2	---	---	33727.66

Source: *Field Survey.*

Value of main and by product forms the basis of Gross return of wheat production. Table 3 depicts that net revenue of wheat in district Peshawar and in Mardan was Rs 77028.8 and Rs. 66605.2 per acre respectively. By taking difference of total cost and gross return we can be obtained net revenue of wheat. Results also show that net return of wheat in district Peshawar and in Mardan was Rs 40384.2 and Rs. 33727.66 per acre respectively.

Model estimates and diagnostics

In this research study cross sectional data has been used that is why the problem of heteroscedasticity is expected. To deal with the issue concerned, all regression equations were estimated with robust standard errors. The robust standard errors can efficiently address minor issues concerning regularity, heteroscedasticity, or nearly findings that displays large residuals. The point estimates of the coefficients with the robust standard errors are much comparable as in OLS but the standards errors consider problems about Heterogeneity and lack of normality (Chen et al., 2003). Moreover, the sample size <100 used in this study relaxes the normality assumption (Gujrati, 2003). As this study used growers level cross sectional data the problem of autocorrelation was not taken as a priori (Hussain, 1991).

Estimation of production function for wheat crop

In Table 4 the outcomes of production function for wheat crop are given.

Table 4: Factors share to total wheat yield per acre.

Independent variables	coefficient	St. Error	t value	Sig.	VIF	1/VIF
(Constant)	-10.687	7.136	-1.497	0.138	---	---
Tractor (Hrs)	3.016	2.257	1.336	0.185	2.96	0.337809
Seed (kgs)	.0074	.00165	4.495	.0000	4.75	0.210433
IrrigationNo.	1.548	0.8714	1.776	0.079	4.05	0.247075
Pesticide	.00273	0.00269	1.012	0.314	2.30	0.435507
Fertilizer kgs	.00158	0.00104	1.520	0.132	3.61	0.277034
Labour days	.489	.212	2.301	0.024	3.53	0.283404

R Square: .87; Adj. R Square: .865; F: 99.41; * (P value = 0.000); Highly significant *** Mean VIF: 3.53; Source: Field Survey.**

In order to check the problem of multicollinearity in the selected independent variable, variance inflation factor was computed. It is evident, in case of wheat, that each of the independent variable has VIF less than 10, indicating that there is no problem of multicollin-

earity in the independents variables used in model.

The empirical results of the regression model for wheat crop shows that the wheat yield is positively affected by some inputs. A 1 unit increase in seed will increase wheat yield by 0.0074 units. Some modern inputs like fertilizers will increase the yield of wheat by .00158, irrigation by 1.548, labor days by 0.489, pesticides by 0.00273, and tractor hours by 3.016 unit. As obvious from t-ratios that at 5% probability level, some significant variables like seed used and labor days have weighty effect on wheat, on the other hand due to insignificant variables like tractor hours, pesticides used, irrigation and fertilizer has unweighted effect on wheat yield. Similar studies conducted by Khan (2014) and Hussain (2013) also found tractor hours pesticides as insignificant variable. The R Square indicates that 87% variation in wheat yield is due to independent variables.

Comparison of yield total cost and net revenue

Dummy variable approach (Gujarati, 2003, p.297) was used to associate yield total cost and net return of wheat in district Peshawar and district Mardan.

Comparison of yield

The yield of wheat grown in district Peshawar and Mardan were compared obtaining the following results.

$$\begin{aligned}
 Y &= 1809.032 + 334.194D \\
 S.E &= (42.539) (52.100) \\
 t\text{-ratio} &= (42.526) (6.415) \\
 R^2 &= 0.311; F = 41.146
 \end{aligned}$$

Where;

D1: 1 for Peshawar and 0 otherwise (For Mardan).

From the above econometrically estimated equation it is obvious that the average per acre yield of wheat in district Mardan was 1809.032 kg while in Peshawar was 334.194 kg more than that of district Mardan.

Comparison of total cost

The total cost of production of per acre wheat grown in district Peshawar and district Mardan was compared by using dummy variable approach obtaining the following results.

$$\begin{aligned}
 TC &= 32877.50 + 3767.129D \\
 S.E &= (301.853) (369.693) \\
 t\text{-ratio} &= (108.919) (10.190) \\
 R^2 &= 0.73 \quad F = 103.834
 \end{aligned}$$

Where;

D1=1 for Peshawar and 0 otherwise (For Mardan).

The empirical results of dummy variable approach used for comparing total cost of wheat production in district Peshawar and district Mardan was represented. The above equation shows that per acre total cost of wheat production in district Mardan and in Peshawar was Rs 32877.50 and Rs 36644.629 respectively. (32873.50+3767.129).

Comparison of net revenue

The net revenue obtained from production of per acre wheat grown in district Peshawar and district Mardan was compared by dummy variable approach obtaining the following results.

$$\begin{aligned} \text{NR} &= 33727.661 + 6656.500D \\ \text{S.E} &= (1402.103) (1717.954) \\ \text{t-ratio} &= (24.045) (3.875) \\ R^2 &= 0.142 \quad F=15.013 \end{aligned}$$

Where;

D1=1 for Peshawar and (otherwise).

The empirical results of dummy variable approach used for comparing net return obtained from per acre wheat production in district Peshawar and district Mardan was shown. Net revenue of wheat per acre production was 33727.661 in district Mardan while it was Rs 40384.161 (33727.661+6656.500) in district Peshawar.

Conclusions and Recommendations

From the research study it is concluded that the net revenue from per acre wheat production was high in district Peshawar as compared to district Mardan. Per acre yield of wheat production in district Mardan was 1809.032 kgs while in district Peshawar was 2143.230 kgs. Based on research findings it is concluded that total cost of wheat was less in district Mardan than the cost in district Peshawar. All the inputs including seed, irrigation, labor, fertilizer, pesticides and tractor used in the production of wheat, maize and sugarcane was having positive relationship with the production of wheat in both the districts. However, by proper utilization of all the inputs production can be raised to an optimal level. Agriculturists should carry out researches in order to improve seed varieties for enhancing net returns per acre and Farmers should be provided with modern equipment and training to improve quality and amount of production.

Author's Contribution

Sadiqa Begum: The paper belong to the MPhil research thesis of the first author. All the data collection and tabulation work done by the first author.

Murad Khan: Helped the first author in analysis of data and also wrote the research paper. Additionally, All the suggested modifications and changes were made by the co-author from time to time.

Noor Pao Khan: Supervisor of the first author who guided and supervised the first author in the whole research work. He also critically reviewed the paper several times for positive suggestions.

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