

# An Economic Analysis of Wheat Farming in the Mixed Farming Zone of Punjab Province, Pakistan

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## ABSTRACT

Wheat is a major crop of Pakistan. It's per hectare yield is very low as compared with other countries. To estimate the impact of various factors of production on yield of wheat, the Cobb-Douglas production function in logarithmic form was used. The results of the production function indicate that wheat yield can be increased by increasing the use of irrigation, fertilizer and ploughing. The country as a whole is facing a severe shortage of canal water that is why; the coefficient of the irrigation variable is highest and statistically significant. The cost of production analysis indicates cost of production and gross income of wheat per acre increases with increase in farm size. The primary reason for this might be increased mechanization and farm inputs like fertilizer, irrigation and weedicide with increase in farm size. The increase in yield is more than the increase in cost that is why the net income per acre, cost per 40 kg and income per 40 kg reduces with farm size.

**Key Words:** Economic analysis; Wheat; Farming zone; Punjab

## INTRODUCTION

Agriculture plays a pivotal role in the economy of Pakistan. The agricultural sector provides livelihood for the population and raw material for agro-based industries. The most important role of agriculture in the national economy is to generate surpluses for export to earn the much-needed foreign exchange. Agriculture accounts for 24% of the Gross Domestic Product (GDP) and employs 48.4% of the total work force. Almost two third of the country's population is living in rural areas and directly or indirectly linked with agriculture for the livelihood (Government of Pakistan, 2003).

In Punjab, agriculture is dominated by the crop sector. The value added of major crops accounts for 41% of value added in overall agriculture. Agriculture in Punjab is not entirely subsistent; there are farmers who grow crops at the commercial level. They sell a part of their product and purchase the required inputs. They are, therefore, affected by the changes in prices of agricultural products received and by technological and marketing developments.

Wheat is an important food crop of the world. It was grown in 121 countries on 215 million hectares in 1999 representing 15% of the world's cropped area. Over 583 million tons of wheat was harvested in 1999, which constituted 28% of the world food supplies of which 17% was traded in the world market (FAO, 2000).

Global wheat consumption was up for the fifth year in a row and it exceeded wheat production. Consequently, wheat stocks tended to deplete, particularly among the importers (FSA, 2002). Developing world's share of all wheat imports amounted to 60% and had been increasing for 25 years and was expected to continue unabated (FAO,

2003).

Out of the 121 wheat growing countries, Pakistan ranks 8<sup>th</sup> in terms of yield per unit area (FAO, 2000).

Wheat is the leading food grain of Punjab province of Pakistan, and is the staple diet of the people. It occupies a central position in agricultural policies. Wheat was cultivated on an area of 6.25 million hectares with the production of 5.419 million tones. It's per hectare yield is 2465 kg (Government of Pakistan, 2002).

To accelerate the process of development and to sustain the tempo of "Green Revolution" in the country, study and analysis of basic data regarding farms and farming operations becomes imperative. Such data may include as to how much a farmer invests in farm enterprise and how much he gets as a return from it. These costs and returns in turn determine the price level and availability of the food grains and other products to the ultimate consumers.

Farm costs are the money values of goods and services acquired and used in crop and livestock production. The study of farm costs is of paramount significance because it serves as an effective guide in planning and allocation of farm expenditure for different agricultural inputs. The most immediate purpose of cost studies is to determine the unit cost of a product so as to compute the terms of trade for the farming community and further to find out the real income per head or per family in agriculture and ultimately to furnish a basis for the Government policies for price fixation, trade regulation, production grants, subsidization and tariff determination. There is always need to make an analytical study of constituent parts of the farm business in order to understand the internal structure of the various enterprises and their relation to each other. Cost studies deal

with the collection and analysis of cost data in monetary terms on the operation and production of individual commodity.

In addition, costs of production studies in the country are also much helpful to the credit institutions because credit could be more confidently advanced by such institutions to the farmers for productive purposes.

The first objective, keeping in view the importance of the study of cost of production cited above, was to estimate and compare the cost of production of wheat and its profitability for different farm sizes in the Jhang district of Punjab province. The second objective was to estimate the contribution of the various factors on the wheat yield.

## METHODOLOGY

**Universe and sample.** The data used in the present study was collected from Jhang district of the Punjab province. A multi-stage purposive sampling technique was adopted to select tehsil, village and respondents. Jhang district comprises of three tehsils i.e. Chiniot, Jhang and Shorkot. Three villages from each tehsil were selected at random for data collection. Ten farmers from each village were selected on the basis of operational holding [Small < 12.5 acres, medium ≥12.5 to < 25 acres and large 25 acres and above]. Among the respondents 50% were small, 30% were medium and 20% were large farmers. Thus, the sample size consisted of 90 respondents. Small farms occupy major portion in farm distribution. Medium farms occupy second and large farms have third position in farm distribution. Although large farmers in number are small but their own land is more as compared to medium and small farms. Large farmers also rented in but did not shared out any land. Medium farmers also share out no land. Average operational holding of small, medium and large farms are 7.82, 17.67 and 44.83 acres respectively.

Wheat crop occupy the largest acreage on small, medium and large farms.

**Collection of data.** Data were collected through a well-designed, comprehensive and pre-tested questionnaire. This questionnaire comprised of the questions helping the estimation of cost of production i.e., number of cultivations, and number of hours of irrigation, number of bags of fertilizers etc. and their respective rates.

**Estimation of cost of production.** The procedure adopted by Chaudhry *et al.* (1992) in estimating and subsequently apportioning the cost of various items was used in this study.

**Production function.** To estimate the impact of various factors of production (inputs) on yield of wheat, the following Cobb-Douglas production function in logarithmic form was used.

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \mu_i \quad (1.1)$$

Where

Y = Yield of major crops in maunds per acre (dependent

variable)

$\beta_0$  = Constant term (Intercept),

$\beta_1$  = Elasticities of production

$X_1$  = Number of ploughings,

$X_2$  = Seed rate (kg/acre)

$X_3$  = Number of irrigations,

$X_4$  = Number of bags of urea,

$X_5$  = Number of bags of DAP,

$X_6$  = Number of sprays,

$\mu_i$  = Disturbance term

The results of this production function are presented in Table IV.

## RESULTS

**Cost of production of wheat crop per acre.** Average yield and per acre quantity of inputs applied to wheat crop pertaining to each farm size group is presented in Table I. The average wheat yield per acre on small, medium and large farms were 33.49, 33.50 and 37.47 mounds respectively, showing a direct positive relationship between wheat yield and farm size as shown in Table I This result is in line with that of Salam *et al.* (2002). The Table II shows the average total cost by items according to farm size categories.

**Land preparation and cultural operation costs.** Number of ploughings and plankings with bullocks were 1.18, 1.11 and 0.6 on small, medium and large farms respectively. This indicates inverse relation between Bullock labour and farm size. This result is in line with that of Ahmad (1990). The cost borne by the all farm groups for these operations were Rs. 272.52, 254.38 and 139.06 respectively. There were no costs for leveling with the bullocks for medium farmers. Large farmers were mostly carrying out the ploughing and planking operations with their own tractors. Number of ploughings and plankings by owned tractor were 1.22, 2.15 and 4.72 for small, medium and large farm sizes groups. Ploughing and planking with owned tractors costed to Rs. 102.56, 197.53 and 428.48 for small, medium and large farm size groups. Small and medium farmers mostly used hired tractors for cultural operations. Ploughing and planking with hired tractors amounted to Rs. 465.68, 383.33 and 101.67 for respective farm sizes.

### Capital input Costs.

**Seed.** There was a little variation in seed sown on different farm sizes. The average seed rate came to be 52.02, 52.22 and 50.00 kgs per acre for wheat crop for small, medium and large farm size groups respectively and it costed Rs. 460.40, 455.13 and 433.64 for farm size 1, 11 and 111 respectively.

**Farm yard manure.** Farm yard manure applied to wheat in terms of carts loads was 3.82, 4.44 and 2.78 for small, medium and large farms. It costed to Rs. 106.82, 122.22 and 77.78 for respective farm size groups.

**Fertilizer.** Farmers mostly applied the nitrogenous fertilizer and this input in terms of bags per acre came to be 1.69,

1.72 and 1.76 for small, medium and large farm size groups. Large farmers used more fertilizer compared to small and medium farms. The cost of urea amounted to 692.62, 706.11 and 723.19 for small, medium and large farm size groups. The number of bags of DAP were estimated to be 0.98, 1.11 and 1.30 for small, medium and large farm size groups. The cost of DAP was worked out to be Rs. 756.31, 850.00 and 998.75 for respective farm sizes

**Irrigation.** There was very little difference in the number of irrigations applied to wheat crop per acre among farm groups. Average numbers of irrigations for wheat crop were 4.70, 4.59, 4.72 for small, medium and large farms. It costed to Rs. 802.88, 913.80 and 992.22 for respective farm sizes.

**Plant Protection measures.** No. of plant protection measures applied on wheat crop were 0.77, 0.77 and 0.94 for three farm size groups. It indicates that large farmers use more plant protection measure than small and medium farmers. In monetary terms these plant protection measures amounted to Rs. 313.36, 322.78 and 389.17 for respective farm sizes. Expenditure on plant protection measure was greater for larger farmers than small and medium farmers.

**Mark up @ 14% on above investment.** Markup is the interest on capital invested for the production of wheat crop. It amounted to Rs. 298.35, 318.09 and 321.54 for small, medium and large group of farmers respectively.

**Labour input.** Labour input includes family labour, permanent hired labour and casual hired labour.

**Permanent hired and family labour.** The hours worked on by permanent hired and family labour for wheat crop were 16.2, 13.89 and 15.2 mans days for small, medium and large farm sizes.

**Casual labour for harvesting.** The casual labour for harvesting for wheat crop amounted to Rs. 843.55, 865.92 and 883.11 for small, medium and large farm sizes. It

increased with the increasing yield for the crop.

**Casual labour for threshing.** The casual labour for threshing the wheat crop amounted to Rs. 596.58, 589.46 and 658.02 for small, medium and large farms.

**Other Costs.**

**Land tax.** The Government levies land taxes on farms having acreage of 40 kanals or more. It amounted to Rs. 35.56, 81.48 and 80.56 for small, medium and large farms respectively.

**Land rent.** Land input includes land rent only. It was worked out at Rs. 1784.44, 1805.56 and 2091.67 per acre for respective farm sizes. On an average it contributed to 21.72% of total cost.

**Water charges.** Water rate was fixed for each farm size groups and it amounted to Rs. 69.42 per acre.

**Marketing charges.** Marketing cost amounted to Rs. 100.47, 100.5 and 112.4 for small, medium and large farm size groups. Marketing cost was estimated on yield basis.

**Management cost.** Management cost occupies a special position when production cost is estimated.

An economist always adds this to the cost of production. Usually there is no manager at small and medium farms. So, management charges are calculated as opportunity cost. The management cost was worked out to be Rs. 240, 270 and 288 for small, medium and large farm groups.

**Gross income per acre for different farm sizes.** The gross income per acre for small, medium and large farms was rupees 10859, 10988 and 124567 respectively. Indicating an inverse relation between gross income and farm size. This result is in line with that of Ahmad and Querishi (1999).

**Total Cost per acre for different farm sizes.** Adding land preparation and cultural operations, capital input, labour and other costs arrived at total cost per acre for the farms under

**Table I. Per acre quantity of inputs applied in wheat by farm size**

Item	Unit	Farm Size Categories			Total
		Small	Medium	Large	
<b>Land preparation</b>					
Ploughing & planking (Bullocks)	No	1.18	1.11	0.61	1.04
Leveling (Bullocks)	No	0.11	0.00	0.05	0.06
Ploughing & planking (Own Tractor)	No	1.22	2.15	4.72	2.20
Leveling (Own Tractor)	No	0.18	0.37	0.72	0.34
Ploughing & planking (Hired Tractor)	No	3.00	2.56	0.67	2.40
Leveling (Hired Tractor)	No	0.24	0.24	0.05	0.24
<b>Capital Inputs</b>					
Seed	Kg	52.02	52.22	50.00	51.68
Farm yard manure	Carts	3.82	4.44	2.78	3.80
<b>Fertilizers</b>					
Urea	Bags	1.69	1.72	1.76	1.71
DAP	Bags	0.98	1.11	1.30	1.09
Nitro Phos	Bags	0.01	0.07	0.06	0.04
SSP	Bags	0.18	0.00	0.28	0.10
Irrigation	No	4.70	4.59	4.72	4.67
Plant protection measures	No	0.77	0.77	0.94	0.81
<b>Labour</b>					
Permanent hired and family labour	Hours	16.12	13.89	15.25	15.26
<b>Product</b>					
Yield	Maunds	33.49	33.50	37.47	34.30

**Table II. Per acre total cost, gross income and net income of wheat by size of holding**

Item	Unit	Farm Size Categories			All
		Small	Medium	Large	
<b>Land preparation cost</b>					
Ploughing & planking (Bullocks)	Rs.	272.52	254.38	139.06	240.02
Leveling (Bullocks)	Rs.	24.70	0.00	15.09	15.26
Ploughing & planking (Own Tractor)	Rs.	102.56	197.53	428.48	197.29
Leveling (Own Tractor)	Rs.	28.46	57.97	113.05	54.52
Ploughing & planking (Hired Tractor)	Rs.	465.68	383.33	101.67	367.08
Leveling (Hired Tractor)	Rs.	49.09	53.33	10.00	42.47
<b>Capital Inputs cost</b>					
Seed	Rs.	460.40	455.13	433.64	453.47
Farm yard manure	Rs.	106.82	122.22	77.78	105.62
<b>Fertilizers</b>					
Urea	Rs.	692.62	706.11	723.19	702.89
DAP	Rs.	756.31	850.00	998.75	833.76
Nitro Phos	Rs.	8.31	41.04	30.78	22.78
SSP	Rs.	45.69	65.00	7.14	24.27
Irrigation	Rs.	802.88	913.80	992.22	874.82
Plant protection measures	Rs.	313.36	322.78	389.17	331.55
<b>Labour cost</b>					
Permanent hired and family labour	Rs.	141.09	121.53	133.44	133.52
Casual labour for harvesting	Rs.	843.55	865.92	883.11	861.91
Casual labour for threshing	Rs.	596.58	598.46	568.02	609.57
<b>Other costs</b>					
Land tax	Rs.	35.56	81.48	80.56	58.34
Land rent	Rs.	1784.44	1805.56	2091.67	1852.22
Water charges	Rs.	69.42	69.42	69.42	69.42
Marketing cost	Rs.	100.47	100.5	112.41	102.9
Management cost	Rs.	240	270	288	266
Mark up @ 14% on Investment	Rs.	298.35	318.09	321.54	307.95
Total variable cost	Rs.	6341.14	6697.12	6856.54	6547.65
Total cost	Rs.	8230.56	8653.58	9098.19	8527.63
<b>Income</b>					
Gross income	Rs.	10859.03	10988.81	12456.99	11221.59
Net income	Rs.	2628.47	2335.23	3358.80	2693.96
Gross margin	Rs.	4517.89	4291.69	5600.45	4673.94

**Table III. Gross income, total cost, net income per acre and cost, income per 40 kg for Wheat by Farm Size**

Item	Farm size categories			All
	Small	Medium	Large	
Gross income per acre (Rs.)	10859.03	10988.81	12456.99	11221.59
Total cost per acre (Rs.)	8230.56	8653.58	9098.19	8527.63
Net income per acre (Rs.)	2628.47	2335.23	3358.8	2693.96
Cost per 40 kg (Rs.)	245.76	258.32	242.81	248.62
Income per 40 kg (Rs.)	324.25	328.02	332.45	327.16

**Table IV. Summary statistics of analysis for wheat**

	Coefficient	Standard Error	T stat	Level of significance
Intercept	1.780	1.079	1.650	0.105
Ploughings( $X_1$ )	0.122	0.082	1.474	0.146
Seed rate( $X_2$ )	0.185	0.243	0.762	0.449
Irrigation ( $X_3$ )	0.505	0.216	2.335	0.023
Urea ( $X_4$ )	0.079	0.66	1.193	0.238
DAP ( $X_5$ )	0.24	0.085	2.990	0.004
Sprays ( $X_6$ )	0.058	0.161	0.359	0.72

R square = 0.336; Adjusted R square = 0.265

study. The total cost per acre was estimated to be Rs. 8230.56, 8653.58 and 9098.19 for all three-farm size groups.

**Net income per acre for different farm sizes.** Net income

per acre was calculated by subtracting total cost from gross income Per acre. It was found that large farmers got more net income than small and medium farms. Reason behind this greater net income is that gross income per acre of

wheat is higher in case of large farmer. Net income per acre was estimated to be Rs. 2628.47, 2335.23, 3358.8 for small, medium and large farms respectively.

**Gross margin per acre for different farm sizes.** Gross margin per acre is calculated by subtracting total variable cost from gross income arrived at gross margin per acre. The value of gross margin was positive for all farm size categories. The gross margins were Rs. 4517.89, 4291.60 and 5600.45 for small medium and large farm size groups.

**Cost per 40 kg for different farm sizes.** The wheat yield per acre was 33.49, 33.5 and 37.47 maund (local unit. one mound is equal to 40 kg) for the three farm sizes groups. The cost of production per 40 kg (mound) was calculated by dividing the total production cost per acre of each farm size group by the yield per acre in that particular size group. Thus, the cost per 40 kgs was estimated to be Rs. 245.76, 258.32 and 242.81 for small, medium and large farm size groups respectively. Thus the cost per 40 kg is low on large farms as compared with small and medium size farms. This result is in line with that of Mannan (2001) and Salam *et al.* (2002).

**Income per 40 kg for different farm sizes.** Income per 40 kg was calculated by dividing total income per acre of each farm size group by average yield of that group. Income per 40 kgs for wheat crop came to be Rs. 324.25, 328.02 and 332.45 for small, medium and large farm size groups.

Income per 40 kgs for wheat crop was higher than cost per 40 kgs for all three types of farmer. So there was profit for wheat crop for all farms.

As it was Cobb Douglas Production function, so the coefficients presented in the Table IV are the elasticities of production. The signs of coefficients are as expected. The coefficient of the irrigation and DAP variables are significant at less than 5% level of significance, coefficients of ploughing and urea variable are significant at 15% and 24% level of significance respectively. The coefficient of the irrigation variable is 0.50 this indicates that on the average one percent increase in irrigation numbers will increase the wheat yield by 0.50%. The coefficients for the DAP variable is 0.085 indicates that on an average one percent increase in the DAP (bags) will increase the wheat yield by 0.085 percent. The value of the  $R^2$  is 0.336, this indicates that about 34% variation in wheat yield is explained by the variable included in the model i.e. equation 1.1.

## CONCLUSION AND SUGGESTION

The results of the production function indicate that wheat yield can be increased by increasing the use of irrigation, DAP, urea and Ploughing. The country as a whole is facing a severe, shortage of canal water due to low rainfall and snow on the mountains and the Siltation of the reservoirs. But this shortage is more severe in Jhang district, as the under ground water is also unfit for irrigation. So the farmers as a whole are applying less irrigation than the recommended once. That is why; the coefficient of the

irrigation variable is highest and statistically significant. The coefficient of DAP and urea variable (Fertilizer) are also significant as the farmers are using these fertilizer less than the recommended level. Especially the use of DAP should be encouraged as it effect the size of grains and hence the yield wheat. Ploughing is another important variable as the wheat in this mixed farming system mostly comes after Sugar cane and Rice. Wheat sowing is mostly delayed after Sugar cane and fine rice as little time is available for the land preparation. That is why farmer apply less cultivation to land. Developing and sowing early maturing fine rice variety and early start of the crushing season can avoid this situation.

The cost of production analysis indicates that wheat yield, cost of production and gross income per acre increases with increase in farm size. The primary reason for this is that large farmers having their own tractor, plough their fields more are able to sow the crop timely, spend more on fertilizer, irrigation and weedicides. Wheat yield is more responsive to these commercial inputs that is why the gross income increases with farm size as above mentioned input usage increases. The increase in yield is more than the increase in cost that is why the net income per acre, cost per 40 kg and income per 40 kg reduces with farm size. So to increase the usage of these inputs, time availability of these inputs both in term of quality and quantity be ensured at the doorstep of the farmers. The cheap and timely availability of credit is also necessary to achieve this end.

## REFERENCES

- Ahmad, B., 1990. Economics of various enterprises on small farms. In: *Proc. National Sem. on Economic Revival of Small Farmers*. pp. 150–87. March 4–5, 1989. Faculty of Agri. Economics and Rural Sociology and Punjab Agriculture, Faisalabad
- Chaudhry, A.M., B. Ahmad and M.A. Chaudhry, 1992. *Cost of Producing Major Crops in Pakistan 1991–92. Research Report*, Department of farm management, University of Agriculture, Faisalabad.
- Ahmad, M. and S.K. Qureshi, 1999. Recent evidence on farm size and land productivity: implications for public policy. *Pakistan Development Review*, 38: 1135–53
- FAO, 2000. *FAO Production year book*. Food and Agriculture Organization of the United Nations, Rome, Vol. 54.
- FAO, 2003. Commodities and Trade Division, Food and Agriculture Organization of the United Nations, Rome, <http://www.fao.org/waicent/faoinfo/economic/ESC/csce/cmr/cmrnotes/cmrwe.ht>.
- FSA, 2002. *Food and Agriculture Situation On-line 'World Wheat Situation and Outlook'*. [http://www.fas.usda.gov/grain/circular/2000/00-02/wht\\_txt.htm](http://www.fas.usda.gov/grain/circular/2000/00-02/wht_txt.htm).
- Government of Pakistan, 2002. *Agricultural statistics of Pakistan (2000–01)*. Ministry of Food, Agriculture and Livestock, (Economic Wing), Islamabad, Pakistan.
- Government of Pakistan, 2003. *Economic Survey of Pakistan, 2002–03*. Finance Division, Economic Advisor's Wing, Islamabad, Pakistan.
- Mannan, A., 2001. An estimation of cost of production of major crops with special reference to District Vehari, An Unpublished *M.Sc. (Hons.) Thesis*, Department of Agri. Economics. University of Agriculture, Faisalabad.
- Salam, A., M.B. Siddique and S.W.R. Zaidi, 2002. Economics of wheat production: Results from field surveys in Punjab and Sindh. Agricultural Prices Commission, Govt. of Pakistan, Islamabad. *Apcom Serial No. 202*.

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