Wheat Crop Cultivation's Profitability Studies in Sugar Crop Dominated Areas

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Abstract. The study was conducted at Arid Zone Research Centre (AZRC), Dera Ismail Khan (D.I.Khan) to evaluate cost and benefit of wheat cultivation in district Dera Ismail Khan, Khyber Paktoon Khwa province of Pakistan during 2015. The basic underlying assumption of economic analysis of wheat production was to assess the farmers/growers financial impact of wheat cultivation. A sample of 200 respondents from 10 major wheat growing villages of the respective areas of the district was interviewed through pretested questionnaire. The study revealed that the cost of wheat production was Rs=35,680 per acres, whereas output comes 1650 Kg per acre (42 mounds) amounting Rs=63,600 per acre. Farmers' margin also rises by adding the value of family labour and owned land which is sufficient to sustain a normal family. Moreover, positive influence between return price and output of wheat was concluded from the study, whereas negative effect of cost was also observed. The output elasticity of Land Preparation (LP), Seed and Sowing (SS), Farm Inputs (FI), Irrigation (Irr), Pesticides (Pest) and Harvesting/Threshing (HT) are 0.124587, 0.31244, 0.5874, 0.55461, 0.08248 and 0.65743, respectively.

Keywords: wheat, cost, return, profit, cobb douglas, Arid Zone, D.I.Khan, Pakistan

Introduction

In Pakistan, the leading food grain and being staple diet of the people is wheat, which occupies largest agriculture area of the country. Wheat contributes 9.9% to the value added in agriculture and 2% to the GDP. The area under wheat crop during 2015-16, the cultivation has increased to 9260 thousand hectares from last year's area of 9204 thousand hectares which shows an increase of 0.6 percent, while production of wheat stood at 25.482 million tons during 2015-16, showing an increase of 1.6 percent over the last year's production of 25.086 million tonnes. The production increased as crop was sown at appropriate time and available moisture particularly in Barani Track supported germination/growth and availability and use of inputs remained adequate. It is mostly grown in all most all provinces including Khyber Paktoon Khawa province (KPK) (GoP, 2015-16). Wheat and its products are used in Pakistan in a number of ways, it accounts for over 70% of the gross cereals and over 36% of the country's acreage is devoted to wheat cultivation.

In D.I.Khan district, wide variety of crops ranging from arid to humid is cultivated. Among these, the most important are wheat, rice, sugarcane, cotton, maize,

millet, sorghum, pulses, oilseed, vegetables and fruits. Prior to the inception of CRBC, sorghum and millet were the major crops grown in the area. However, after CRBC, sugarcane, rice and orchards took the lead and were largely introduced in the summer season. The area under sugarcane crop has been increased to 15.5 million acres in D.I.Khan, which is the largest in Khyber Paktoon Khwa province. D.I.Khan is the only district in Pakistan having four Sugar Mills (Chashma-1, Chashma-2, Tandlian Wala Sugar Mills Extension Miran and Al-Moiz) in working condition, while two new Sugar Mills "Al-Mughni" and "Alman Sayyam" are under construction. The present shift of area to sugarcane crop needs to be rationalized in order to meet food requirements of the local masses and maintain production equilibrium in food and industrial crops. Although the area has potential to produce important winter crops wheat, barley, pulse, oilseed, and fruits yet there has been constant increase in summer and winter acreage of sugarcane particularly after the commencement of CRBC. Tripathi (1993) scrutinized the economics of high yielding variety (HYV) wheat cultivation for three farm size groups for middle hill and valley farms in Tehri Garhwal district, Uttar Pradesh, India. Data were collected from a sample of 120 farms for 1987-88. The average operational cost was Rs=2431/ha for middle hills farms and Rs=2506/ha on valley farms. Bullock

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labour accounted for the highest percentage of operational cost followed by manure, fertilizer and seeds. (Ahmed *et al*., 2011) concluded that wheat production contribute significantly to farm sustainability and contribute to alleviation of mal-nutrition in the State. The actual production constraints restrict the sustainability of this important crop. The cooperation between International Organizations and Governmental Institutions should tackle the hindrances of wheat production and achieve stability of wheat. There is a great potential for improvement the yield of the crop and an intervention of the State is needed to ease having the inputs of production especially irrigation water inputs. Various studies were conducted to explore the impact of improved wheat production technology, including high yielding varieties with cultural practices and comparing yield, input level and net returns. Farmers adopting advanced technology had 61.92% and 76.07% higher yield as compared to the traditional system. We have aimed profitability studies of wheat crop in the area to focus the ever growing food demand of inhabitants of D.I.Khan and rest of the KPK where land availability is much limited. The second aim of the study was to formulate new economically viable cropping pattern having diverse crop rotations. The study concludes that the investment in modern technologies proportionately enhanced output and net income.

Materials and Methods

The study was conducted at Arid Zone Research Centre, D.I.Khan, KPK, Pakistan during 2015. For data collection, only major wheat producing areas of district were used. Ten (10) villages were selected randomly, which includes Himat, Mandaran, Ketch, Lar, Dhap Shumali, Shorkot, Daraban Kalan, Parova, Lunda Sharif and Ramak falls under the command area of Chashma Right Bank Canal (CRBC), D.I.Khan. The analysis is based on the primary data, 200 farmers out of major wheat growers of these areas were considered as sample for study. Necessary information from farmers was collected at their field or home by using pretested questionnaire to get the actual data. It included maximum information such as land holding, total cultivated area, area under wheat cultivation etc. However, main focus was on various inputs used in wheat crop production.

Statistical analysis. Econometric view (E-Views)/SPSS package was used to analyze data. The detail is given below: cost and benefit of wheat will be compared through benefit cost ratios (BCR) formula also used by Santha (1993):

$$\text{Benefit cost ratio of wheat} = TR/TC \dots\dots(1)$$

where:

the TR is the per acre total benefit generated from wheat production and TC is the per acre total cost of wheat cultivation.

Profit function. Π = Total Revenue (TR) – Total Cost (TC); Π = TRTC .... (2)

where:

TR = P*Q (P = Price of output and Q=Output); TC = V*X (V = Input price and X = Input purchased) and Π = PQ – VC ………………...................................…. (3)

Model of profit function. Empirical model of crop profit function in econometric form may be given as:

$$\Pi = \alpha + \beta 1P + \beta 2Q + \beta 3C \dots\dots\dots.......... (4)$$

The above model described that (Π) is determined by the three major factors, which are as under:

P = Output price; Q = Output produced; C = Output cost equations (2), (3) are used to generate equation (4) above. It indicates that profit (Π) depends on output price (P), total output (Q) and cost per unit (C) of output produced. As are the parameters to be estimated and measure the change in (Π) with a unit change in the variables on right hand side as the case may be. This model was also used by Derbertin (2012) and Anwar (2013).

To show the input and output relationship, log linear Cobb Douglas production function has been used. The said model was also used by Hussain and Khattak, (2011) and Haq *et al*., (2002). However, due to some additional variables used in the present study, accordingly it was modified. This model is widely used in agriculture production. The following log linear Cobb Douglas production function was applied, using the least square method:

ln P=ln a0+a1 ln Area+a 2ln LP+a 3ln SS+a 4ln FI+a 5ln Irr+a 6ln Pest+a 7ln HT+ei ....… (5)

The above model was then converted into following general form:

Pw=ao´Area a1´LPa2´SS a3´ FI a4´ Irr´ Pesta6´ HTa7' ei ……... (6)

where:

Table 1. Average cost of production of wheat cultivation in D.I.Khan

Item/Inputs	Unit	Quantity	Rate(Rs.)/unit	Total expenditure
Tractor hours	Hours per acre	2	800	1,600
Labour	Man days	1	400	400
Land preparation	Rs=	-	-	2,000
Seed of wheat	Kg	40	90	1,920
Labour (from sowing)	Man days	1	400	400
Seed & sowing	Rs=	-	-	2,320
Diammonium phosphate (DAP)	Rs=	1	3480	3,480
Urea	Rs=	2	2020	4,040
Transportation cost	Rs=	3	100	300
Application (Labour)	Man days	1	400	400
Farm inputs	Rs=	-	-	8,220
Canal	Seasonal	1	800	800
Labour	Man days	4	400	1,600
Irrigation	Rs=	-	-	2,400
Insecticide/pesticides	Ks=		1600	
Spray pumps (Rent)	Per day	1	200	200
Application (Labour)	Man days	1	400	400
Pesticides	Rs=	-	-	2,200
Harvesting	Per acre	1	1,500	1,500
Threshing	Mounds	40	120	4,800
Empty bags	Per bags	20	12	240
Harvesting/threshing	Rs=	-	-	6,540
Land rent	Kanal	8	1500	12,000
Total Cost	-	-	-	35,680

P = total wheat production (Kg/acre); Area = area under wheat crop; LP = land preparation; seed and sowing = seed and sowing; FI = farm inputs; Irr = irrigation; pest = pesticides/insecticides; HT = harvester threshing; ao = shows the impact of innovations or technology.

a1, a2, a3, a4, a5 a6 and a7 are the output elasticity of area, LP, SS, FI, Irr, Pest and HT, respectively.

ei = residual term (to include effect of omitted variables).

Table 2. Average total and net benefit of wheat

Item	Quantity (maund*)	Rate (Rs/maund*)	Total amount (Rs.)
Produce	42	1400	58,000
Stalk	-	4800	4800
Total revenue	-	-	63,600
Net revenue	-	-	-

* Maund = 40 Kg.

Result and Discussion

To compare the cost and revenue of wheat, Benefit Cost Ratio (BCR) was calculated by using equation1 as under: BCR for Wheat = TR/TC = 63,600 / 35,680 (Table 1-2).

BCR for wheat = 1.78

The calculated value of BCR clearly indicates that the wheat cultivation is profitable.

By using equation 2, net return is calculated as:

Net return = TR – TC = 63,600 – 35,680 = 27,920

Estimated model as per equation 4. $\Pi = 0.0052 + 0.831P + 0.072Q + 0.53C$ and standard error = {0.004} {6.12 E} { 0.07} {1.03 E}; t ratio = {1.69} {1548.13} {0.75}{753562}; R = 0.82; R (adjusted) = 0.68; F = 6.39 and EF test determines the overall goodness of fit/significance of the model. It is clear from the above model that the value of f test is very high. F calculated =6.39 E20 > F and tabulated= 3.12 i.e. calculated value of "f" statistic is greater than tabulated value of "f" statistic. Thus the model shows overall significance. The coefficient of determination (R2), signify that the 82% deviation in the dependent variable has been

explained by the independent variables. The sign of independent variables shows that effects of explanatory variables are according to the theory. t $_{calculated}$ > t $_{tabulated}$ = 1.895, indicates that t ratios of the factors confirms that, profit of the wheat production (π) is significantly determined by the three already mentioned factors of the model keeping all the other inputs constant. Thus, a unit increase in per acre cost of wheat, profits will rise by Rs=0.83, producing another Kg of output (Q) will increase the profit by Rs=0.72, while each additional unit of per Kg cost (C) will decrease the profit by Rs=53. The estimation of the profit function revealed that profit is significantly affected by the above three mentioned factors. However, the effect of cost is higher than the effect of price and output of wheat.

At the end, Cobb Douglas Production Function is calculated through equation-5 given as under:

$$\ln P = 3.51008 + 0.64123 \ln \text{Area} + 0.124587 \ln \text{LP} + 0.31244 \ln \text{SS} + 0.5874 \ln \text{FI} + 0.55461 \ln \text{Irr} + 0.08248 \ln \text{Pest} + 0.65743 \ln \text{HT} \ldots\ldots\ldots\ldots (7)$$

In general form is given as:

$$\ln P = 33.54094375 + \text{Area} + \text{LP} + \text{SS} + \text{FI} + \text{Irr} + \text{Pest} + \text{HT} \ldots\ldots\ldots\ldots\ldots (8)$$

It is concluded that Area, LP, SS, FI, Irr, Pest and Hrvt are statistically significant. As per equation 7 and 8, the calculated value of wheat area elasticity of production (0.64123) indicates that if wheat area increase by 1% and all other inputs remain unchanged, production will increase by 0.64%. Similarly, the output elasticity of LP, SS, FI, Irr, Pest and HT are 0.124587, 0.31244, 0.5874, 0.55461, 0.08248 and 0.65743, respectively, which can be interpreted in the same way.

Conclusion

The results indicate that the average cost per acre was Rs=35,680 and average production (output) of wheat was estimated to be 1650 Kg/acre. Therefore, the gross return of wheat production was Rs=63,600/acre. According to the result, the BCR was calculated as

1.78. Moreover, positive influence between return price and output of wheat was concluded from the study whereas negative effect of cost on the other hand was observed in wheat production. It is concluded that Area, LP, SS, FI, Irr, Pest and HT are statistically significant variables. As per equation 7 & 8, the calculated value of output elasticity of Area, LP, SS, FI, Irr, Pest and HT are 0.64123, 0.124587, 0.31244, 0.5874, 0.55461, 0.08248 and 0.65743, respectively.

Conflict of Interest. The authors declare no conflict of interest.

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