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Economic Analysis of Cotton Cultivation Under Agro-Climatic Conditions of District Muzaffargarh

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Abstract: Southern Punjab of Pakistan known as the cotton zone, study was conducted to examine cost benefit analysis of cotton cultivation in district Muzaffargarh (core cotton zone), Punjab in 2015-16. The focus of the study was to evaluate economic analysis of cotton production and financial impact of cotton growers in cotton cultivation. A sample of one hundred cotton growers were randomly selected and directly interviewed for pre-tested questionnaire. Benefit cost ratio estimated 1.479 which denoted the profitability of cotton cultivation. Econometric model of cotton profit function was examined, price of output and quantity produced of cotton positively affect profit, while cost of production negatively affect profit. It was determined Cropped Area, Land Preparation, Seed, Fertilizer, Pesticides, Irrigation and Labor statically significant and positively affects cotton production. Proper policies are pertinent to input prices and output of cotton mandatory for cotton growers to increase profitability and refining socio-economic status in farming community.

Key words: Economic · Cobb-Douglas · Profit · Punjab · Pakistan

INTRODUCTION

Mostly developing countries belong to Agrarian economies consistently depends agriculture sector for nutrition needs and major source of employment. Agriculture sector plays crucial role in Pakistan to meeting the nutritional needs of population and coactive partner in provision of raw material to industrial sector. Agriculture sector weigh in to employment source of 42.3 percent of labor force of country and sharing the 19.8% of gross domestic product of country. Major crops importantly and cotton crop particularly play vital role as major source of raw material to local textile industry and foreign exchange earnings for the country [1].

Pakistan is 4th major producer of cotton after China, India and USA and 3rd major consumer of cotton after China and India in the world. Pakistan produces 6.94% of total world production and consumes 9.2% of total consumption of world [2].

Cotton contributes 1% of gross domestic product and 5.1% of agriculture value addition in the economy of country. Area cultivated in 2015-16 cotton crop 2916 thousand hectares as compared to 2961 thousand hectares previous year decrease of 1.5% and cotton production 10.074 million bales as compared to 13.960 million bales in previous year viewing the decline of 27.8 percent. Textile industry suffered to increase importing raw cotton due to decrease in cotton production 345.363 thousands tonnes in 2015-16 as compared to 97.354 thousand tonnes compared to previous year [3].

Punjab and Sindh are leading provinces in cotton production of Pakistan. Punjab produces 1555.47 thousands tonnes with the sharing of 71.62 percent, while Sindh produces 599.30 thousand tonnes contributes 27.59, so both provinces produces more than 98 percent of total cotton production of the country [4]. Favourable agro-climatic conditions are prerequisite for the potential production of cotton production. Multiple shocks of extended rainy season, rigorous pests attack and low market cotton price, suppressed farmers to investing in fertilizer and pesticides, such uncertainties played vital role in declining the cotton production [1].

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Cotton production can enhanced with proper policy measure of subsidizing through inputs and benefiting to farmers. In this study, it is attempted to compare mechanized farming through cost benefit analysis of net income and expenditure with conventional farming system. Numerous researchers have focused to casing the economic viewpoint in their studies. Anwar *et al.* [5] scrutinized that rational use of crop inputs with proper managed and economical basis enhance cotton production, minimize cost of production and multiples the net income of farmers. Anwar *et al.* [6] analyzed large farmer' s cotton production increases and bear the economized cost of production due to utilization available latest technologies and proper resource oriented while small farmers deficiency of resources produces lower cotton production and higher cost of production. Favourable policy measures to small farmer to subsidizing which economize the cost and increases production and net profit will increase.

Nazli *et al.* [7] examined the economic performance of Bt cotton varieties in Pakistan. Findings of study mentioned that expenditure of cotton production can be economized and its cultivation profitable to cotton growers in adoption of Bt varieties through regulated national market for Bt cotton technologies. Samuel *et al.* [8] study production, growth and export competitiveness of raw cotton in India an economic analysis concluded the negative growth rate in India yet cotton production increased observed in period II. Indian exports are increasing throughout years due to economized cost of production and India comparative advantage in export competitiveness. Elahi *et al.* [9] study investigated economic analysis of Maize cultivation under agro-climatic conditions of district Dera Ismail Khan. Findings of study remarked price and quantity output positively and cost negatively related to profit of cotton cultivation while overall cotton cultivation profitable for cotton growers.

The focus of study is examining the cost benefit analysis of cotton production under agro-climatic conditions in district Muzaffargarh Punjab, Pakistan.

MATERIALS AND METHODS

The present study was organized in the year 2015-16. Core cotton producing area of southern Punjab district Muzaffargarh selected for the study. Tehsil Alipur from out of four tehsils Muzaffargarh, Kot addu, Jatoi and Alipur of district Muzaffargarh was randomly selected. Five villages of Tehsil Alipur, Yaki Wali, Fateh Pur Junabi, Ali wala, Azmat pur and Makwal Hadir randomly selected for the questionnaire. Analysis was based on the primary data of one hundred farmers and twenty farmers from each village randomly selected for the data sample. Study relevant and compulsory information of cotton crop was collected at the fields or homes of concerned farmers for the accuracy of data. In the questionnaires maximum information tried to acquire from the cotton-producing farmers as farm area, cotton crop area, cotton yield and inputs of cotton crop utilized for cotton production in the farm.

Statistical Analysis: In the study for statistical analysis, Econometric View (E-View) package employed for the data evaluation. Procedure for the data analysis as followed. Formula of benefit cost ratio employed by the studies of Samiuallah *et al.[*10], Santha [11] and Elahi *et al.* [9] followed in this study to measure cost and benefit of cotton.

$$\text{Cotton Benefit Cost Ratio} = TR/TC \quad (1)$$

TR mentions the total revenue, which properly analyzed as the benefit generated through the production of the cotton. TC remarked as the total cost appropriately evaluated as the total expenditures of cotton cultivation. Profit function as followed

$$\Pi = TR - TC \quad (2)$$

Π taken as the net profit gained from cotton production total revenue minus total cost.
Formula can defined as given below

$TR = P * Q$ [P = price of output cotton Q = quantity of output cotton]

$TC = V * X$ [V = cotton input prices X = cotton input purchased quantity]

Specific form of formula given below

$$\Pi = PQ - VC \quad (3)$$

Econometric Model of Cotton Profit Function: Functional form of empirical cotton profit function analyzed in econometric as below which previously used in the studies of Elahi *et al.* [12], Derbertin [13], Samiullah *et al.* [10] and Elahi *et al.* [9] also employed in this study.

$$\Pi = \delta + \beta^1 P + \beta^2 Q + \beta^3 C \quad (4)$$

Π mentioned as the profit which to be specified with the three factors

P = price of output
Q = quantity of output produced
C = cost/expenditure of output

Equation (4) formulated through the combination of equation (2) and (3).

Π defines profit which measured through (P) price of output, total output taken as the (Q) and the inputs used in the production process as the expenditures/cost © of inputs. The β's were mentioned as the parameters in the model estimated which measures the change in the profit Π reflected through the change in the price, quantity of output and the cost of the inputs used in the model.

Cobb-Douglas production function used in the previous studies like the Samiullah et al [10], Hussain and Khattak [14], Haq *et al.* [15] and Ahmad *et al.* [16] also followed in the study. Log linear Cobb-Douglas production function used in the study to find out the input-output relationship among the variables of study. Cobb-Douglas production function model frequently employed in the agriculture to defining the nature of returns to scale. Model employed in the study was modified because of some added variables in the study. Least square method employed in the study for the estimation of given below log linear Cobb-Douglas production function.

$$\text{Ln } Y = \ln\delta 0 + \delta 1 \ln \text{Cropped Area} + \delta 2 \ln \text{Land Preparation} + \delta 3 \ln \text{Seed} + \delta 4 \ln \text{Fertilizer} + \delta 5 \ln \text{Pesticides} + \delta 6 \ln \text{Irrigation} + \delta 7 \ln \text{Labor} + ei \quad (5)$$

Variables of study can defined accordingly

Y	=	Yield of cotton per acre in Maunds (40 kg in a maund)
Cropped Area	=	Total area under cotton crop in acres
Land Preparation	=	Land preparation (tractor hours per acre)
Seed	=	Seed used for sowing cotton (kg per acre)
Fertilizer	=	Fertilizer used (bags per acre)
Pesticides	=	Pesticides used to control pests (no per acre)
Irrigation	=	Irrigation used for crop (total no per acre)
Labor	=	Labor participated during crop (no of days of worker per acre)
δ_0	=	Discloses the impact of technology or innovation

Output elasticties of Cropped Area, Land Preparation, Seed, Fertilizer, Pesticides, Irrigation and Labor were denoted as the $\delta 1$, $\delta 2$, $\delta 3$, $\delta 4$, $\delta 5$, $\delta 6$ and $\delta 7$ while the residual term to mention the effect of omitted variables gives as the ei

RESULTS AND DISCUSSIONS

Cost of production prominently divided into two categories fix cost and variable cost. Rent of land consider the fix cost in the crop production, while the expenditures on the inputs of the crop production like land preparation, seed, fertilizer, pesticides, irrigation, labor services expenditures and others intercultural expenditures consider the variable expenditures. Variable cost (expenditures) play vital role in crop production and variation noted in expenditures, from the respondents due to variation in inputs. Table 1 indicated average total cost (expenditures) of cotton production per acre Rs 67576.2, while per acre average production of cotton 32.52 (maunds). Total revenue of cotton production including cotton straws Rs 99996/- with net return per acre of cotton production Rs 32419.8 as pointed out in Table 2.

Benefit Cost Ratio (BCR): Equation (1) determined the benefit cost ratio of cotton production with comparison of total revenue and total cost as given below

Benefit cost ratio of cotton production = Total Revenue/Total Cost
Benefit cost ratio of cotton production = 99996/67576.2
Benefit cost ratio of cotton production = 1.479

Benefit cost ratio estimation points out that cotton cultivation is profitable in the district Muzaffargarh. Investment is profitable in cotton production if one invests Rs 1 in cotton production it gains 1.479 so net return is 0.479 in investment of Rs 1.

Net return in the cotton production can obtained through the equation of (2) as calculated below

Net Return in cotton production per acre = Total Revenue – Total Cost

Net Return in cotton production per acre = 99996 - 67576.2
Net Return in cotton production per acre = 32419.8

Price of cotton production, quantity of output produced and cost of production are three main factors, which play prominent role in cotton production per acre as given

P = Price of output of cotton production received by the farmers

Q = Quantity (output) of cotton production
C = Cost (expenditures) of the cotton production

Model estimation as by the equation no (4)
$\Pi = -1.005649 + 2.874190\ P + 4.544893\ Q - 2.359337\ C$
Standard Error ={3.250174} {0.807482} {0.298018} {0.244727}
t- ratio = {-0.309414} {3.559448} {15.25042} {-9.640674}
R-squared = 0.876945 Adjusted R-squared = 0.868920 F-statistic = 109.2724(Prob(F-statistic) 0.000000)

Table 1: Average cost of production of cotton cultivation in Muzaffargarh

Serial no	Inputs	Units	Quantity	Rate/Rs	Total Cost Rs
1	Tractor	Hour/per acre	10.083	400	4024
2	Seed	Kg/per acre	9.1	240.3	2158
3	Fertilizer				
3.1	Urea	Bag/per acre	2.96	1695.2	5014
3.2	Nitrophos	Bag/per acre	1.24	1200	1488
3.3	DAP	Bag/per acre	0.92	2664.23	2451.1
	Total fertilizer cost				8953.1
4	Irrigation	No/per acre	16.64	673.9	10697
5	Pesticides	No/per acre	6.6	1105.87	7392
6	Cotton picking	Rs per 40 kg	32.52	290.2	9452.1
7	Labor cost				
7.1	Land preparation	day/ per acre	1	300	300
7.2	Labor potha	day/ per acre	1	600	600
7.3	Labor fertilizer	day/per acre	4	300	1200
7.4	Labor irrigation	day/per acre	10	300	3000
7.5	Labor pesticides	day/ per acre	6	300	1800
	Total labor cost				6900
8	Rent of land	Kanal	8	2250	18000
Total Cost					67576.2

Table 2: Average total and net benefit of cotton cultivation in Muzaffargarh

Serial no	Item	Quantity(maunds)	Rate(maund)	Total
1	Cotton Production	32.52	3004.84	97746
2	Cotton straws	Per acre		2250
3	Total revenue			99996
4	Net revenue			32419.8

Model significance or the overall goodness of fit determined through the F- test. Model is considered significant or the goodness of fit if calculated value of F-test greater than the tabulated value F-statistics. In this model, calculated value of F-statistics, which is greater than tabulated value which mentioned the overall significance of model.

F-statistic = 109.2724 > F-tabulated = 3.32

The R-square denoted as coefficient of determination and its value mentions variation of dependent variable explained through the independent variables. In this model, R-square has the value of 88%, which shows the variation of dependent variables has been explained by independent variable. Economic theory regarding to profit function states, cost negatively affect profit while price of cotton production and quantity of cotton (output), positively affects profit.

Estimated sign of independent variables of exposed the consequences of explanatory variables according to theory.

The t-calculated greater than t-tabulated = 1.895 points out the t-ratios of the factors strengthen as profit of maize production significantly strong minded by the price of production, quantity of output produced and cost of production as mentioned in model while all others variables keeping constant. Findings of model elaborated as one rupee increase in price of cotton production increase profit 2.87 percent while increase in kg output quantity of cotton production increase profit 4.54 percent and one percent increase in cost of inputs will decrease the profit 2.35 percent. Profit function estimation points out profit function significantly affected by price of output, quantity of output and cost of inputs used in cotton production while the effect of quantity produced of cotton production higher than the other factors in the profit function model.

Estimation of equation 5 through Cobb-Douglas production function as given below

Ln Y = 1.490866 + 0.065976 Cropped Area + 0.322261Land Preparation + 0.887609Seed +0.319402Fertilizer + 0.536034 Pesticides + 0.219361Irrigation + 0.913785Labor (6)

Findings of Cobb-Douglas production function, cropped area, land preparation, seed, fertilizer, pesticides, irrigation and labor force participating in crop cultivation statistically significant and according to economic theory and expectations. Elasticity of cropped area 0.0659 denotes if one percent increase in cropped area increase cotton production 0.065 percent. Labor force elasticity of production 0.91 higher than all others variables which indicates as one percent increase in labor force increase in production 0.91 percent. Elasticties of production cotton of, land preparation, seed, fertilizers, pesticides and irrigation are 0.322, 0.887, 0.319, 0.536, 0.219 correspondingly clarified in such a way.

CONCLUSION

The findings of study pointed out profitability of cotton directly (positive) affected by price of cotton and production of cotton (output) while it inversely (negatively) affected to cost of production. The value of benefit cost ratio 1.479 validates the study profitability of cotton cultivation. It is determined cropped area, land preparation, seed, fertilizer, pesticides, irrigation and labor force participating in crop cultivation statistically significant and positively affects in cotton production. Proper policy measure required to implement and control market imperfections and stable price mechanism with subsidized, adequate and quality based inputs. Stable and supportive output prices of cotton production prerequisite for increasing output productivity and profitability for cotton farmers such type of measure will encourage farmers to improve farming practices and perk up socio economic status of farming community.

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