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Impact of Farm Inputs on Cotton Productivity in Pakistan: an Econometric Analysis (1980 - 2010)

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ABSTRACT

The study is conducted in 2013 to see the impact of area under cotton crop and fertilizers off-take on its productivity in Pakistan by considering time series data rsince1980 till 2010 by evaluating econometric techniques. The finding showed that one hectare increase in area under cotton cultivation brings about 0.87 tones increase in total cotton production while 1 percent increase in fertilizer off-take for cotton bring about 0.63 tones increase in cotton production. Due to positive, statistically significant at 5 percent and high value of R-squared (0.82) of the explanatory variables, it is recommended that more and more area under cotton cultivation, suitable and proper amount of fertilizers off-take should be managed to increase cotton production.

Keywords: Impact; farm inputs; area; fertilizer off-take; cotton productivity; econometric analysis.

INTRODUCTION

Cotton is the major cash crop of Pakistan it is also called “White Gold”. It brings cash returns to farmers, supplies raw materials to the Textile Industries and provides employment to the people both in rural and urban areas. In the world Pakistan is no. fourth producer and no. third consumer of cotton. During the time period 1980 – 2010 significant fluctuations in cotton production and its area under cultivation took place. In 1980 – 1981 the total area under cotton cultivation was 2108 thousand hectares which increases to 3106 thousand hectares in 2009 – 2010. In 1981 the total cotton production was 715 thousand tones which has increase to 2196 thousand tones in 2009 – 2010 (Statistical Supplement 2009 – 2010). On the other hand fertilizer off-take for cotton was 172 nutrient tones which has increase to 348.80 nutrient tones in 2009 – 2010 (NFDC). There are other inputs as well of cotton production in Pakistan but area under cotton cultivation and fertilizer off-take for cotton are Key inputs through which its production can be increased.

LITERATURE REVIEW

Number of studies has been conducted on this topic some of which are given below:-

Anwar (1998) concluded that if cost of cultivation, fertilizers, irrigation, Interculturing, hoeing, labour, plant protection, seeds & sowing are to be minimized and managed in good ways than overall cost of production would decrease and net income of the farmers would increase due to increase in overall production.

Anwar et.al (2009) applied Cobb Douglas production function to various inputs to see their effect on cotton yield. The results depicted that cost benefit ratio was 1.41 for large,1.24 for medium and1.22 for small farmers so that inputs should be provided by both public and private sectors to increase cotton production.

Carlos et.al (2002) introduced yield and acreage model for Pakistan, India and Australia. The result depicted was that cotton production depends on prices of cotton competing crops, fertilizers , area under cotton cultivation and time trend.

Hina et.al (2004) concluded that inputs involved in cotton production are cost intensive. The cost of land is high (Land Rent) while cost of seeds are lower and with the passage of time cost of production of cotton has increased which resulted in overall negative returns during 2002, 2006 and 2007.

Hassan (1991) became to know that costly inputs, scarce financial support, untrained farmers and no access to markets are main causes for the low yield per hectares and eventually less benefits to the farmers.

Khuda Baksh et.al (2005) used Cobb Douglas production function and revealed that high skilled farmers to prepare barren land for cultivation, high quality of seeds and protection of plants were contributing towards high cotton yield and among these variables plant protection measures had a positive effect on yield and was highly significant with 0.224 coefficients.

Muhammad Abid et.al (2011) also used Cobb Douglas production function to observe the effect of different agronomic and demographic variables on BT Cotton Productivity and found that focusing on maintenance and improving the quality of soil is necessary to get high yields.

Nabi Muhammad (1991) concluded that use of inputs variables has direct relationship with production and profit of farmers.
Sab. E. et. al (2009) concluded that among the cost of inputs variables the highest cost was of labour.

The current paper is different from the previous ones as it applies econometric techniques to show the impact of area under cotton cultivation and fertilizer off-take on its productivity in Pakistan using time series data.

MATERIALS AND METHODS

The current paper has been conducted in 2010 by applying econometric analysis of the impact of area under cotton cultivation and fertilizer off-take for cotton on its productivity in Pakistan.

Time Series Data from 1980 – 2010 on the above two inputs, the data has been collected from economic survey of Pakistan (Statistical Supplement 2009 - 2010). Augmented Dickey Fuller (ADF) test is used to check the stationary of the data. The Schwarz Info Criterion is used to select the stationary of data; variables which were non-stationary at level form have been made stationary after taking their first difference. Moreover Johnsons Co-Integration test is also used to analyze long term relationship among the series.

To show the impact of area under cotton cultivation and fertilizers off-take (Independent Variables) on total cotton productivity (dependent variable) the models of ordinary least square is used.

$$TCP = bo + + b1AUC + b2\ FOC$$

Where:
TCP = Total cotton production (000, tones) in Pakistan.
AUC = Area under cotton crop (000, hectares) in Pakistan.
FOC = Fertilizers off-take for cotton (000, nutrient tones) in Pakistan.

RESULTS AND DISCUSSIONS

Regression result of 3 variables are given below. The table shows that 1 hectare increase in area under cotton cultivation brings 0.87 tonnes increase in total cotton production and one percent increase in fertilizer off-take increases cotton production by 0.63 tones. Both the independent variables AUC and FOC have positive sign showing positive relationship with dependent variable TCP. Also coefficient of both independent variable are statistically significance at 5 percent level of significance the value of R-squared (0.82) and adjusted R-Squared (0.81) which is best fitted. It means both independent variables are explaining 82 percent of the variations in the dependent variable (TCP).

Dependent Variable: TCP
Method: Least Squares
Date: 09/03/13 Time: 10:47
Sample: 1981 2010
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AUC	0.870843	0.223157	3.902370	0.0006
FOC	0.632285	0.261256	2.420172	0.0225
C	-1154.972	506.4344	-2.280596	0.0307

R-squared	0.824760	Mean dependent var	1577.267
Adjusted R-squared	0.811780	S.D. dependent var	481.8105
S.E. of regression	209.0304	Akaike info criterion	13.61748
Sum squared resid	1179730.	Schwarz criterion	13.75760
Log likelihood	-201.2621	Hannan-Quinn criter.	13.66230
F-statistic	63.53738	Durbin-Watson stat	1.471790
Prob(F-statistic)	0.000000		

As Durbin-Watson Stats is (1.47) which is near to 2 so it shows there is no auto co-relation. Also the value of R-Squared is high (0.82) while values of individuals parameters are significant at 5 percent so it shows no multi co-linearity while applying the white test with cross terms also shows that the value of F-Statistics is in significant (1.234)which is less than 2 so there is no hetroscadisty.

The ADF test has been presented in table No.2. In table 2 the stationarity of data is been checked by taking both intercept and trend . Variables which were not stationery at level form have been made stationary after taking their first difference shown by I(1) and then second difference I(2) if needed.

Table 2 ADF Test result for stationarity (Including intercept and trend)

Variables	I(0) (Level Form)		I(1) (First Difference)		Results
	Test Statistic	Probabilities	Test Statistic	Probabilities	
TCP	- 3.478147 [0]	0.0608	-5.828 [2]	0.0003	I(1)
AUC	3.026148 [0]	0.142	- 4.0448 [6]	0.0224	I(1)
FOC	2.337918 [0]	0.4019	-5.470 [3]	0.0009	I(1)

values in square brackets along each statistics represent lag , length using the Schwarz info criterion using 7 as maximum lag.

Moreover there is a possibility of spurious regression results so the Johnsons co-integration test is used, the trace statistic values are given in Table 3 (Including both intercept and trend) which indicates the long term relationship among the taken variables and rejects the hypothesis of no co-integration because one of the absolute values of the trace statistic 43.041 is greater than its relevant critical value 42.915.

Table 3 Johnsons Co-Integration test results including intercept and trend

	Trace statistics	5 Percent	Prob**	Hypothesized
Eigenvalue		Critical Value		No. of CE(s)
0.595111	43.04146	42.91525	0.0486	None*
0.331942	17.72544	25.87211	0.3627	At most 1
0.205205	6.430797	12.51798	0.4076	At most 2

*(**) denotes rejection of the hypothesis at 5% Significance Level .

CONCLUSION AND RECOMMENDATIONS

From the whole above discussion it is absolutely clear that cotton production is mostly dependent upon its area under cultivation and fertilizers off-take in Pakistan.

1 hectares increase in area under cotton cultivation brings 0.87 tones increase in total cotton production while 1 percent increase in fertilizer off-take for cotton leads to increase cotton production by 0.63 tones. Both the explanatory variables are statistically significant at 5 percent level, positive and responsible for 82 percent of variation in response variable (TCP).

Government should make efforts to bring more and more area under cotton cultivation, appropriate and suitable fertilizer off-take for cotton crop must be ensured. Still there is increasing pressure under consumption of cotton production so appropriate agriculture input policy is needed in this sector.

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