ECONOMIC ANALYSIS OF INPUT TREND IN COTTON PRODUCTION PROCESS IN PAKISTAN

Hina Ali[1]
Muhammad Aslam[2]
Huma Ali[3]

ABSTRACT

Cotton is essential crop for Pakistan economy. The Cotton production process involves various inputs from land preparation to picking and marketing. The inputs involved are cost intensive and overtime the cost of production has increased. The highest share in the total cost was that of land rent (28.536 percent) and the lowest of seed (21.336 percent). Over the time, the maximum increase in input cost growth rate have been noticed in pesticide (8.98 percent). However the minimum input cost growth rate was observed in seed (4.26 percent). The increased in input cost have also resulted in overall negative return during 2002, 2002, 2006 and 2007.

Key Words: Cotton, Various Inputs, Return, Growth Rate, Percent, Negative Return

INTRODUCTION

Pakistan Cotton World Scenario

Agriculture is one of the major sectors of economy in Pakistan. The economic development of Pakistan mostly depends on agriculture. At the time of independence (1947) agriculture was contributing major share of the GDP. As the industrialization progressed, the position of agriculture sector was dominated by service sector and at present, agriculture share ranks third in the GDP of Pakistan. Agriculture sector also feeds/provides raw material to the domestic cotton industry. The agriculture sector contributed 20 % of GDP during 2007, whereas during 2008-09 its contribution was 21.8 % (Pakistan Economy survey 2008-09)[1]. Agriculture is the main source of employment in the country. The development report of UNDP for the year 2007-08 disclosed that 65 % of Pakistan population lives in rural areas. In rural areas agriculture in the only source of their employment and 44.7 of the total employed labor force in the country mainly depend on agriculture (Pakistan Economic survey 2008-09)[1]. Pakistan can be called the land of cotton. Cotton fabrics dates 3000 BC and has excavated in the Indus valley of Pakistan. There are four major cotton producing countries of the world. They are china, USA, India and Pakistan. Pakistan is world's fourth cotton producing country. Pakistan cotton yield comparison with world leading cotton producing countries is given in Table-1.

---

[1] Govt. Degree College, Multan, Pakistan
[2] Agri. Economist, Agri. Mechanization Research Institute Multan, Pakistan
[3] Institute of Information Technology, Lahore, Pakistan

Pakistan yield comparison with China indicates that there is a wide difference between both countries. During 2005 the China cotton yield was 38.22% higher and it was lowest higher whereas the maximum yield difference recorded was during 2007 which was 50.30 percent higher.

Pakistan yield also experienced lower tendency than that of USA. For the period from 2005 to 2009, the USA cotton yield remained 18.80 percent higher (2009). The highest difference was during 2007 and it was 34.47 percent. During 2005 to 2009, Pakistan yield showed higher trend than that of India. The minimum higher percentage was 14.24 (2007) and the maximum yield difference was recorded during 2005(34.54 percent). The yield comparison is also produced in graph-1

Pakistan cotton area as compared to the leading cotton producing countries remained lower than China, USA and India. The area Comparison is given in annexure-1

Cotton - Domestic Scenario

There are two major crop season in Pakistan, Rabi and Kharif. Cotton is Rabi crop and mostly grown in Punjab and Sind province. Cotton is cash crop and its value addition in agriculture is 7.3 percent and 106 percent to the country Gross Domestic Product. (Pakistan Economy survey 2008-09). Over the time period from 1947 to 2008, the area under cotton and per acre yield has increased at higher rate. The area has increased due to reasonable returns to the cotton growers. The per acre yield has increased due to introduction of new seed varieties, better and latest mechanized land preparation techniques, insect and disease control due to efficient plant protection measures and mechanical cultural practices etc. The following graphs exhibit overtime Pakistan cotton area, yield and production.

The graph-2 indicates that area under cotton has increased but not at constant increasing trend. The area under cotton depends on the previous year crop conditions. The higher return is an incentive for the grower to put more area under cotton. However the increasing cost of inputs and lower crop return have forced the cotton growers to switch over to other crops like rice etc.There had been upward and downward trend in yield and production also.

Production depends on area under cotton and per acre yield. Although, the per acre cotton yield have experienced increasing trend from 1947 to 2008. However the after 1983-84 the yield trend increased at higher rate. The intensity of pest attack and adverse weather conditions are two major sources of yield reduction. Pakistan cotton production and yield since 1947 are shown in graph-3 and graph-4 respectively.

Significance of Cotton Production Inputs

The cotton production process involves use of various inputs including land preparation, inputs like seed, irrigation water, fertilizer, pesticide and labor etc. Overtime, the prices of these inputs have increased resulting higher cost of production. In addition the cotton crop is susceptible to various pests attack and natural hazards like rain, hail storm and humidity etc. Different studies have been carried out by experts regarding input impact on cotton yield and production. The individual input effects studies have also been conducted. Sabo E, Daniel j.D (2009)[2] while carrying out economic analysis of cotton found that among the cost of inputs variables, the highest cost was of labor ($453.68). Khuda bux, et al.(2005)[3] while analyzing the factor affecting cotton yield found the cost of plant protection measures had a positive effect on yield and this variable was highly significant with coefficient of 0.224. Pakistan cotton yield remained sluggish up 1960. Afterward when green revolution was introduced and chemical fertilizers and new cotton varieties were introduced, the yield started increasing. During 1983-84 heavy rains badly damaged the crop and the country had to import cotton. During 1986 and up to 1992 the rate of textile mills installation increased at an increasing rate. The increasing trend of input use coupled with partial crop mechanization increased per hectare cost of production. It has been confirmed by various field

studies that although the appropriate use of inputs has resulted in increased yield, but the farmer profit share have gradually been reduced.

The cotton support price trend, prices of inputs and weather play crucial role in the cotton production process. The production process involves different inputs. Every input has its influence and plays a vital role in this process. The basic and foremost is land and its preparation has key influence on the crop condition. The other inputs include; seed, irrigational water, fertilizer and plant protection measures etc. all these inputs also play crucial role cotton production process. The cost of these inputs has influenced the cotton production in Pakistan. In order to identify the influence of these inputs the present study has been undertaken.The foremost purpose of the study is to analyze the most critical input regarding its cost over the time period. The main objectives of study are:

Objectives of the Study
The purpose of the study is to analyze the overtime input cost trend for crop production. However, the major objectives of the study are:-
1   To study the overtime cost of inputs trend in the cotton production process.
2   To find out the cost benefit of overtime cotton production process.

METHODOLOGY

The data required for doing cost-benefit analysis have been collected from different organizations of Pakistan. These institutions include Punjab Economic Research Institute (PERI) Lahore, Cotton Research Institute Multan and Apcom, Islamabad. These organizations overtime have prepared cost of production of cotton. After collecting data, analysis is based on Cobb Douglas production function. The Multiple Linear regression has been used to study the impact of individual input on total return. The model functional form is:

Linear

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + €$$

β's are coefficient of the relevant input;
Where Y = Total income/revenue rupees per acreage.
X_1= Cost of land preparation rupees per acreage
X_2= Cost of seed rupees per acreage
X_3= Cost of irrigation rupees per acreage
X_4= Cost of interculture rupees per acreage
X_5= Cost of the fertilizer used rupees per acreage
X_6= Cost of the plant protection rupees per acreage
Bs=Coefficient of the variables
€ =error term
α = constant

Cost-Benefit Analysis
The cost benefit has been calculated using following formula. Total benefit is termed as Net Return.
TC   = Total Cost of production
TR   = Total revenue earned
Net Return   = TR-TC

Results and Discussion

The linear multiple regression models were used to access the impact of each input on total return. The variables included are seed, land preparation, fertilizer, interculture, irrigation and plant protection. The cost and return are taken in rupees. The R^2 value of 0.97 indicates that about 96 percent variation in Total return is explained by independent variables included in the model.

Estimated Model

TR = 1040.683 - 4.160*FERT + 2.186*IRRI + 21.606*ITCL - 3.588*LP + 1.206*PP + 19.271*SEED

The Impact/influence of independent variable on return is explained below:

Land preparation

Land preparation is one of the most important factors for achieving maximum return. The coefficient of land preparation is negative indicating that even 1 rupee invested on land preparation will decrease total revenue by 3.588 rupees.

Seed

Seed is an important input in cotton production. The model result indicates that 1 rupee invested in seed will result an increase of 19.271 rupees in total return achieved from on acre of cotton. This investment in seed implies that further investment in seed mean to get better quality of seed resulting in higher production ultimately enhancing total return. The coefficient of seed (19.2) is positive and statistically significant at 1 % level showing that the farmers are using good quality and recommended variety and the quantity of seed.

Irrigation

Irrigation represents to apply water to the crop. Timely application of water is essential for enhancing crop growth. Irrigation water. If one rupee is invested in irrigation, the total return will increase by 2.18 rupees. Statistically it is significant at one percent level.

Fertilizer

Application of fertilizer is essential however according to the data available and analysis it is evident that farmers were spending maximum on fertilizer. Therefore the negative coefficient forbids to spend even one rupee otherwise the total revenue will decrease by rupees 4.16.

Interculture

Intercultural practices mean eradication of weed that adversely affects the crop yield. Different studies have highlighted much importance to interculture. For the present analysis, interculture has shown high significance. This variable has shown the highest t value (5.76) among all other included variables. The coefficient is the highest among all others variables included in the model. It explains that one rupee invested for interculture, will result in increase of rupees 21.60 in the total revenue.

Plant Protection

Application of pesticide covers plant protection. To save crop from pest attack, plant protection is very necessary. It further expresses that investing one rupee on plant protection; the total return will be increased by 1.20 rupees. Khuda bux, et al (2005) while analyzing the factor affecting cotton yield found the cost of plant protection measures had a positive effect on yield and this variable was highly significant with coefficient of 0.224.

Correlation Matrix

The correlation matrix indicates if there exists a linear relationship between two variables. The correlation coefficient value lies between 0 and 1. The value 0 depicts no relationship whereas value of 1 indicates perfect correlation. Table-3 explains the correlation between the variables.The correlation matrix explained in table-2 depicts that there is positive and high correlation between the variables. The diagonal matrix shows a value of 1 as the variable with itself has a perfect correlation.

Inputs Growth Rate

The overtime growth rate of the cost of the variables incorporated in the study have shown positive and increasing trend. However the growth rate of the cost of plant protection was the highest (8.98%), whereas, the seed growth rate (4.26%) was the lowest amongst all the variables. It was attributed to high intensity of pest attacks, resulting increased number of pesticide applications which ultimately resulted in higher cost. The lower seed cost growth rate depicted the dependence of cotton growers on their own farm seed. It also indicated that the use of new cotton seed varieties was limited to a few farmers. The Inputs cost growth rate in given in fig-1

Input Share (%) in Total Cost of Production

The each input share in the average total per acre cost of cotton production is given in Fig-1 .Among the variable inputs, the major and highest percent share (28.536) was of land rent. Whereas the lowest percent share (2.1336) was of the seed. Plant protection share remained 15.91 percent. It was second highest input share after land rent. The others variable include labour cost, management charges, and abiana and usher charges and their cumulative share remained 17.01 percent. APCOM 2004-2005 calculated that in the total per acre cost of production of cotton, the highest share was of land rent (23 percent) followed by fertilizer (19 percent). The land rent cost share was the highest among all other inputs.

Cost-Benefit

The cost benefit has simply been calculated by subtracting total revenue by total cost. For the early ten years the net return has not been found significant. However, the year 1998 and 1999 have shown the highest per acre total return. The year 2000, 2002, 2006 and 2007 have shown negative return to the farmers. The total cost for these four years have increased from the total return mainly due to increasing cost of inputs and lower sale price of the produce which even have not covered the cost. The graphical representation of total cost, total return and net return is presented in the graph-5.

The graph-5 depicts that up to 1984 there was not much difference in the total cost and total revenue resulting a nominal per acre net return. However the net return showed increasing trend except during the year 2000 2002, 2006 and 2007. The per acre net return for these four years was Rupees, -1451, -1852.20, -1696.80 and -1065.58 respectively.

CONCLUSIONS

The analysis has revealed that the input cost has increased over time. The cost of seed, irrigation and interculture has shown significant relation with total return. The negative return indicated that the cost of inputs have increased at increasing rate. The highest (8.89 percent) input cost growth rate was observed in case of plant protection. Whereas the lowest cost growth rate was found in case of seed. The major share (28.536 percent) in the total cost of production was that of land rent and minimum was that of seed (2.1336 percent). The correlation matrix has shown a positive correlation among the input variables. In order to assist farmers to cover the loss, either cost of inputs should be decreased or the cotton support price be increased so that the cotton growers

should continue growing seed cotton. If there exists an increasing trend in the input cost, the cotton growers will shift gradually to other competitive crop like rice and sugarcane.

REFERENCES

Government of Pakistan.2008-09 "Economic Survey of Pakistan (Various issues)" Ministry of Finance, Economic Advisor's Wing, Islamabad.

Sabo E, Daniel, J. D and Adeniji O.T (2009) "African Journal of Agricultural Research" Vol. Vol.4, No.5, pp.438-444.

Baksh. K., Ishtiaq Hassan & Asif Maqbool (2005) "Factors affecting cotton yield: a case study of Sargodha (Pakistan)" Journal of Agriculture & Social Sciences, 1833-2235/2005/o1-4-332-334.

Chaudhry Imran Sharif, Muhammad Bashir Khan, Mumtaz Anwar (2009) "Factors Affecting Cotton Production in Pakistan: Empirical Evidence from Multan District", Journal of Quality and Technology Management Volume V, Issue I1, Dec, 2009, pg. 91-100.

Government of Pakistan (2007-08) "Agricultural Statistics of Pakistan (Various issues)" Ministry of Food, Agriculture and Livestock, Economic Wing, Islamabad.

Government of Pakistan (1997) "Fifty years of Pakistan in Statistics, 1947-1997" Federal Bureau of Statistics, Ministry of Finance and Economic Affairs, Islamabad.

National Cotton Council of America ,World cotton database (2009-2010), 1521 New Hampshire Ave NW Washington DC 20036-1205

Table-1. Cotton Yield Comparison with Other Countries Lbs/acre

Year	China	India	USA	Pakistan	< China	> India	< USA
2005	1,031	417	831	637	394(38.22%)	220(34.54 %)	194(23.35 %)
2006	1,149	462	814	592	557(48.48 %)	130(21.99%)	222(27.27 %)
2007	1,159	494	879	576	583(50.30 %)	82(14.24 %)	303(34.47%)
2008	1,188	467	813	603	585(49.24)	136(22.55%)	210(25.83%)
2009	1,177	451	782	635	542(46.05 %)	184(28.98%)	147(18.80 %)

Table-2. The cotton production function Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1040.683	403.2996	2.580422	0.0161
FERT	-4.160006	2.982516	-1.394798	0.1753
IRRI	2.186018	0.612539	3.568779	0.0015
ITCL	21.60635	3.749646	5.762237	0.0000
LP	-3.587815	1.513892	-2.369928	0.0258
PP	1.206273	0.951103	1.268289	0.2164
SEED	19.27067	4.365419	4.414391	0.0002
R-squared	0.973728	Mean dependent var		9196.534
Adjusted R-squared	0.967422	S.D. dependent var		7164.382
S.E. of regression	1293.121	Akaike info criterion		17.35814
Sum squared resid	41804019	Schwarz criterion		17.67877
Log likelihood	-270.7303	F-statistic		154.4285
Durbin-Watson stat	1.555526	Prob(F-statistic)		0.000000

Table-3. Correlation between the Variables

	TR	FERT	IRRI	ITCL	LP	PP	SEED
TR	1.000000	0.954667	0.819381	0.961735	0.916786	0.959274	0.905775
FERT	0.954667	1.000000	0.895525	0.966414	0.980508	0.966669	0.891712
IRRI	0.819381	0.895525	1.000000	0.811257	0.917229	0.841285	0.697844
ITCL	0.961735	0.966414	0.811257	1.000000	0.940834	0.940660	0.850694
LP	0.916786	0.980508	0.917229	0.940834	1.000000	0.929359	0.857195
PP	0.959274	0.966669	0.841285	0.940660	0.929359	1.000000	0.905699
SEED	0.905775	0.891712	0.697844	0.850694	0.857195	0.905699	1.000000

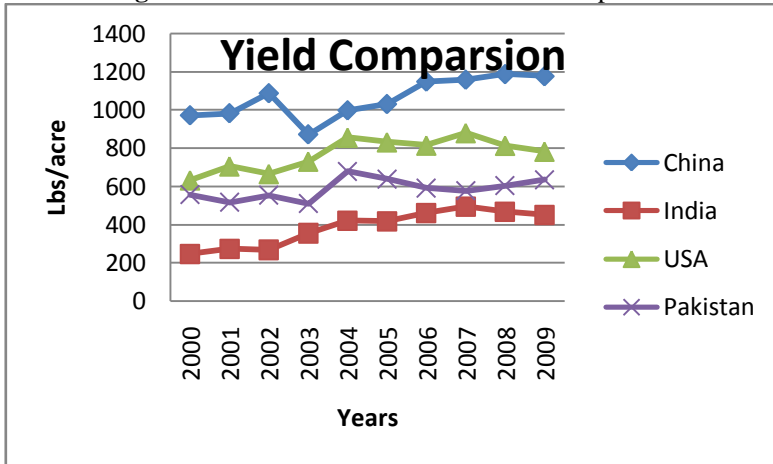**Fig-1.** Pakistan and World Cotton Yield Comparison

Fig-2. Pakistan cotton Area
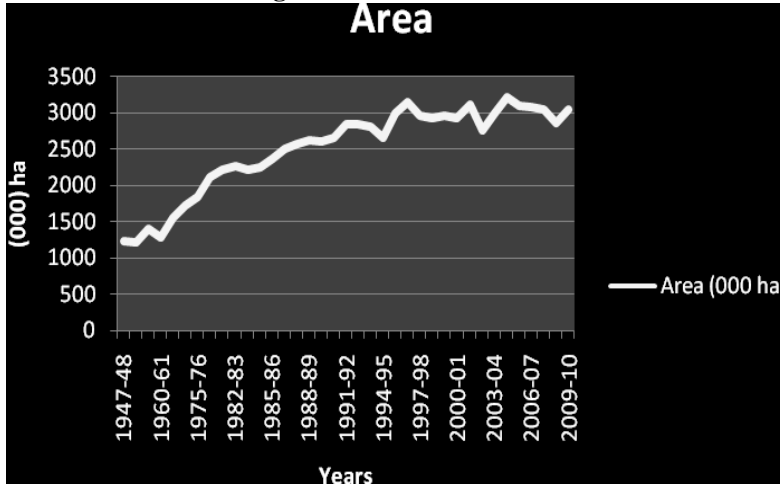

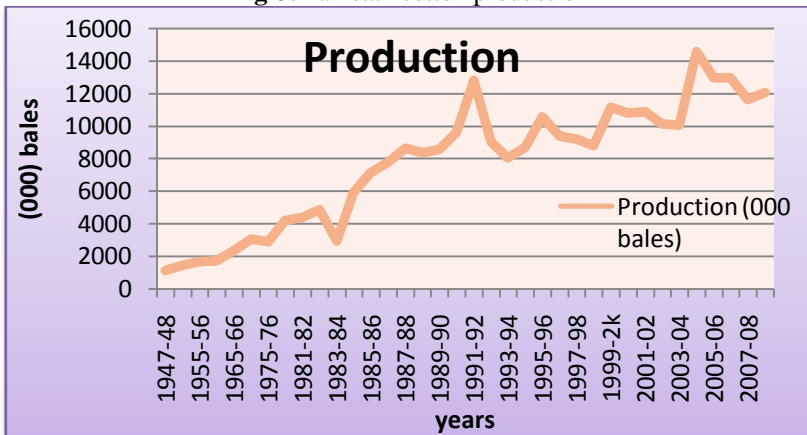**Fig-3.** Pakistan cotton production

Fig-4. Pakistan Lint Yield

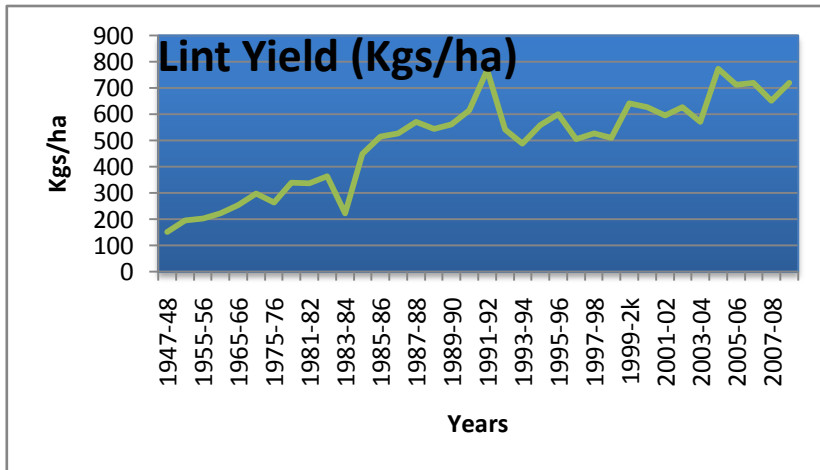**Source:** (Agri statistics of Pakistan, various issues)
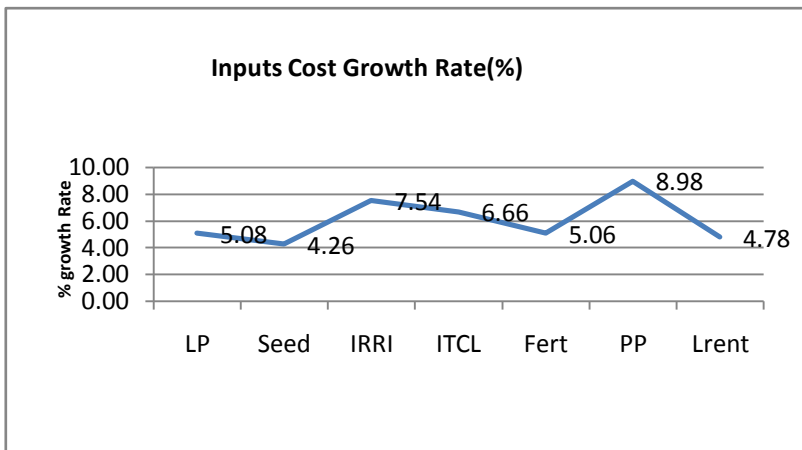
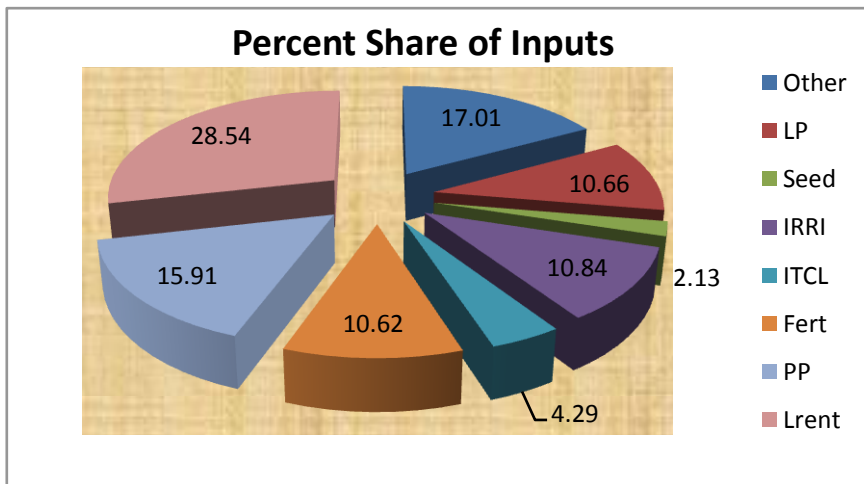**Fig-5.** Input growth rate

Figure-6. Input percent Share

Fig-7. Cost and Return