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DYNAMICS OF COTTON CULTIVATION IN PUNJAB AGRICULTURE

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ABSTRACT

The study has revealed that the productivity and returns of cotton cultivation has increased substantially in Punjab during the last decade, producing cotton at the highest yield per hectare in India. The study employed the plot level data of Cost of Cultivation Scheme by the Directorate of Economics and Statistics and analyse the input-wise cost of cultivation of cotton in Punjab. During 2000-01 to 2010-11 the cost of production has increased at a trend growth rate of 10.9 percent whereas the value of production has accelerated at a much higher growth rate of 17 percent, leading to the boost in net returns of the cultivators and prove to be a profitable commercial crop of Punjab.

KEYWORDS

Cotton, productivity, net returns, Punjab.

INTRODUCTION

Cotton, the king of fibers, is a significant agricultural commodity, traded all over the world. Cotton, popularly known as 'White Gold', plays a dominant role in the agrarian and industrial activities of the nation both as a crop and a commodity and has a unique place in the Indian economy. Cotton is produced in more than seventy countries. However, only four countries namely-China, India, the US and Pakistan produce about two-thirds of the world's cotton. According to the estimates of Cotton Corporation of India Ltd., China is the largest cotton producer with a share of 27.3 percent followed by India (21.6 percent), US (12.7 percent) and Pakistan (8.6 percent) in the year 2012-13.

India has progressed substantially in improving both production and productivity of cotton over the last decade. The average cotton yields increased steadily over time in India, almost in a linear fashion until 2002, but after the adoption of Bt cotton average yields increased dramatically. In 2011-12 about 90 percent area of cotton in India is under Bt cotton seeds. Cotton is produced in three zones of India i.e. the *Northern zone*, comprising the states of Punjab, Haryana and Rajasthan, the *Central zone*, comprising Maharashtra, Madhya Pradesh and Gujarat and the *Southern zone*, comprising Andhra Pradesh, Karnataka and Tamil Nadu.

Punjab has the highest cotton yield per hectare among the major cotton producing states of India. It is an important commercial cash crop of semi-arid region of Indian Punjab. The state has covered 0.48 million hectare area under cotton cropping (about 4.72 percent area of country area under cotton) and produced 2.10 million bales (each 170 kg.) i.e. about 6.36 percent production of the country during 2012-13 (Cotton Corporation of India Ltd.). In 2004-05 use of Bt cotton seed was certified in Punjab and sharply covered area under bt cotton seeds. In this context, it becomes imperative to make a situation assessment on the trends of cotton production and productivity in Punjab agriculture during the last decade.

OBJECTIVES OF THE STUDY

In this study an attempt has been made to estimate

- trend of productivity and return of cotton in Punjab over the period of time;
- changing composition of cost of production of cotton in Punjab during last decade;
- the responsiveness of cost of inputs to value of output of cotton in Punjab.

DATA AND METHODOLOGY

Data for this study were taken from the "Cost of Cultivation Scheme" run by the Directorate of Economics and Statistics, Ministry of Agriculture. Under this scheme, data were collected from a sample of 300 farm households in 30 tehsils spread across three agro-climatic zones of the Punjab state. From each zone, farmers were selected using three-stage stratified sampling technique, with tehsil as stage one, a village or cluster of villages as stage two and operational holdings within the cluster as stage three. From each cluster, a sample of 10 operational holdings, two each from the five size-classes, viz. marginal (< 1 ha), small (1-2 ha), semi-medium (2-4 ha), medium (4-10 ha) and large (≥ 10 ha), were selected randomly. In this study the data related to cotton cropping were collected from 2000-01 to 2010-11 at Plot level, while the data of two years viz., 2006-07 and 2008-09 was missing. Hence, the given study presents the analysis of returns and cost of production of cotton over the period of ten years i.e. from 2000-01 and 2010-11 and to determine the responsiveness in time series form. Tools of analysis used in the study include firstly the descriptive techniques that include tabular and graphical technique of analysis along with compound annual growth rate and secondly deal with relationship analysis using multiple regression.

Compound Annual Growth Rate (CAGR) has been computed as:

$$\text{CAGR} = ((\text{EV} / \text{BV})^{1/n} - 1) * 100 \quad \dots (1)$$

Where EV is the ending value, BV is the beginning value, and n is the number of years.

While the multiple regression procedures will estimate a linear equation of the form:

$$Y = \beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \beta_3 * X_3 + \beta_4 * X_4 + \beta_5 * X_5 + \beta_6 * X_6 + \beta_7 * X_7 + e \quad \dots (2)$$

Where Y = value of output, β_0 - intercept, β_{1-7} - regression coefficients, X_1 - Total labour cost;

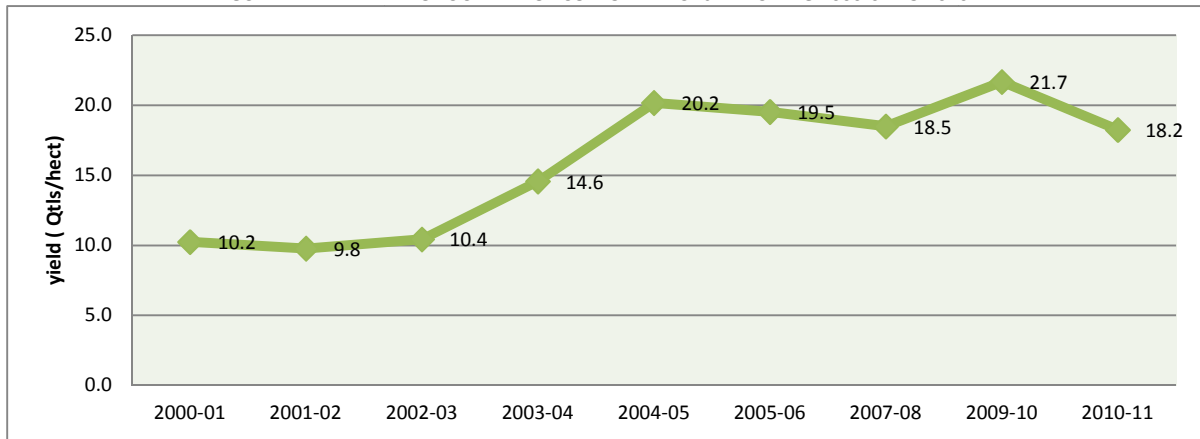
X_2 - Total animal cost; X_3 - Machine cost, X_4 - Irrigation machine cost, X_5 - Seed Cost; X_6 - Fertiliser cost; X_7 - Insecticides cost; e - error/residual term.

TRENDS IN PRODUCTIVITY, RETURN AND COST OF CULTIVATION OF COTTON IN PUNJAB

Cotton is a major cash crop in the south western districts of the state, known as cotton belt of Punjab. In the last decade the production and yield of cotton has shown a remarkable progress despite of the marginal increase in the area under cotton (Cotton Corporation of India Ltd.). The figure 1 illustrates the trend in the productivity of cotton in Punjab during the period under study i.e. from 2000-01 to 2010-11. As indicated by the figure productivity of cotton in Punjab has shown an increasing trend specifically after the year 2002-03, during this year Bt cotton was introduced in India but it has witnessed a significant increase in the cotton yield in the year 2004-05 when the use of Bt cotton seed was certified in Punjab. As it has jumped from 10.4 quintal per hectare in 2002-03 to 20.2

quintal per hectare in 2004-05 and further moved to 21.7 quintal per hectare in 2009-10. The cotton yield has registered a slight decline in few years viz. 2007-08 and 2010-11 due to bad weather conditions, but overall the productivity of cotton in Punjab has an increasing trend during the last decade.

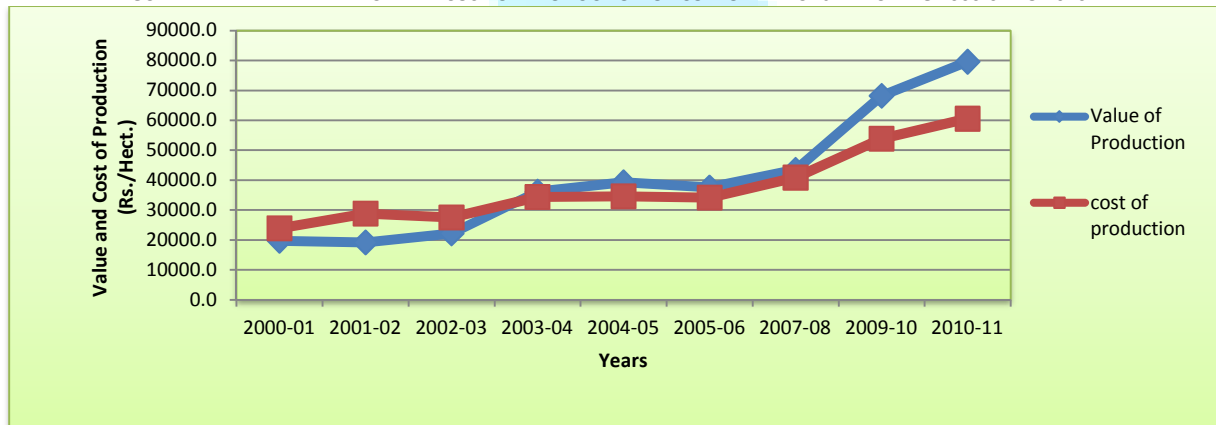
FIGURE 1: TREND IN PRODUCTIVITY OF COTTON IN PUNJAB DURING 2000-01 TO 2010-11



Source: Calculated by authors using Plot-level CCS data, DES

Figure 2 presented the value and cost of production of cotton in the state during the period under study. As indicated from the figure that both cost as well as the value of production of the cash crop cotton has an increasing trend but it has been observed from the figure that prior to 2003-04 the cost of production was relatively higher than the value of production resulting in negative returns (Figure 3) but after the year 2003-04 value of production has improved drastically due to the increase in the productivity of cotton in Punjab. As clear from the figure 3 the net return became positive in the year 2003-04 and has accelerated sharply since 2007-08, resulted to be profitable crop in Punjab.

FIGURE 2: TREND IN THE VALUE AND COST OF PRODUCTION OF COTTON IN PUNJAB DURING 2000-01 TO 2010-11



Source: Calculated by authors using Plot-level CCS data, DES

FIGURE 3: NET RETURN OF COTTON IN PUNJAB DURING 2000-01 TO 2010-11



Source: Calculated by authors using Plot-level CCS data, DES

CHANGING COMPOSITION OF COST OF PRODUCTION OF COTTON IN PUNJAB

To estimate the changing composition of cost of production of cotton in Punjab during last decade the compound annual growth rate (CAGR) of various components of cost of cultivation has been calculated and analysed (Table 1). As depicted from the table the productivity of cotton has increased at a trend growth rate of 6.6 percent per annum over the last decade. During 2000-01 to 2010-11 the cost of production has increased at a growth rate of 10.9 percent while the value of production has accelerated at a higher compound annual growth rate of 17 percent, thereby increasing the net return of the cultivators. By

analysing the growth of various components of cost of cultivation for cotton in Punjab, it has been pointed out that the cost of seeds has grown rapidly at a trend growth rate of 25.4 percent per annum mainly due to the practice of genetically modified seeds, (in comparison to cost of seeds the quantity used has declined significantly) and also the insecticides cost has shown no growth over the period under study.

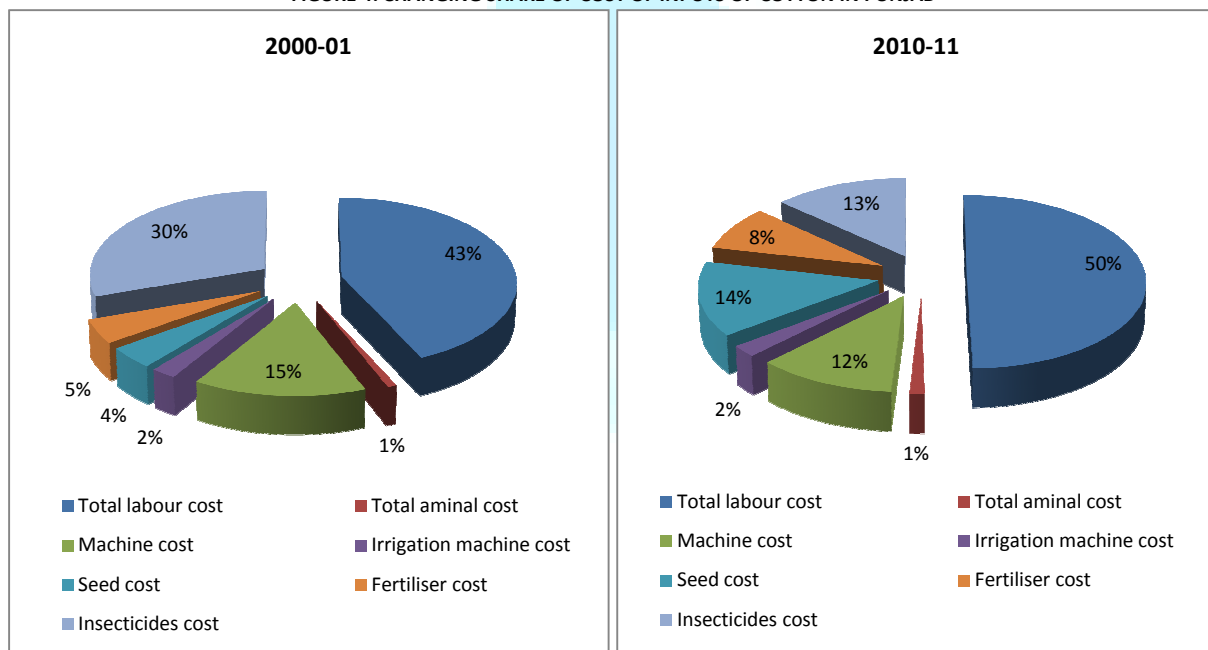
TABLE 1: GROWTH OF COMPONENTS OF CULTIVATION AND PRODUCTION DATA OF COTTON IN PUNJAB DURING 2000-01 TO 2010-11

Indicators	CAGR (2000-01 to 2010-11) (In percentage)
Productivity (Qtls/hect.)	6.6
Value of Production (Rs./Hect.)	16.9
Cost of production (Rs./Hect.)	10.9
Labour cost (Rs./Hect.)	11.5
Animal cost (Rs./Hect.)	14.4
Machine cost (Rs./Hect.)	6.8
Irrigation machine cost (Rs./Hect.)	9.9
Cost of seeds (Rs./Hect.)	25.4
Fertilizer cost (Rs./Hect.)	17.1
Insecticides cost (Rs./Hect.)	0.0

Source: Calculated by authors using Plot-level CCS data, DES

Figure 4 examined the changing composition of cost of cultivation for the cotton crop in Punjab at a two point of time i.e. during the year 2000-01 and 2010-11. It can be noticed from the figure that the share of total labour cost has risen from 43 percent to 50 percent, seed cost share has increased significantly from 4 percent to 14 percent and the insecticide cost share has declined from 30 percent to 13 percent over the period of time. These components of cost has shown the major change over the period of time while there was slight change in the shares of machine cost and fertilizer cost i.e. from 15 to 12 percent and 5 to 8 percent respectively during the years 2001-02 and 2010-11. But the shares of animal and irrigation machine cost remained unaltered.

FIGURE 4: CHANGING SHARE OF COST OF INPUTS OF COTTON IN PUNJAB



Source: Calculated by authors using Plot-level CCS data, DES

DETERMINANTS OF VALUE OF PRODUCTION OF COTTON IN PUNJAB

To examine the responsiveness of cost of inputs to value of output of cotton in Punjab the multiple regression has been applied. From the table 2 it has been observed that all the cost components have statistically significant impact on the value of output. The various input cost viz. labour cost, machine cost, irrigation machine cost, seed cost and fertilizer cost has positively significantly affected the value of production of cotton whereas the animal cost and insecticide cost have a negative significant affect on the value of cotton production at 1 percent level of significance. The Adjusted R² value has recorded at 43 percent while F test has a significant value (F value - 1233.14), thus it has reasonably explained the variability and model has a good fit.

TABLE 2: MULTIPLE REGRESSION RESULTS

Variable	Parameter Estimate	Standard Error	t Value
Intercept	8983.40*	411.89	21.81
Total labour cost	2.22*	0.03	62.34
Total animal cost	-3.29*	0.24	-13.61
Machine cost	1.25*	0.05	23.21
Irrigation machine cost	0.17**	0.07	2.33
Seed Cost	1.64*	0.09	17.21
Fertiliser cost	4.93*	0.15	33.38
Insecticides cost	-0.49*	0.06	-7.81
Adj. R ²	0.43		
F Value	1233.14*		

Source: Calculated by authors using Plot-level CCS data, DES

Notes: *= 1% level of significance and **= 5% level of significance

CONCLUSION

Based on the empirical data and its analysis, thus it can be concluded that in Punjab cotton production and yield has improved steadily over the last decade i.e. 2000-01- to 2010-11 despite of the marginal increase in acreage. While both value of output and cost of production has an increasing trend but the rate of increase in value of output was observed to be much higher than the cost of production. As such the net returns has accelerated from negative to positive side specifically after 2003-04 resulting into a profitable cash crop of Punjab. During the last decade, it has been evident that in the composition of cost of cultivation there was a major increase in labour and seed cost while there was a remarkable decline in the insecticide cost.

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