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Economic Analysis and Resource Use Efficiency of Cotton Production in Haryana

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ABSTRACT

The study was conducted on the economic analysis of cotton crop and its returns in two districts viz. Sirsa and Hisar of Haryana selected purposely having the highest area. The collected data was used to calculate the cost and returns and resource use efficiency of cotton crop in Haryana. The cost benefit ratio for the study area came out as 1:1.22, 1:1.04 and 1:1.13 Sirsa, Hisar and overall, respectively. The findings concluded that resource use efficiency of the cotton farms is showing decreasing returns to scale in both Sirsa (0.419) and Hisar (0.413) districts, which means that there is no scope for improvement in the yield of cotton and there is over-utilization of the resources for the cotton cultivation in Haryana.

INTRODUCTION

Cotton is botanically identified as Gossypium spp. and is a member of the mallow family (Malvaceae). Cotton can be cultivated in a variety of soil types, but medium to deep black clayey soil is the most ideal. Farmers can also grow cotton on sandy and sandy loam soil by adding additional irrigation (Ahmad et al., 2016). Both irrigated and rain-fed systems are used to cultivate cotton. In Haryana, the total area planted with cotton was 6.95 lakh hectares, yielding 20.5 lakh bales at a rate of 500 kg/ha in the year 2021–2022 (Singh et al., 2022). As a result, even if the area planted in cotton has reduced from the previous year, production and yield per hectare have increased, indicating that farmers have adopted improved farming practices (Kumari et al., 2022). Understanding and awareness of stakeholder views and opinions may assist in planning and management of the Bt cotton production. (Yadav et al., 2017). By generating direct and indirect jobs in the industrial and agricultural sectors, cotton has a prominent position among several cash crops that influence the nation's economic growth at various stages (Gamanagatti et al., 2012).

Resource use efficiency has a substantial impact on agricultural revenue and production. (Singh et al., 2021). The economic analysis tools may be used to assess the feasibility of cultivation practices (Kumar et al., 2021). The most crucial inputs in agriculture are labour, seeds, bullock labour, hired labour, working capital, farm equipment and machinery, irrigation systems, manure and fertilisers, and crop protection methods (Shelke et al., 2016). The efficiency with which farmers can utilise these resources influences the income from their farms. The income and savings of farmers can be enhanced by using available resources more effectively (Shankar & Naidu, 2017).

METHODOLOGY

The present study was carried out in Haryana state. Two districts were selected purposively from the State namely, Sirsa and Hisar as these districts have the highest area under cotton. Blocks were selected at random from each selected district namely, Dabwali and Sirsa, from the Sirsa district, Adampur and Uklana from the Hisar district. Two villages were selected randomly from each selected block. In this way, a total number of eight villages, viz; Ashakhera and Ganga from Dabwali block; Kelnia and Khairekan from Sirsa block of Sirsa district. Sadalpur and Siswal from Adampur block; Prabhuwala and Surewala from Uklana block from Hisar district

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were selected. For computing, the cost and returns of the cotton crop; cost of farm inputs, variable as well as fixed cost, gross returns, returns over variable cost and net returns of cotton growers were calculated separately for both the districts i.e. Sirsa and Hisar. Data on a variety of costs, including preparatory tillage, seed, fertiliser, plant protection chemicals, human labour, machine labour, irrigation, harvesting, etc., were calculated for various types of farms. These expenses made up the operating capital. Also, a 10 per cent annual interest rate was calculated on the working capital. The variable cost was made up of interest and working capital combined. The rental value of the land, transportation cost, management fees, and risk considerations were all included in the calculation of the fixed cost of cultivation per acre. By adding the variable cost to the fixed cost, the overall cost was approximated. The per-acre cotton yield was multiplied by the actual price paid to the farmers to determine gross returns. The net return and returns over variable costs were computed by subtracting the corresponding costs from the gross returns. Also, production function analysis was applied to calculate the cotton production's resource use efficiency.

RESULTS AND DISCUSSION

The costs incurred and returns realized from the cotton cultivation by the respondents are presented in Table 1. It could be seen from the table that in Sirsa district, the total cost occurred in cultivation of cotton was Rs. 118310 per ha, out of that 61.98 per cent was variable cost and 38.02 per cent was fixed cost. In the variable cost, the share of human labour for harvesting/picking was major factor amounting to Rs. 21104 (17.84%). Other major variable costs such as plant protection chemicals, fertilizers and seed contributed 16.07, 7.40 and 3.57 per cent of the total cost occurred in cultivation, respectively. Among the fixed cost, rental value of land accounted the highest cost i.e., Rs. 26163 (22.11%). Management charges, risk factor and transportation accounted for 6.20, 6.20 and 3.51 per cent of the total cost respectively.

Similarly, for Hisar district, the total cost occurred in cultivation of cotton was Rs. 110170 per hectare, out of that 61.33 per cent of the total cost was variable cost and 38.67 per cent was fixed cost. In variable cost, the share of plant protection was major

Table 1. Cost of cultivation and returns of Cotton production in Sirsa, Hisar and Overall (Rs./ha)

S.No.	Particulars	Sirsa			Hisar			Overall		
		Qty.	Value	%*	Qty.	Value	%*	Qty.	Value	%*
1	Preparatory tillage	2.2	3326	(2.81)	2.4	3410	(3.10)	2.3	3368	(2.95)
2	Pre-sowing Irrigation		1361	(1.15)		1435	(1.30)		1398	(1.22)
3	Sowing		1360	(1.15)		1243	(1.13)		1301	(1.14)
4	Ridging		396	(0.33)		381	(0.35)		388	(0.34)
5	Seed (qtl.)	5.4	4227	(3.57)	6.0	4454	(4.04)	5.7	4341	(3.80)
	(a) Nitrogen	294.7	1769	(1.49)	285.8	1715	(1.56)	290.2	1742	(1.52)
	(b) Phosphatic	87.3	2074	(1.75)	108.7	2622	(2.38)	98.0	2348	(2.06)
	(c) Potassic	76.7	1423	(1.20)	90.9	1561	(1.42)	83.8	1492	(1.31)
	(d) Zinc Sulphate	15.3	495	(0.42)	18.1	598	(0.54)	16.7	547	(0.48)
	(e) Magnesium		2140	(1.81)		1310	(1.19)		1725	(1.51)
	(f) Sulphur		849	(0.72)		623	(0.57)		736	(0.64)
6	Total Fertilizer Investment		8750	(7.40)		8428	(7.65)		8589	(7.52)
7	Fertilizer Application		899	(0.76)		901	(0.82)		900	(0.79)
8	Irrigation	5.2	3085	(2.61)	4.7	3063	(2.78)	4.9	3074	(2.69)
	Hoeing/Weeding									
9	(a) Chemical									
10	(b) manual		4403	(3.72)		4254	(3.86)		4328	(3.79)
11	Plant Protection	4.1	19016	(16.07)	4.0	22415	(20.35)	4.0	20716	(18.13)
12	Harvesting/Picking		21104	(17.84)		12430	(11.28)		16767	(14.68)
13	Miscellaneous		2242	(1.90)		2244	(2.04)		2243	(1.96)
	Total (1to 13)		70170	(59.31)		64657	(58.69)		67413	(59.01)
14	Interest on working Capital		3158	(2.67)		2910	(2.64)		3034	(2.66)
	(A) Variable cost (1 to 14)		73327	(61.98)		67566	(61.33)		70447	(61.67)
15	Management charges		7333	(6.20)		6757	(6.13)		7045	(6.17)
16	Risk factor		7333	(6.20)		6757	(6.13)		7045	(6.17)
17	Transportation		4155	(3.51)		4155	(3.77)		4155	(3.64)
18	Rental value of land		26163	(22.11)		24935	(22.63)		25549	(22.36)
	(A) Fixed Cost (15 to 18)		44983	38.02		42603	38.67		43793	38.33
	Total Cost (A + B)		118310	(100)		110170	(100)		114240	(100)
	Production (qtl./ha)	16.0	144384		12.8	114605		14.4	129494	
	Gross return		144384			114605			129494	
	Return over variable cost		71056			47039			59048	
	Net return		26074			4435			15255	
	Cost of Production/(qtl.)		7383			8600			7924	
	B:C Ratio		1:1.22			1:1.04			1:1.13	

component amounting to Rs. 22415 (20.35%) followed by picking (11.28%), fertilizers (7.65%), seed (4.04%) and irrigation (2.78%). The findings were similar to Dhakal et al., (2018) & Ahmad et al., (2019) who revealed that variable costs such as expenses on plant protection, fertilizers and labour charges form the major portion of total cultivation costs.

The average yield of cotton was 16 qtl/ha in Sirsa and 12.8 qtl/ha in Hisar. The gross returns were found to be Rs. 71056 and Rs. 47039 in Sirsa and Hisar districts, respectively, whereas net returns from both the districts were found to be Rs. 26074 and Rs. 4435, respectively. The cost of production was found Rs. 7383 per qtl in Sirsa and in case of Hisar it came out to be Rs. 8600 per qtl. The BC ratio was found to be 1.22 and 1.04 for Sirsa and Hisar, respectively. Overall total cost of cultivation was found to be Rs. 114240 while the gross and net returns were Rs. 129494 and Rs. 15255, respectively. The BC ratio on total cost was estimated to be 1.13. The findings were similar to Abid et al., (2011) who revealed that cotton is a profitable crop enterprise in areas where there is water scarcity.

Resource use efficiency

For cotton cultivation, Cobb-Douglas production function has been estimated. Marginal value productivities (MVPs) of various inputs that were employed and whose regression coefficients were determined to be significant were derived from the empirical production function. The coefficient of regression, standard error, and multiple determination coefficient of the production function suitable for the cultivation of cotton on sample farmers in the research areas are shown in Table 2. The estimated multiple determination coefficient (R^2) disclosed that selected inputs human labour, machine labour, seed, fertilizers, plant protection and irrigation were capable of explaining 61.42 and 78.98 per cent variation in cotton production in Sirsa and Hisar district, respectively. In Sirsa district, the magnitude of coefficient of regression of machine labour and fertilizer were found positive and statistically significant at 1 and 5 per cent level of significance, respectively. This indicates that cotton production increased with an increase in machine labour and fertilizer. For example, the production function indicates that by increasing one per cent quantity of fertilizer cotton production could increase by 0.12 per cent keeping the level of other inputs constant. The magnitude of coefficients of human labour, plant protection and irrigation were found negative but statistically non-significant.

Table 2. Regression coefficient and standard error of cotton production in Sirsa and Hisar

Variables	Coefficient	
	Sirsa	Hisar
Constant	7.679	6.927
Human labour	-0.124^{NS}	0.974*
	(0.131)	(0.058)
Machine Labour	0.433**	0.028^{NS}
	(0.259)	(0.221)
Seed	0.044^{NS}	0.081*
	(0.111)	(0.062)
Fertilizers	0.128**	-0.013^{NS}
	(0.063)	(0.057)
Plant protection	-0.005^{NS}	-0.303^{NS}
	(0.048)	(0.173)
Irrigation	-0.057^{NS}	-0.354^{NS}
	(0.196)	(0.184)
Return to scale	0.419	0.413
	Decreasing	Decreasing
R^2 (%)	61.42	78.98

Figures in parentheses indicate the standard error of estimated parameters, *Significance at 1% level, **Significance at 5% level

In the case of the Hisar district, the estimated multiple determination coefficient (R^2) helped in finding that the selected inputs were capable of explaining about 79.00 per cent variation in cotton production. The magnitude of human labour and seed were positive and statistically significant, whereas, fertilizer coefficient, plant protection and irrigation were negative however statistically non-significant. It indicates that these inputs did not contribute significantly to cotton production. The positive and significant coefficients of regression indicated that cotton production increased with an increase in the respective inputs. The summation of regression coefficients indicated decreasing return to scale in both the districts i.e. 0.419 in the Sirsa district and 0.413 in Hisar district. It indicates one per cent increase in all the inputs used in production simultaneously would increase cotton output by less than one per cent. The marginal value productivity (MVP) of inputs whose coefficients of regression were found statistically significant in the production function was compared with their respective unit pricing in order to analyse the resource usage efficiency in the cotton production. The t-statistics, MVP deviation from unit pricing, and significance test were applied. The monetary return that results from using one more unit of input is represented by the MVP of a specific input. While a significantly lower MVP of an input from its unit price helped in revealing that the input is being used excessively and its usage needed to be reduced, a significantly higher value of MVP of an input against its unit price suggests that usage of that input can be increased in order to increase the cotton output. The results are backed by More & Shinde (2021), who revealed that increasing input usage increases the marginal output of cotton crop up to the point of equilibrium. Manjunath et al., (2013) also found that Bt cotton varieties respond positively to increased input and gives higher returns with balanced use of fertilizers. Yadav et al., (2018) reported unfavourable weather conditions and high cost of seed as the reasons for crop failure of crop, as such seed need to be looked into seriously.

In the Sirsa district, the difference between value of MVP of machine labour and fertiliser and their unit prices was found positive and statistically significant (Table 3) which indicates greater scope for using additional units of these inputs to increase the cotton production. The difference in MVP and unit prices of other inputs was found negative indicating that these inputs were over utilized. In the Hisar district, the difference between MVP and unit prices of human labour and seed was found positive and statistically significant indicating that selected inputs are underutilised and there is a scope for using additional units of these inputs. The difference between MVP and unit price of rest of the variables was found negative and non-significant. The findings were similar to Shafiq & Rehman (2000), who revealed that there

Table 3. Marginal value productivities of cotton production in Sirsa and Hisar

Input	Human Labour	Machine Labour	Seed	Fertilizers	Plant protection	Irrigation
MVP	-0.616	6.524	1.501	2.731	-0.040	-1.835
Price	1.000	1.000	1.000	1.000	1.000	1.000
Difference	-1.616	5.524**	0.501	1.731**	-1.040	-2.835
S.E. of MVP	0.131	0.259	0.111	0.063	0.048	0.196
t-value	-0.952	1.670	0.393	2.024	-0.109	-0.290
Hisar						
MVP	7.428	0.334	2.068	-0.223	-1.506	-8.737
Price	1.000	1.000	1.000	1.000	1.000	1.000
Difference	6.428*	-0.666	1.068*	-1.223	-2.506	-9.737
SE of MVP	0.058	0.221	0.062	0.057	0.173	0.184
t-value	16.926	0.127	1.304	-0.230	-1.751	-1.929

*Significance at 1% level, **Significance at 5% level

is high number of underutilized inputs in cotton cultivation.

CONCLUSION

Cost benefit ratio was found 1:1.22, 1:1.04 and 1:1.13 Sirsa, Hisar and overall. The calculated coefficient of multiple determinations (R^2) reveals that selected inputs were capable of explaining 61.42 and 78.98 per cent variation in cotton production in Sirsa and Hisar districts, respectively. The difference among MVP of machine labour and fertilizers and their unit price was found to positive and significant in Sirsa district. The findings concluded that the cotton farms are showing decreasing returns to scale in both Sirsa (0.419) and Hisar (0.413) districts. To increase cotton productivity the government should give the incentive like; quality of seeds, pesticide subsidy, training of farmers, machinery operations, raw materials and improve quality at par with the international standards with effective implementation of the Technology Mission on cotton.

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