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Research Note

RESOURCE USE EFFICIENCY IN HYBRID COTTON IN DIFFERENT LOCATIONS OF THE TUNGABHADRA COMMAND AREA*

The farm returns depend not only on the crops grown by the farming community, but also how efficiently the available resources are utilized. An analysis of input use efficiency presents a glimpse of the present input use pattern, besides indicating the possibilities of making readjustments for increased farm returns. If resource use is inefficient, the production can be increased by making adjustments in the use of resources in the optimal direction. In case the resource use is efficient, production can be increased by using modern technology. Despite the congenial factors available to the Indian farmer, the per hectare yields are low. This may be due to the improper utilization of available resources. The present study was undertaken to evaluate the resource-use efficiency in cotton enterprise.

Methodology

The study was carried out in Tungabhadra Project (TBP) Command Area during the year 1991-92. Multi-stage random sampling technique was employed to select the sample farmers. In the initial stage, Tungabhadra Right Bank High Level Canal Command was selected and the entire area was stratified into three locations based on the length of the canal, namely, head reach (upto 50 km.), middle reach (50 to 80 km) and tail reach (80 to 105 km). From each stratum, a cluster of four villages was selected. From each village, five large and five small farmers were selected randomly. Thus, the ultimate sample size was 120 comprising 40 each from head, middle and tail reaches. Cotton growers were identified and the relevant data obtained from them were used for the evaluation of resource-use efficiency. Data were collected through the survey method.

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Functional Analysis

The technique of functional analysis was employed for evaluating the resource productivities and resource-use efficiency. The Cobb-Douglas type of production function was used for this purpose. Separate functions were fitted for each location.

Before fitting the functions, the zero-order correlation ecoefficients were estimated to test for multicollinearity. The variable irrigation charges was excluded from the function due to the existence of multicollenearity.

The general form of the function fitted was specified as follows:

$$Y = A X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} x_5^{b_5} X_6^{b_6} X_7^{b_7} e^{u}$$

where,

Y = Gross returns of main product and by-product (in rupees)
a = Intercept term
X_1 = Area under crop in hectares
X_2 = Value of seeds in rupees.
X_3 = Value of manures and fertilizer in rupees
X_4 = Value of plant protection chemicals in rupees
X_5 = Value of human labour in rupees
X_6 = Value of bullock labour in rupees
X_7 = Value of machine labour in rupees
u = Error term
b_1 = The regression coefficient of the ith independent variable (i = 1 to 7)

The marginal value product (MVP) of each resource was worked out by using the following formula;

$$\text{MVP with reference to resource } X_i = b_i \frac{\overline{Y}}{\overline{X}_i}$$

where,

$\overline{Y}$ = Geometric mean of gross return of the crop
$\overline{X}_i$ = Geometric mean of ith independent variable
bi = The regression coefficient of ith independent variable.

After estimating the marginal value of each input, it was compared with its marginal cost.

The average per hectare rental value of land was taken as its marginal cost. The marginal cost of all other inputs was considered as one rupee, since these inputs have been measured in value terms.

Results and discussion

Production function analysis

It is seen from Table 1, that in case of cotton in head reach, seed with a regression coefficient of 0.4120 had the maximum influence on farm income. Since this regression coefficient was not statistically significant, it could not be considered to have an influence on the gross returns. Manures and fertilizers had an elasticity coefficient (0.1912) which was highly significant. The significant regression coefficient of plant protection chemicals (0.3110) indicated that this resource was the major factor influencing the gross returns. The seven variables included in the analysis explained 96.18 per cent of the variation in gross returns as revealed by the coefficient of multiple determination (R^2).

In middle reach of the canal command, land and human labour together had maximum influence on the gross returns from cotton. The regression coefficients for both the resources were found to be statistically significant at 10 per cent significance level. Manures and fertilizers had a negative elasticity coefficient indicating a decrease in gross returns due to an increase in the use of this resource, when all other resources were kept constant at their respective geometric mean levels.

In tail reach, the regression coefficient for plant protection chemicals (0.5990) was highly significant. The regression coefficient of human labour (0.1882) was also found to be significant, indicating positive contribution of this resource to the gross returns from cotton. The regression coefficient of manures and fertilizers was both negative and significant, indicating a decrease in the gross returns from cotton by further increase in the use of this resource when the use of all other resources is kept constant.

Ratio of marginal value product to factor cost

From the Table 2 it can be observed that in head reach of the canal command, the ratios of marginal value product to marginal factor cost for all the factors other than human labour and machine labour were greater than one. This suggests that there is a scope to increase the gross returns from cotton in head reach of the canal command by using more land, seed, manures and fertilizers, plant protection chemicals and bullock labour, keeping other variables at their respective geometric mean levels of use.

Table 1. Regression Coefficients of Cotton in Different Locations of TBP Command Area

Location	n	Intercept	Land	Seed	Manures & Fertilizers	Plant protection chemicals	Human labour	Bullock labour	Machine labour	R^2
Head reach	20	1.9073	0.3065	0.4120	0.1912***	0.3110*	-0.3028	0.0761	0.0113	0.9618
			(0.5867)	(0.6767)	(0.0633)	(0.1504)	(0.1998)	(0.1265)	(0.0052)	
Middle reach	30	2.7816	0.4275*	0.1004	-0.2879	0.2075	0.4703*	0.0759	0.0075*	0.9907
			(0.2329)	(0.0627)	(0.1876)	(0.1896)	(0.2078)	(0.0576)	(0.0042)	
Tail reach	23	1.8804	0.2693	0.0970	-0.1393*	0.5930***	0.1882*	-0.0320	0.0011	0.9472
			(0.2109)	(0.1581)	(0.0774)	(0.1844)	(0.1027)	(0.0659)	(0.0047)	

Figures in parentheses indicate respective standard errors

*** Significant at 1% level

** Significant at 5% level

* Significant at 10% level

R^2 Coefficient of Multiple Determination

Table 2: Ratios of Marginal Value Products (MVP) to Factor Costs (FC) for Cotton in TBP Command Area

Location	Land	Seed	Manures and fertilizers	Plant protection chemicals	Human labour	Bullock labour	Machine labour
Head reach	2.1604	22.9949	4.6287	4.5534	-4.7785	6.2418	0.5227
Middle reach	3.2767	5.1028	-6.6122	3.0479	8.3753	8.3168	0.3008
Tail reach	1.9382	3.9586	-3.2452	7.2622	2.5803	-1.7908	0.0438

In middle reach of the canal command, the ratio of marginal value product to marginal factor cost for manures and fertilizers (-6.6122) and that for machine labour (0.3008) suggested that these factors were used uneconomically. Hence it would not be profitable to further increase the use of these factors, unless the other factors of production are varied. However, the gross returns from cotton in this location could be increased by using additional units of land, seed, plant protection chemicals, human labour and bullock labour.

The production function analysis for cotton in tail reach of the canal command indicated the possiblities of increasing the gross returns by using more land, seed, plant protection chemicals and human labour, while maintaining the levels of other factors at their current geometric mean levels. In other words, the proportion between the various factors of production should be adjusted to realise higher levels of gross returns in this location of the canal command. The negative marginal value product of manures and fertilizers observed could be attributed to excessive use of this resource at the present levels of use of other resources.

Cost components and unit cost of production in the three regions

Table 3 gives the location wise and size group wise costs and returns structure of cotton as a sole crop per hectare. It is observed that not only the costs A, B and C of cotton were higher but also the profits over these costs were more in the middle reach of the canal command compared to those in head and tail reaches of the canal command. The per hectare gross returns were the highest in middle reach (Rs. 38, 324.41), followed by head reach (Rs. 35,243.05) and tail reach (Rs. 26,989.02) of the command. The net income was the highest in middle reach (Rs. 23, 335.55), lowest

in tail reach (Rs. 14,637.61) while that in head reach was Rs. 20,949.72. This was due to the higher levels of input use by the middle reach farmers as evidenced by cost A. They have realised higher levels of gross returns by utilizing higher levels of inputs. The lower levels of inputs used by the tail reach farmers could be attributed to inadequacy and uncertainty of canal water, whereas the head reach farmers concentrated on intensive use of irrigation water without bothering much about the actual water requirement of the crop. The lower level of gross returns realised by the head reach farmers might be due to over-irrigation. The middle reach farmers were able to get a return of Rs. 2.56 per rupee of investment, as revealed by the benefit-cost ratio. The returns per rupee invested in case of head and tail reaches of the canal command were Rs. 2.47 and Rs. 2.19, respectively. The benefit-cost ratio for the tail reach farmers was however not too low as expected, as they managed with the prevailing situation. At the aggregate level, the per hectare profitability (at cost C) increased with increase in the size of holding. The negligible higher amount of per hectare profit realised by the large farmers was due to higher level of input use. Similar findings were reported by Singh and Singh (1975). Habbi (1984) also observed an increase in per hectare costs, returns and net profits with an increase in farm size.

Table 3: Location-wise and Size Group-wise Costs and Returns Structure of Cotton in TBP Command Area

(Rs/ha)

Sl. No.	item	Location			Size group		
		Head reach	Middle reach	Tail reach	Small	Large	Overall
1.	Cost A	8328.33	9354.55	7756.83	7937.38	8940.43	8840.96
2.	Cost B	13588.33	14616.48	11751.41	12674.63	14002.73	13872.39
3.	Cost C	14293.33	14988.26	12351.41	13492.13	14443.23	14350.39
4.	Gross Returns	35243.05	38324.41	26989.02	33639.00	36304.97	36041.74
5.	Profit at						
	Cost A	26914.72	28969.86	19232.19	25701.62	27364.54	27200.78
	Cost B	21654.72	23707.93	15237.61	20964.37	22302.24	22169.35
	Cost C	20949.72	23335.55	14637.61	20146.87	21861.74	21691.35
6.	Benefit-cost ratio	2.47	2.56	2.19	2.49	2.51	2.51

The returns per rupee of investment in cotton crop was Rs. 2.51 for the farmers of the command area under overall situation as indicated by the benefit-cost ratio.

Conclusions and Policy Implications

The study indicated that, the use of human and machine labour was excess in head reach of the canal command. Further increase in the use of these resources would reduce the returns from cotton in this location. There was scope for increasing the use of land, seed, manures and fertilizers, plant protection chemicals and bullock labour in middle reach. In tail reach, the use of manures and fertilizers was more than warranted as the availability of adequate irrigation was a problem. The coefficient of multiple determination (R^2) in all the three functions fitted was more than 0.90 and indicated the goodness of fit. The middle reach farmers were able to get the highest returns of Rs. 2.56 per rupee of investment, as revealed by the benefit cost ratio, followed by head and tail reaches of the canal command area with Rs. 2.47 and Rs. 2.19, respectively. The policy implications emerging from the findings of the study are that cotton crop is suitable for head reach and middle reach of the command area. However, the farmers in the head reach of the canal should reduce the use of human labour and machine labour and the farmers in the middle reach should increase the use of inputs like seeds, manures and fertilizers, plant protection chemicals and bullock labour for realising higher net returns.

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T. Nagaraj[1], H.S.S. Khan[2] and H.S. Vijaya Kumar[3]

1. P.G. Student, Deptt. of Agricultural Economics, UAS, Dharwad.
2. Assoc. Professor of Agril. Marketing, UAS, Dharwad.
3. Assoc. Professor of Finance, UAS, Dharwad.