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Resource productivity and resource use efficiency of cotton on small farms in Parbhani district of Marathwada region

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ABSTRACT

The study attempted to examine the resource productivity, resource use efficiency and return to scale of cotton production on small farms in Parbhani district of Marathwada region of Maharashtra state. A sample of 54 farmers was selected through multistage sampling technique from Parbhani district and data were collected during November – December 2012. Cobb Douglas production function approach was used to measure the resource productivity, resource use efficiency and return to scale by calculating and comparing Marginal Value Products (MVPs) and MVP to factor price. Results depicted that on small farms, in case of cotton, 53.80 per cent variation in cotton production was explained due to independent variables considered for analysis. Regression co-efficient of manure (X_5) was 0.3871, which was positive and highly significant at 1 per cent level. Whereas regression co-efficient of bullock labour (X_3), fertilizer (X_6) and machine labour (X_7) were 0.4837, 0.6023 and 0.7543, which were positive and significant at 5 per cent level. Regarding utilization of resource, MVP of family labour, bullock labour, machine labour and manure were greater than unity indicating under utilization. However, all other resources were used in excess. The result also indicates that return to scale on small farm was increasing (Σbi: 1.435).

KEY WORDS : Cotton, Small farms, Resource productivity, Resource use efficiency

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Cotton is a soft, fluffy staple fibre that grows in a boll or protective capsule, around the seeds of cotton plants of the genus *Gossypium*. The fibre is almost pure cellulose. Under natural conditions, the cotton bolls will tend to increase the dispersion of the seeds. The plant is a shrub native to tropical and subtropical regions around the world, including the Americas, Africa, and India. The greatest diversity of wild cotton species is found in Mexico, followed by Australia and Africa. Cotton is said to be a gift of the Indian sub-continent to human civilization. The key role that cotton plays in our economy can be gauged from the extent of area under the crop as well as trade, processing, manufacture, export of raw cotton and cotton textile goods. Current estimates for world production are about 25 million tonnes or 110 million bales annually, accounting for 2.5 per cent of the world's arable land. China is the world's largest producer of cotton, but most of this is used domestically. The United States has been the largest exporter for many years. India with its 13 per cent share of world's cotton production ranks the third largest producer of cotton in the world (Cotton Corporation of India (CCI) 2008). Although, India has the world's largest acreage of cotton, its productivity is among the lowest in the world (F.A.O, 2008).

Cotton is one of the most important cash crops in Maharashtra. Out of the total cultivation of cotton in the country, 36 per cent of the total area is in Maharashtra. Cotton is cultivated in an area of 15.9 per cent of the cultivable land in the State, that is, 30-35 lakh hectares. In India, Maharashtra

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ranks first in the production of cotton. 60 per cent of the total cotton is produced mainly in Vidharbha, 25 per cent in Marathwada, while 10 per cent is produced in Khandesh. Cotton industry is one of the largest employers in the country accounting for nearly 15 per cent of the total labour force. There are about 60 million owner cultivators in India, out of which about 15 million produce cotton. The processing and manufacturing of cotton from 'Kapi' to textile provides employment to more than 15 million people in the country. Being a commerceal crop, cotton is so remunerative that it is being grown by farmers in even un-prescribed agro-climatic zones. The reason for this, practice rests with the reality that it fetches higher returns. In recent years cotton crop has been experiencing many ups and down due to natural and man-made calamities. Dependency of the crop on rain fall, fluctuations of the area under the crop, fluctuations in productivity due to pests and diseases, fluctuations in prices are the few important factors.

METHODOLOGY

Sampling technique and data description:

The data were collected for the research during November - December 2012 with multi-stage sampling technique. Parbhani district was selected purposively as study area in the first stage; in the second stage Parbhani tehsil was selected. In third stage four villages were selected in the tehsil. And in fourth stage small farmers including marginal farmers were selected randomly from each village. Thus, 54 small farmers were selected for the study. Well structured questionnaires were used for personal interview from sample farmers.

Functional analysis:

The resources productivity and resources use efficiency were analyzed by application of functional analysis. In functional analysis, Cobb-Douglas (power production function) production function was used. Cobb-Douglas production function (non-linear) was used to determine the resources productivity and resources use efficiency of cotton production. The data were, therefore, subjected to functional analysis by using the following form of equation:

$$Y = a x_1^{b1} . x_2^{b2} . x_3^{b3} \ldots\ldots\ldots x_n^{bn} . e^{u}$$

This function can easily be transformed into a linear form by making logarithmic transformation, after logarithmic transformation this function is:

$$\text{Log } Y = \log_a + b_1 \log X_1 + b_2 \log X_2 + \text{————} b_5 \log X_8 + a \log_e$$

where,

Y = Output in quintals

a = Intercept / constant

X_1 = Family labour (mandays).

X_2 = Hired labour (mandays)

X_3 = Bullock labour (pair days)

X_4 = Quantity of seeds (kg.)

X_5 = Manure used (quintals)

X_6 = cost of fertilizer (Rs.)

X_7 = Machine labour (hours)

X_8 = cost of plant protection (Rs.)

b_1 to b_8 = Regression co-efficient of respective variables

e = Random term with zero mean and constant variance.

Marginal value product (MVP):

The marginal value productivity of resources indicate the addition of gross value of farm production for a unit increase in the i^{th} resources with all resources fixed at their geometric mean level. The MVP of various input is worked out by the following formula:

$$MVP = bi \frac{\bar{Y}}{\bar{X}} Py$$

where,

bi = Partial regression co-efficient of particular independent variable.

$\bar{X}$ =Geometric mean of particular independent variable (input).

$\bar{Y}$ = Geometric mean of dependent variable (output).

Py = Price of dependent variable.

Return to scale:

It refers to the summation of bi values, return to scale = Σbi

If, Σbi = 1, Constant return to scale.

Σbi = < 1, Decreasing returns to scale.

Σbi = >1, Increasing returns to scale.

ANALYSIS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Resource productivity and resource use efficiency of cotton:

The effect of various resources on cotton production has been studied by employing Cobb-Douglas production function in order to determine resource productivity and resource use efficiency of cotton. Cobb-Douglas production function gives elasticities of production directly. The sum of regression co-efficient indicates the return to scale. Also these regression co-efficients can be used to determine the resource productivity and resource use efficiency directly.

Regression co-efficient with relation to various explanatory variables were calculated with 't' values which is presented in Table 1. It was observed that regression co-efficient of manure (X_5) was 0.3871, which was positive and

highly significant at 1 per cent level. It inferred that when 1 per cent increase in use of manure, it would lead to increase production of cotton by 0.3871 per cent. Whereas regression co-efficient of bullock labour (X_3), fertilizer (X_6) and machine labour (X_7) were 0.4837, 0.6023 and 0.7543, which were positive and significant at 5 per cent level. It inferred that 5 per cent increase in use of bullock labour, fertilizer and machine labour, would lead to increase production of cotton by 0.4837 per cent, 0.6023 per cent and 0.7543 per cent, respectively. Similarly regression co-efficient of hired labour (X_2) and seed (X_4) was -0.8036 and -0.3977, which was negative and significant at 5 per cent level. It inferred that when 5 per cent increase in use of hired labour and seed, it would lead to decrease production of cotton by 0.8036 and 0.3977 per cent, respectively. Other variables like family labour (X_1) and plant protection (X_8) were non-significant.

Co-efficient of multiple determination (R^2) was 0.538 which indicated that 53.80 per cent variation in cotton production was explained because of variables (independent) included in the model. 'F' value was significant (6.548), it means that model has statistical fit. It is clear that explanatory variables together explained significant part of variation in cotton production. The sum of regression co-efficient was 1.435 which indicated increasing return to scale.

Marginal value productivity and resource use efficiency of cotton production:

The marginal value productivity (MVP) of independent variables in the fitted equation for cotton production was derived at geometric mean level of respective input and output. The ratio between marginal value productivity and factor price of respective variables were then worked out to know the resource use efficiency. The results of the analysis are presented in Table 2.

With regard to resource use efficiency, it is evident from Table 2 that, use of machine labour in cotton production indicated that highest MVP to price ratio (92.15), followed by manure (21.75), bullock labour (6.306) and family labour (5.814). If MVP to price ratio was greater than unity, the use of resource could be increased to increase the level of profit. The resource use efficiency analysis further showed that hired labour, seed, fertilizer and plant protection chemicals were used in excess on selected farm, which increase the cost of cultivation of crop. Therefore, to maximize the profit from cotton production, the farmers in study area have to reallocate the available resources. Ashfaq *et al.* (2012) and Balakrishna (2012) home aslo generated some information related to the present investigation from Pakistan and India, respectively.

Table 1: Estimates of cobb-douglas production function for cotton

Independent variables	Regression co-efficient (bi)	Standard error of (bi)	t value
Family labour (X_1)	0.5289	0.3898	0.1356^{NS}
Hired labour (X_2)	-0.8036	0.3772	-2.1306*
Bullock labour (X_3)	0.4837	0.2256	2.1735*
Seed (X_4)	-0.3977	0.1983	-2.0054*
Manure (X_5)	0.3871	0.1389	.7874**
Fertilizer (X_6)	0.6023	0.2803	2.1483*
Machine labour (X_7)	0.7543	0.3583	2.1099*
Plant protection chemicals (X_8)	-0.1193	2.5518	-4.6738^{NS}

Intercept =8.872, Return to scale (? bi):1.435, F valu =6.548**, R^2 =0.538, * and** indicate significance of values at P=0.05 and 0.01, respectively
NS=Non-significant

Table 2: Resource use efficiency of cotton production

Resources	G.M.	MPP	MVP	Factor price (Px)	MVP / Px	Level of resource use
Family labour (X_1)	64.880	0.138	581.43	100	5.814	Under
Hired labour (X_2)	37.578	-0363	-1525.36	100	-15.25	Excess
Bullock labour (X_3)	16.579	0.494	2081.05	330	6.306	Under
Seed (X_4)	1.908	-3.539	-14865.61	1500	-9.910	Excess
Manure (X_5)	12.695	0.518	2175.13	100	21.75	Under
Fertilizer (X_6)	5390.62	0.002	7.9690	46.12	0.173	Excess
Machine labour (X_7)	1.668	7.679	32352.48	350	92.15	Under
Plant protection chemicals (X_8)	3320.77	-0.0006	-2.5615	1500	-0.002	Excess

Geometric mean of Y = 16.982, Price of output = 4200

Conclusion and recommendation:

This study has examined the resource productively, resource use efficiency and return to scale among small farms in Parbhani district of Marathwada region of Maharashtra state. The functional analysis of cotton revealed that in case of cotton 53.80 per cent variation in cotton production was explained due to independent variables considered for analysis. Regression co-efficient of manure (X_5) was 0.3871, which was positive and highly significant at 1 per cent level. Whereas regression co-efficient of bullock labour (X_3), fertilizer (X_6) and machine labour (X_7) were 0.4837, 0.6023 and 0.7543, which were positive and significant at 5 per cent level. Similarly regression co-efficient of hired labour (X_2) and seed (X_4) was -0.8036 and -0.3977, which was negative and significant at 5 per cent level. Other variables like family labour (X_1) and plant protection (X_8) were non-significant. Regarding utilization of resource, MVP of family labour, bullock labour, machine labour and manure were greater than unity indicating under utilization. However, all other resources were used in excess.

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