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Resource use efficiencies of okra in Thane district of Maharashtra

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ABSTRACT : The functional relationship between inputs factors in production of okra namely independent variables like seed (X_1), fertilizers (X_2), plant protection (X_3), human labour (X_4) and dependent variable as okra production (yield) was estimated by Cobb-Douglas type production function. The co-efficient of determination (R^2) was 0.824 indicating that 82 per cent of the variation in the yield is explained by independent factor such as seed (X_1), fertilizers (X_2), plant protection (X_3) and human labour (X_4). R^2 was found to bestatistically significant.The functional analysis indicated that seed, fertilizer plant protection and human labour were used excessively. They need proper monitoring to increase allocative efficiency.

KEY WORDS : Inputs, Production, Production function, Resource use efficiency

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Vegetable plays an important role in providing a balanced diet which is essential to improve the nutrition of the people. Vegetables are considered as protective foods and contain most of the food nutrients such as a large quantities of carbohydrates and proteins which are required for human systems. Okra is most popular in India, Nigeria, Pakistan, Cameroon, Iraq and Ghana. Though, it is virtually not grown in Europe and North America, yet, lot of people in these countries prefer this vegetable because of its vitamin content. Productivity of okra in world was 6.9 MT/ha (Annonymous, 2011). In India, it is cultivated almost in all states throughout the year and consumed by many people. Major okra growing states in India are Andhra Pradesh (20%), West Bengal (15%), Bihar (14%), Orissa (11%) and Maharashtra share only 4 per cent. The total area grown under okra crop in India was about 498 thousand ha with production of 5784 thousand MT and productivity was 11.6 MT/ha in 2010-11 (Annonymous, 2011). In Maharashtra area of okra crops grown was about 19,000 ha with annual production of 224,000 metric tonnes and productivity was 11.8 MT/ha in 2010-11. Out of the total area in Konkan region, Thane district has 6047 ha area under vegetables, with production and productivity were 53712 M.T. and 8.88 MT/ha, respectively. Okra being high value crop has got tremendous scope to increase the income of farmers. Keeping all these points in view regarding resource use efficiencies of okra, the present study was undertaken.

RESEARCH METHODS

The multistage purpose cum random sampling technique was used for the selection okra cultivator. At the first stage, the area under okra is concentrated in Shahapur, Murbad and Kalyan tahsils in Thane district were selected purposively. The second stage involved selection of three villages from each taluka having maximum area under okra crop. Lastly from each selected village five farmers each were selected randomly from small, medium and large size of land

holding thus, the final sample consisted of 135 vegetable growers from nine villages. The data and information for the present study pertained to the agricultural year 2011-2012.

Functional analysis :

The empirical evidences from previous studies suggest that amongst the various production functions Cobb-Douglas type of production function was the found to be appropriate one for the given data set Cobb-Douglas (1928). The following form of production function was used.

$Y = aX_1^{b_1}X_2^{b_2}X_3^{b_3}X_4^{b_4}eu$

where,

Y = Per hectare yield of okra (q)

a = Intercept term

X_1 = Seed (kg./ha)

X_2 = Fertilizer (kg./ha)

X_3 = Plant protection (lit. /ha.)

X_4 = Human labour (days/ ha)

eu = Error term.

b_1 to b_4 are the production elasticities of respective resources.

In this functional form 'Y' is the dependent variable and X_1, X_2, X_3 …X_4 are independent variables and were considered on per hectare basis. The regression coefficients obtained from this function are also called as elasticities of production. The sum of co-efficient of regression *i.e.* $b_1b_2b_3…b_4$ indicates return to scale.

Estimation of MPP and MVP:

The following formulae was used for the calculation of marginal physical product and marginal value product.

Marginal physical product (MPP) :

$$MPPx_i = Dy/dx_1 = bi\frac{\overline{Y}}{X_i}$$

where,

bi = Production elasticities of i^{th} input.

Y= Geometric mean of output.

Xi = Geometric mean of i^{th} input

Marginal value product (MVP) :

MVP = MPP x unit price of the output.

Marginal factor cost (MFC):

MFC = Price per unit of the input.

Allocative efficiency :

After estimating the MVP, the resource use efficiency of different resources were judged with the help of MVP/MFC ratio

– MVP/MFC = 1 Optimum use of resource.

– MVP/MFC < 1 Excess utilization of resource.

– MVP/MFC > 1 Underutilization of resource.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Distribution of sample okra cultivators :

The selected okra growers were grouped according to their size of total holding of land. The cultivators were classified into three categories *viz.*, I) Small farmers group: upto 2 ha, II) Medium farmer's group: 2.01 to 4.0 ha, III) Large farmer's group: 4.01 ha to above. The distribution of sample okra grower is given in Table 1.

Table 1 : Distribution of sample okra cultivators

Category	Holding size (ha)	No. of cultivators	Per farm area under okra
Small	Upto 2	45	0.25
Medium	2.01 to 4.0	45	0.37
Large	4.01 to above	45	0.80
Total		135	0.47

The area under okra cultivation was 0.25 ha. in small, 0.37 ha. in medium and 0.80 in large category with an overall average area under okra cultivation was 0.47 ha.

Input utilization :

Per hectare quantities of different input and their values are given in Table 2.

Human labour :

It was observed that the per hectare total human labour required for okra cultivation was 304.58 days. Out of which family labour was 223.27 labour days while hired labour was 81.31 days. Thus, the study revealed that the proportion of family labour (73.30%) was more than hired labour (26.70%) (Table 2).

Seed:

At an overall level, quantities of seed of okra used and expenditure incurred on seed were 10.31 kg and '

7889, respectively. It could be seen form Table 2 that in case of small farmers seed utilized for okra was 10.81 kg and expenditure incurred was Rs. 8083. Whereas, expenditure in incurred by the medium and large farmers on seed was Rs. 7889 and Rs. 9106, respectively. This indicated that expenditure incurred on seed item was highest by large size group of farmers followed by medium and small size group of farmers.

Manures :

It was observed from table that at overall level, manure used was 3.68 ton and expenditure incurred was Rs.4409. The expenditure incurred on manure was highest in case of large farmers followed by medium and small size group of farmers.The manures used in large size farmers was 5.12 ton and expenditure incurred on them were Rs. 6113. In case of small and medium farmers, expenditure incurred on manure was Rs. 2063 and Rs. 5051, respectively.

Fertilizer:

Regarding fertilizer use it was observed that average use small size land holding group was 1874.58 kg fertilizer and expenditure incurred on this was Rs. 25763 per hectare. Whereas, quantities of fertilizers used by the medium size of the farmers were 1570.11 kg and expenditure incurred on these fertilizer was Rs.29516 per hectare. In case of large size farmers, 1518.75 kg fertilizer were used and expenditure incurred on these fertilizers was Rs. 29004 per hectare.

Table 2 : Per hectare input used for okra cultivation

Sr. No.	Inputs used	Group						Overall (n=135)	
		Small (n=45)		Medium (n=45)		Large (n=45)			
		Qty.	Value (Rs.)	Qty.	Value (Rs.)	Qty.	Value (Rs.)	Qty.	Value (Rs.)
1.	**Labour**								
	Family	269.14	31222	231.03	27414	169.64	27372	223.27	28669
	Hired	71.58	7376	94.35	9471	77.99	7920	81.31	8255
2.	Seed (kg)	10.81	8083	10.31	7889	9.90	9106	10.34	8360
3.	Manures (ton)	1.72	2063	4.21	5051	5.12	6113	3.68	4409
4.	Fertilizers (kg.)	1874.58	25763	1570.11	29516	1518.75	29004	1654.48	28095
5.	**Plant protection**								
	Insecticides (lit.)	6.52	7215	9.28	7448	6.72	7176	7.51	5720
	Fungicides (lit)	11.54	4243	8.81	4767	8.58	9162	9.64	7348
	Weedicides (lit.)	8.96	5146	8.45	4442	9.39	10019	8.93	6805

(Figures in the parentheses indicate percentages to the total)

Table 3: Regression co-efficients of independent variables in estimated Cobb-Douglas type of production function

Sr. No.	Variables	Estimated regression co-efficient	Standard error
1.	Seed (X_1)	0.292609*	0.055594
2.	Fertilizer (X_2)	0.075192**	0.040081
3.	Plant protection (X_3)	0.069953*	0.018109
4.	Human labour (X_4)	0.436551*	0.043197
5.	Intercept (a)	2.561740	0.108847
6.	R^2	0.823902	
7.	Return to scale (? b_i)	0.874305	

Figures in brackets indicates standard errors to total * and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 4 : Resource use efficiency in okra production

Sr. No.	Variables	GM	MPP	MVP	MFC	MVP /MFC	Remarks
1.	Seed (X_1)	10.344	545.020	7.678	808.395	0.009	Excess utilization
2.	Fertilizer (X_2)	1595.938	0.908	1.973	16.981	0.116	Excess utilization
3.	Plant protection (X_3)	21.441	62.982	1.839	761.894	0.002	Excess utilization
4.	Human labour (X_4)	317.604	26.483	11.455	250.000	0.046	Excess utilization

Plant protection :

At overall level, quantity used for insecticide, fungicide and weedicide used for okra was 7.51 lit., 9.64 lit. and 8.93 lit., respectively and expenditure on it Rs. 5720, Rs. 7348 and Rs. 6805, respectively. In study area, insecticide, fungicide and weedicides were commonly used as plant protection measures. Medium size group of farmers used highest quantity of insecticide (9.28 lit.) followed by large (6.72 lit.) and small size group (6.52 lit.) of farmers expenditure incurred on it was Rs. 7448, Rs. 7215 and Rs. 7176, respectively. In case of fungicide medium size group of farmers used highest quantity of fungicides (11.54 lit.) followed by medium (8.81 lit.) and large size group (8.58 lit) of farmers. The expenditure incurred was Rs.4243, Rs. 4767 and Rs. 9162 respectively. In case of weedicides, large size group of farmers used highest (9.39 lit.) quantity than other *i.e.* small (8.96 lit.) and medium (8.45 lit.) and expenditure incurred was Rs. 10019, Rs. 5146 and Rs. 4442, respectively.

The results of input utilization in okra cultivation are in conformity with Nawadkar and Pant (1984) in their study on chillies.

Functional analysis :

The functional relationship between inputs factors in production of okra namely independent variables like seed (X_1), fertilizers (X_2), plant protection (X_3), human labour (X_4) and dependent variable as okra production (yield) on overall group of farms were studied by estimating Cobb-Douglas type production function as it was found to be statistically appropriate for present data set. The estimated functional relationship is presented in Table 3.

It could be seen from the table 3 that the co-efficient of determination (R^2) was 0.824 indicating that 82 per cent of the variation in the yield is explained by independent factor such as seed (X_1), fertilizers (X_2), plant protection (X_3) and human labour (X_4). R^2 was found to bestatistically significant. Similar results were also obtained by Dangat *et al*. (1991) while studying resource use structure and resource productivity of tomato.

The respective regression co-efficient of seed (X_1), fertilizers (X_2), plant protection (X_3) and human labour (X_4) were 0.292, 0.075, 0.069 and 0.436, respectively. Results were in conformity with that of Koyande (2000) during his study in resource use efficiency of Chilli in Sindhudurg district of Maharashtra. The regression co-efficients of independent variable such as seed, plant protection and human labour were statistically significant at 5 per cent level. The regression co-efficient of fertilizer was statistically significant at 10 per cent level. The returns to scale (sum of elasticity of inputs) was 0.874 indicating decreasing returns to scale.

Resource use efficiency in okra production :

The efficiency of resource used in okra production with the help of marginal value product/marginal factor costs (MVP/MFC) ratio is given in Table 4.

It is observed from the Table 4 that, marginal value product/marginal factor cost ratio for seed, fertilizers, plant protection and human labour was 0.009, 0.116, 0.002 and 0.046, respectively. This indicated that the all inputs used for okra cultivation need to be curtailed. There was an excess use of all the variables used for okra production in study area.

Conclusion :

The per hectare input use was okra cultivation *viz.*, 304.58 man days human labour,10.34 kg.seed, 3.68 tonnmanures, 1654.48 kg. fertilizers and 26.08 lit. plant protection okra found to be highly labour intensive crop and provided proportionately higher employment 304 days to family members *i.e.* for male and female members. The functional analysis indicated that seed, fertilizer plant protection and human labour were used excessively. They need proper monitoring to increase allocative efficiency.

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