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Resource productivity and resource use efficiency in drip irrigated banana production

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ABSTRACT

Banana (*Musa paradisica.*L.) is one of the most important fruit crops in the world. It ranks next to mango in both area and production in India. About 48 drip irrigated banana growers were randomly selected for the study. Cross sectional data were collected from the banana growers with the help of pretested schedule by personal interview method. The study was conducted to know the resource productivity, resource use efficiency and optimum resource use in banana production. Cobb-Douglas production function was fitted to the data. The results revealed that the regression coefficient of machine labour, irrigation and area under banana was 0.054, 0.203 and 0.213, respectively which were positive and significant. Marginal productivity with respect to area, bullock labour and machine labour was 51.291, 2.759 and 2.746 quintals, respectively. It inferred that if area is increased by one hectare, bullock labour increased by one pair and machine labour increased by one hour, it would lead to increase banana production by 51.291, 2.759 and 2.746 quintals, respectively. The sum of the production elasticities (ġbi) was 0.576 which indicated decreasing return to scale.

Key words : Banana, regression, Coefficient, Optimum resource, Marginal product, Drip irrigated

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INTRODUCTION

Banana (*Musa paradisica* L.) is one of the cheapest fruit and is a rich source of energy in the form of sugar and starch. It ranks next to mango in both area and production in India. Nanded is one of the districts of Maharashtra where banana has been grown on large scale with Basrai and Ardhapuri varities. Nowdays, farmers are using drip irrigation system in banana production in order to overcome the problem of scarce water resource. Due to this system, fertilizers can be applied to the crop. In this system, farmer is also facing the problem of management of resources. In order to minimize the over and under utilization of resources, the present study has been undertaken to determine the optimum utilization of the resources in drip irrigated banana production.

METHODOLOGY

Multistage sampling design was used in selection of district, tehsil, villages and banana gardens. In first stage, Nanded district in Maharashtra was selected purposely because of favourable climate to grow banana crop. In the second stage, Ardhapur tehsil was selected on the basis of highest area under banana crop. In the third stage, eight villages were selected from the tehsil on the basis of area under drip irrigated banana gardens. In the fourth stage, six drip irrigated banana gardens were randomly selected from each of the selected villages. Thus, from eight villages, forty eight drip irrigated banana gardens were selected for the study. The cross-sectional data were collected from forty eight drip irrigated banana growers by personal interview method with help of pre-tested schedule for the year 2007-08. Use of resources namely, area of banana, hired human labour, machine labour, nitrogen, phosphorus, potash and manures on farm were taken into consideration. Cobb-Douglas production function was to be the best fit to data to estimate the resource productivity with respect to each of the explanatory variables. The fitted equation was as follows:

$$Y = aX_1^{b1} \times X_2^{b2} \times X_3^{b3} \text{ —— } X_n^{bn} \cdot e^u$$

In this functional form 'Y' is dependent variable, 'X_i' are independent resource variables, 'a' is the constant representing intercept of the production function and 'b_i' are the regression coefficients of the respective resource variables. The regression coefficients obtained from this function directly represent the elasticities of production, which remain constant throughout the relevant ranges of inputs. The sum of coefficients that is 'bi' indicates the nature of returns to scale. This function can easily be transformed into a linear form by making logarithmic transformation. After logarithmic transformation, this function is:

$$\textbf{Log Y = log}_a + b_1 \log x_1 + b2 \log x_2 + \ldots\ldots\ b_n \log x_n + u \log_e$$

For fitting the production function in banana crop, ten inputs were considered as important factors by considering the problem of multicollinerity in estimating production function. multicollinerity refers to situation where because of storing interrelationship among the independent variables, it becomes difficult to disentangle their separate effects on the dependent variables. Some of the independent variables are not important just because the standard errors are high. It might be due to the presence of multicollinerity.

The main consequences of multicollinearity, (a) the sampling variances of the estimate coefficients increases as the degree of collinearity increase between the explanatory variables, (b) estimated coefficients may become very sensitive to small charges in data that is addition or deletion of a few observations produce, a drastic change in some of the estimates of the coefficients. This results in non-significance of regression coefficients. Sometimes it so happens that more of the regression coefficients are significant but the value of R^2 is very high. The equation fitted was of the following formula:

$$Y = aX_1^{b1}.\ X_2^{b2}.\ X_3^{b3}.\ X_4^{b4}.\ X_5^{b5}.\ X_6^{b6}.\ X_7^{b7}.\ X_8^{b8} \cdot X_9^{b9}.\ X_{10}^{b10}$$

where, Y = Estimated yield of the crop in quintals per farm, a = Intercept of production function

b_i = Partial regression coefficients of the respective resource variable (i = 1, 2, 3, ... 12), X_1 = Area of the crop in hectares, X_2 = Human labour in man days per farm, X_3 = Bullock labour in pair days per farm, X_4 = Machine labour in hours per farm, X_5 = Manure in quintals, X6 = Nitrogen in kg per farm, X_7 = Phosphorus in kg per farm, X_8 = Potash in kg per farm, X_9 = Irrigation in m^3 per farm, X_{10} = Family labour in man days per farm.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented in Table 1.

Elasticity of banana production:

Regression coefficient with respect to various explanatory variables were calculated and are presented in Table 1. Regression coefficient of machine labour was 0.054 which was positive and highly significant at 1 per cent level. Similarly, regression coefficient of irrigation

Table 1 : Estimates of Cobb-Douglas production function as partial regression coefficients with resource productivity, resource use efficiency and optimum resource use in drip irrigated banana production

Independent variable	Regression coefficient (bi)	Standard error bi (SE)	't' value	Geometric mean of input ($\overline{X}$i)	Marginal product (q)	Marginal value product (Rs.)	Price of input (Rs.)	MVP to price ratio	Optimum resource use (Xi)
Area of banana (ha/garden)	0.213	0.103	2.068*	1.596	51.291	27154.16	20913.25	1.29	2.07
Hired human labour (man day/garden)	0.025	0.148	0.168	75.690	0.126	66.70	80.00	0.83	63.58
Bullock labour (pair day/garden)	0.037	0.072	0.514	5.153	2.759	1460.64	150.00	9.74	50.18
Machine labour (hours/garden)	0.054	0.016	3.375**	7.555	2.746	1453.76	270.00	5.38	40.69
Manure (q/garden)	0.053	0.068	0779	77.949	0.261	138.18	50.00	2.76	215.67
Nitrogen (kg/garden)	-0.028	0.013	-2.154*	354.79	-0.030	-15.88	10.86	-1.46	-
Phosphorus(kg/garden	0.062	0.037	1.676	333.705	0.071	35.80	22.25	1.60	566.95
Potash (kg/garden)	-0.018	0.014	-1.286	203.208	-0.034	-17.99	8.33	-2.16	-
Irrigation (m^3/garden)	0.203	0.030	6.766**	20941.006	0.012	6.35	1.25	5.08	33042.71
Family human labour (man day/garden)	-0.025	0.011	-2.273*	44.051	-0.218	-115.41	80.00	-1.44	-

Intercept (Log a) = 4.290
F value = 68.034**
R^2 = 0.941
Return to scale (Σ bi) = 0.576

Note : Geometric mean ($\overline{Y}$) of drip irrigated banana production was 384.324 q per garden and price was Rs.529.41/q

* and ** indicates significance of values at P=0.05 and 0.01, respectively

was 0.203 which was positive and highly significant at 1 per cent level. Regression coefficient of area was 0.213 which was positive and significant at 5 per cent level. On the contrary, regression coefficient of nitrogen (-0.028) and family human labour (-0.025) were negative and significant at 5 per cent level. Coefficient of multiple determination (R^2) was 0.941 which indicated 94.10 per cent variation in drip irrigated banana production due to variation in all independent variables. F value was highly significant (68.034). It was clear that explanatory variable on its own was not very important but together they explained significantly part of variation in drip irrigated banana production. The sum of regression coefficient was 0.576 which indicate decreasing return to scale.

Marginal productivity of banana:

Resource productivity with respective various explanatory variables was estimated and are also presented in Table 1. It is obvious from Table 1 that marginal productivity with respect to area under drip irrigated banana was highest as 51.291 quintals followed by that of bullock labour (2.759 q), machine labour (2.746 q), manure (0.261 q), hired human labour (0.126 q), phosphorus (0.071 q) and irrigation (0.012 q). It inferred that if area under drip irrigated banana production was increased by one hectare at its geometric mean level, it would lead to increase production of banana with 51.291 quintals. Similarly, per unit of bullock labour, machine labour, manure, hired human labour, phosphorus and irrigation increased, it would cause to increase the production of drip irrigated banana by 2.759, 2.746, 0.261, 0.126, 0.071 and 0.012 q, respectively.

Resource use efficiency in banana production:

In regard to resource use efficiency, it was also evident from the table that use of bullock labour in drip irrigated banana production indicated MVP to price ratio as 9.74 followed by that of machine labour (5.38), irrigation (5.08), manure (2.76), phosphorus (1.60) and area (1.29) which were greater than unity. It implied that there was scope to increase these resources in drip irrigated banana production. On the contrary, in regard to potash, nitrogen and family labour, MVP to price ratio were negative.

Optimum resource use in banana production:

In regard to optimum resource use, it was observed that use of optimum area was 2.07 hectares over its geometric mean followed by hired human labour (63.58 man days), bullock labour (50.18 pair days), machine labour (40.69 hours), manure (215.67 q), phosphorus (566.95 kg) and irrigation (33042.71 m^3). The results are in conformity with the observations made by Nagargoje (2000).

Pawar (1987) and Patil *et al*. (1998) have also made some investigations on productivity and marketing of banana in Maharashtra.

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REFERENCES

Nagargoje, S.R. (2000). Economic analysis of production and marketing of banana in Marathwada region. Ph.D. (Ag.) Thesis, Marathwada Agricultural University, Parbhani, 120 pp.

Patil, E.R., Patil, H.K. and Kshirsagar, P.J. (1998). Resource productivity in banana in Thane district of Maharashtra state. *Maharashtra J. Econ*., **9** (1 and 2) : 12-15.

Pawar, K.G. (1987). Economics of production and marketing of banana in Parbhani district. M.Sc. (Ag.) Thesis, Marathwada Agricultural University, Parbhani, 86 pp.

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