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Resource use Efficiency of Banana in Kurnool District of Andhra Pradesh

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ABSTRACT

The present study was conducted in Kurnool district of Andhra Pradesh with a sample of 120 farmers by probability proportionate to size from four villages with thirty farmers from each village. Data used were pertaining to the period of 2013-14. Cobb-Douglas production function analysis of data indicated that suckers were found to be significant variables affecting the productivity of banana in all size of farm groups except large farms. Nitrogen fertilizers were found to be significant variables affecting the productivity of banana in all size of farm groups. The value of ($\overline{R}^2$) was highest on pooled farms (0.869) followed by medium (0.843) and large farms (0.826). The MVP to MFC ratio for suckers and nitrogen fertilizers were > 1 indicating that there is scope to increase the level of these inputs in banana crop production

Key words: *Banana, Efficiency, Resource.*

India is largest producer of banana in the world producing 28.45 million tonnes from an area of 0.796 million ha with a productivity of 35.7 T ha^{-1} and accounted for 15.48 and 27.01 per cent of the world's area and production respectively (*www.fao.org*). In Andhra Pradesh, the major banana growing districts include Kadapa, Guntur, Prakasam, West Godavari, Vizianagaram, Krishna, Vishakhapatnam, Rangareddy, East Godavari and Kurnool. Kurnool district ranks third in the production of banana in Rayalaseema region of Andhra Pradesh. It is cultivated in 5765 hectares with an annual production of 5.68 lakh tonnes in the year 2012-13. The present study was undertaken to study resource use efficiency of banana in Kurnool district of Andhra Pradesh

MATERIAL AND METHODS

Kurnool district in Andhra Pradesh was purposively selected for the present study, as the district ranks third in position in Rayalaseema region with an area of 5765 hectares under banana cultivation in the year 2012. All the mandals in the Kurnool district along with their banana cultivated area were listed out in descending order and top two mandals were selected *viz.,* Mahanandi and Nandyal. From these selected two mandals, four villages *i.e.,* two from each mandal were selected for a detailed study. Four villages namely Bukkapuram and Thimmapuram from Mahanandi mandal; Kothapalle and Nandyal Rural from Nandyal mandal were selected to collect the required information. Multistage random sampling was adopted to obtain a total sample of 120 respondents. The sample is stratified into small, medium and large farms. From each selected village samples are purposively drawn as per the farmers available in the village to make a sample of 120. i.e small (60), medium (37) and large (23) farmers.

Resource productivity, returns to scale and resource use efficiency (Raju V T, 2006 and Rao *et al.*, 2011,) were estimated by developing a functional relationship between output and inputs. For this purpose, in the present study Cobb-Douglas production function was adopted for its flexibility and suitability to the heterogeneous data and to know the nature of returns to scale.

The general form of this function is as follows….

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

Where Y = dependent variable and
$x_1, x_2 \ldots..x_n$ = The variable inputs
$b_1, b_2 \ldots.b_n$ = Regression coefficients
u = Error term
a = Constant

The function in the double logarithmic form would be

$$\text{Log } Y = \log a + b_1 \log x_1 + b_2 \log x_2 \ldots + b_n \log x_n + \log u$$

The variables in the present study are specified as follows:

Y = Gross returns in Rs/ha
X_1 = Suckers in No. /ha
X_2 = Human labour expenses in Rs/ha
X_3 = FYM in Tons/ha
X_4 = Nitrogen fertilizers in Kg/ha
X_5 =Phosphorous fertilizer in Kg/ha
X_6 = Potassium fertilizer in Kg/ha
X_7 = Irrigation expenses in Rs/ha

Returns to scale

The sum of regression coefficients or production elasticity coefficient ($\sum b_i$) indicates the nature of returns to scale.

If $\sum b_i$ = 1 constant returns to scale
> 1 increasing returns to scale
< 1 decreasing returns to scale

Marginal value product

The marginal value product was computed by multiplying elasticity coefficient of the given resource with the ratio of geometric mean of output and resource. The marginal value product would be

$$\text{MVP of } X_i = bi \times \frac{\bar{Y}}{\bar{X}_L}$$

Where $\bar{X}_L$ and $\bar{Y}$ are geometric means of resource and output and b_i is elasticity coefficient of the variable x_i.

RESULTS AND DISCUSSIONS

Cobb-Douglas production function was used to evaluate the efficiency of the resource use for the farms because of its unique advantage in deriving various decision measures such as elasticity of production, marginal value productivity and returns to scale (Reddy, 2006; Verma, 2007 and Rao H S, 2011)

Small farms:

Table 1 show that the coefficient of multiple determination (R^2) of 0.795, indicated that 80 per cent variation in yield was influenced by the selected input variables. The unexplained 20 per cent variation might be due to the other exogenous factors not included in the function.

The coefficient of suckers (X_1) and FYM (X_3) were positive and significant at one per cent level. It can be inferred that for every one per cent increase of these inputs, the gross value of output increases by 0.541 and 0.141 per cent respectively. The coefficient of human labour (X_2) and potassium (X_6) were positive and significant at 5 per cent level indicating that for every one per cent increase this input, the gross value of output increases by 0. 213 and 0.298 per cent respectively. The coefficient of nitrogen fertilizers (x_4) was negative and significant at 5 per cent level indicating that with one per cent increase of this input, the gross value of output decreases by 0.531 per cent. Remaining variables included in the function have no significant influence on the output.

Medium farms:

The coefficient of multiple determination (R^2) was 0.840, which indicates 84 per cent variation in yield was explained by the selected input variables. The remaining 16 per cent variation might be attributed to the inter farm differences in soil fertility, skill of the farmer and other factors not included in the function (Table .1).

The coefficient of suckers (X_1) and potassium (X_6) were positive and significant at one per cent level. It can be inferred that for every one per cent increase of these inputs, the gross value of output increases by 0.7 per cent and 0.343 per cent respectively. The coefficient of FYM (X_3) was positive and significant at 5 per cent level indicating that one per cent increase of this input causes 0.102 per cent increase of output. The coefficient of nitrogen fertilizers (x_3) was negative and significant at 5 per cent. It is indicating that for every one per cent increase of this input, the gross value of output decreases by 0.242 per cent. Remaining variables included in the function have no significant influence on the output.

Large farms:

The coefficient of multiple determination (R^2) was 0.821, which indicates that 82 per cent variation in yield was explained by the selected input variables. The remaining 18 per cent variation might be attributed to the inter farm differences in soil fertility, skill of the farmer and other factors not included in the function (Table .1).

Table 1. Regression coefficients of production function of banana on different sizes of farms.

Particulars	Farm size			
Constant	Small	Medium	Large	Pooled
X_1 suckers (No./ha)	2.947	3.461	3.223	2.712
X_2 Human labour (Rs./ha)	0.514(0.102)**	0.701(0.218)**	0.692(0.723)	0.381(0.187)*
X_3FYM (Tons./ha)	0.213 (0.079)*	-0.072 (0.118)	-0.284 (0.210)	0.205 (0.088)*
X_4 Nitrogen Fertilizers(kg./ha)	0.141 (0.046) **	0.102(0.054)*	0.468(0.383)NS	0.236(0.098)*
X_5 Phosphorous Fertilizers (kg/ha)	-0.531 (0.125)**	-0.242(0.114)*	-0.148(0.062)*	-0.689(0.094)**
X_6 Potassium Fertilizers , (kg./ha)	0.188 (0.0210)NS	-0.031(0.097)NS	0.086(0.295)NS	0.179(0.161)NS
X_7 Irrigation (Rs./ha)	0.298 (0.220)*	0.343(0.105)**	-0.77(0.343)*	0.055(0.025)*
Coefficient of	0.284 (0.191)NS	0.191 (0.110)NS	0.625 (0.776)NS	0.614 (0.715)NS
determination (R^2)	0.795	0.840	0.821	0.869
Returns to scale (“b_i)	1.107	0.922	0.965	0.981
No. of respondents (N)	60	37	23	120

*NOTE: * Significant at 5 per cent level, ** Significant at 1 per cent level, NS –non significant*
Figures in the parenthesis indicates standard errors

Table 2. MVP of inputs.

S No.	Inputs	MVP of inputs			
		Small	Medium	Large	Pooled
1	Suckers	1.89	2.80	-	2.51
2	Human labour	1.07	-	-	1.21
3	FYM	2.18	1.80	-	1.67
4	Nitrogen Fertilizers	0.38	0.28	0.51	0.45
5	Potassium Fertilizers	2.47	2.85	0.83	1.90

Note: MVP’s were compared with per unit costs of inputs

The coefficient of nitrogen fertilizers (X_3) and potassium (X_6) were negative and significant at 5 per cent level indicating that for every one per cent increase of these inputs, the gross value of output decreases by 0.148 per cent and 0.77 per cent respectively. Remaining variables included in the function have no significant influence on the output.

Pooled farms:

It can be noticed from table that the coefficient of multiple determination (R^2) was 0.869 indicating that 87 per cent variation in yield was explained by the selected input variables. The remaining 13 per cent of variation might be attributed to other extraneous factors.

The coefficient of suckers (X_1), human labour (X_2), FYM (X_3) and potassium (X_6) were positive and significant at five per cent level. It can be inferred that for every one per cent increase of these inputs, the gross value of output increases by 0.381, 0.205, 0.236 and 0.055 per cent respectively. The coefficient of nitrogen fertilizers

(x_3) was negative and significant indicating that for every one per cent increase of this input, the gross value of output decreases by 0.689 per cent. Remaining variables included in the function have no significant influence on the output.

Sum of the elasticities of resources in Cobb-Douglas production function gives an indication of returns of scale. The perusal of table 1 indicates that the returns to scale is greater than unity (“b_i>1) for small farmers revealing increasing returns to scale and for medium, large and pooled farmers it is diminishing returns to scale (“b_i<1).

From the Table 2, it was observed that, in case of small farms, MVP to MFC ratio for the nitrogen fertilizer was less than 1 indicating that there was tremendous scope to reduce the excess utilization of Nitrogen fertilizers in banana production. The variables number of suckers, FYM, human labour and potassium fertilizers were >1 indicating that these inputs were underutilized. The variables in medium farms *viz*., suckers, FYM and potassium fertilizers were found to be > 1 indicating that there is scope to increase the level of these inputs in banana crop production to obtain more profits. The MVP to MFC ratio for nitrogen fertilizer was < 1 indicating that this input was over utilized. The variables in large farms like nitrogen fertilizers and potassium fertilizers were found to be <1 indicating that there is no scope to increase the level of these inputs as they were over utilized in banana crop production. In pooled farms category except nitrogen, all other variables like suckers, FYM, human labour and potassium fertilizers were underutilized.

Conclusions:

Suckers, FYM and potassium fertilizers were found to be significant variables affecting the productivity of banana in all size of farm groups except large farms. Nitrogen fertilizer was found to be significant variable affecting the productivity of banana in all size of farm group. The value of ($\bar{R}^2$) was highest on pooled farms (0.869) followed by medium (0.84) and large farms (0.821). The MVP to MFC ratio for suckers FYM and potassium fertilizers were > 1 indicating that there is scope to increase the level of these inputs in banana crop production. Hence there is a need to reorganize and optimize the utilization of these resources to reduce the cost of cultivation as well as to increase the profit margin. Extension agencies have to educate the farmers on optimum use of resources and reduction on cost of cultivation measures.

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