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Resource productivity and resource use efficiency in *mrugbahar* sweet orange production

P.P. YEWARE[1], B.R. PAWAR*, V.V. LANDGE AND D.S. DESHMUKH[1]
Department of Agricultural Economics and Statistics,College of Agriculture, LATUR (M.S.) INDIA

ABSTRACT

Sweet orange (*Citrus sinensis* Osbeck) is one of the important fruit crops in India. Investigation was carried out in Nanded district of Maharashtra specially on mrugabahar season of sweet orange. The data pertained to the year 2007-08. The study was conducted to know resource productivity, resource use efficiency and optimum resource use in mrugabahar sweet orange production. Cobb-Douglas production function was fitted to the data. The results revealed that the partial regression coefficients of manure (0.126), irrigation (0.124), machine labour (0.048) and hired human labour (0.092) were positive and significant. It revealed that these resources when increased by one per cent each, that led to increase the production of sweet orange by 0.126, 0.124, 0.048 and 0.092 per cent, respectively. With regard to optimum resource use it was observed that optimum use of manure was300.34 quintals followed by irrigation (11823.26 m^3), hired human labour (109.65 man days), machine labour (16.95 hours) and potash (125.91 kg).

Key words : Production, Productivity, Optimum, Marginal, Regression

INTRODUCTION

Production of sweet orange can be taken in two seasons which are designated as *mrugbahar* and *ambebahar* sweet orange. In *mrugbahar* water stretch treatment is given to the garden in the month of April-May. The flowering is occurring in the month of June-July and harvesting can be completed in the month of February-March. On the contrary, in *ambebahar* water stretch treatment is given to the garden in the month of November-December. The flowering is occurring in the month of January-February. Harvesting is done in the month of September-October. Thus *mrugbahar* is more important because of high price for producer and more sweetness of fruit for consumer. In the production of *mrugbahar* sweet orange, water resource is very important. Similarly, human labour, bullock labour, area of garden, fertilizer are also playing vital role in sweet orange production. Hiremath *et al.* (1994) studied resource use efficiency in lime orchards in Bijapur district of Karnataka. The Cobb-Douglas type of production function was used for studying the resource productivities. Similarly, there is need to know the marginal productivity and efficiency of rupee spent on the sweet orange production. By keeping in view, the present study has been undertaken.

MATERIALS AND METHODS

Study was conducted in Nanded district of Maharashtra state. The total sample consisted with 50 *mrugbahar* sweet orange cultivators spread over ten villages, of Nanded tehsil. From each village five *mrugbahar* sweet orange growers were selected. The Cobb- Douglas type of production function was fitted to evaluate the resource use efficiency in *mrugbahar* sweet orange garden. The form of production function was as follows.

$$Y = ax_1^{b1} .x_2^{b2}\ldots\ldots\ldots\ldots x_n^{bn} .e^u$$

$$Y = ax_1^{b1}.x_2^{b2}.x_3^{b3}.x_4^{b4}.x_5^{b5}.x_6^{b6}.x_7^{b7}.x_8^{b8}\, x_9^{b9}.x_{10}^{b10}$$

Where, Y =Yield of sweet orange (q/garden), a = Intercept of production function, b_i = regression coefficients of the respective resource variable (i = 1, 2, 3, …. 5), X_1 = area of sweet orange garden (ha/garden), X_2 = hired human labour (man days/garden), X_3 = bullock labour (pair days/garden), X_4 = machine labour (hours/ garden), X_5 = manures (q/garden), X_6 = nitrogen (kg/ garden), X_7 = phosphorus (kg/garden), X_8 = potash (kg/ garden), X_9 = irrigation (m^3/garden), X_{10} = family human labour (man day / garden). The function was transformed into log linear form as follows.

$$\text{Log } Y = \log_a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + b_6 \log x_6 + b_7 \log x_7 + b_8 \log x_8 + b_9 \log x_9 + b_{10} \log x_{10}$$

Cobb-Douglas production function allows either constant, increasing or decreasing marginal productivity. The MP equation is MP=bY/ X where b is partial regression coefficient of particular independent variable. X=geometric mean of particular independent variable. Y=Geometric mean of dependent variable. MVP of various input worked out by the formula; $MVP = b_i Y Py /X$, Where, b_i = partial regression coefficient of particular independent variable, X = geometric mean of particular

*** Author for correspondence.**
[1] Department of Agricultural Economics and Statistics, College of Agriculture, PARBHANI (M.S.) INDIA

independent variable,Y = geometric mean of dependent variable, Py = price of dependent variable.

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Partrial regression coefficient of explanatry variable:

Linear and Cobb-Douglas production functions were used in *mrugbahar* sweet orange production. On the basis of goodness of fit (R^2) Cobb-Douglas production function was found fit to the data. In *mrugbahar* sweet orange production, partial regression coefficients with respect to various explanatory variables were calculated and are presented in Table 1. It was observed that partial regression coefficient of manure was 0.126 which was positive and highly significant at 1 per cent level. It inferred that if one per cent increase in use of manure over its geometric mean, it would lead to increase sweet orange production by 0.126 per cent. Similarly, partial regression coefficient with respect to irrigation was positive as 0.124 which was highly significant at 1 per cent level. If use of irrigation was increased by one per cent, it would lead to increase the production of sweet orange by 0.124 per cent. Partial regression coefficient with respect to hired human labour and machine labour was 0.092 and 0.048, respectively. It inferred that if one per cent increase in use of hired human labour, it would lead to increase sweet orange production by 0.092 per cent while if one per cent increase in use of machine labour, it would lead to increase the production of sweet orange by 0.048 per cent. On the contrary, partial regression coefficient with respect to phosphorus was -0.022 which was negatively significant at 5 per cent level. It implied that if one per cent increase in use of phosphorus it would lead to decrease production of sweet orange by 0.022 per cent. The partial regression coefficient with respect to area, bullock pair, potash were positive but non significant. While, partial regression coefficient with respect to nitrogen and family human labour were negative but non significant. Coefficient of multiple determination (R^2) was 0.914 which indicated that 91.40 per cent variation in *mrugbahar* sweet orange production was explained due to variation in all independent variables. F-value was highly significant (6.452). It was clear that each explanatory variable on its own was not very important but together they explained significantly part of variation in the *mrugbahar* sweet orange production. Sum of partial regression coefficient was 0.538 which

Table 1 : Estimates of Cobb-Douglas production function in *mrugbahar* sweet orange production

Sr. No.	Independent variable	Partial regression coefficient (bi)	Standard error (SE) of bi	't' value of bi	Geometric mean ($\overline{Xi}$)	Marginal product (q)	Marginal value product (Rs.)	Price of input (Rs.)	MVP to price ratio	Optimum resource use
1.	Area (ha/garden)	0.168	0.103	1.610	1.024	16.345	15643.17	14339.18	1.09	1.12
2.	Hired human labour (man day/garden)	0.092	0.038	2.420*	102.251	0.089	85.17	80.00	1.06	109.65
3.	Bullock labour (pair day/garden)	0.038	0.060	0.633	4.061	0.932	891.951	150.00	5.94	24.15
4.	Machine labour (hr/garden)	0.048	0.023	2.041*	3.142	1.522	1456.599	270.00	5.39	16.95
5.	Manure (q/garden)	0.126	0.044	2.863**	105.442	0.119	113.886	40.00	2.85	300.34
6.	Nitrogen (kg/garden)	-0.025	0.043	0.579	142.252	-0.017	-16.269	10.86	-1.5	--
7.	Phosphorus (kg/garden)	-0.022	0.010	2.145*	83.829	-0.026	-24.882	22.25	-1.12	--
8.	Potash (kg/garden)	0.011	0.012	0.893	61.669	0.017	16.269	8.33	1.95	125.91
9.	Irrigation (m^3/garden)	0.124	0.043	2.903**	9805.500	0.001	0.957	1.00	0.96	11823.26
10.	Family human labour (man day/garden)	-0.022	0.220	0.100	18.953	-0.115	-110.058	80.00	-1.38	--

Intercept (log a)	-4.144	R^2	0.914
F-value	6.452	Return to scale	0.538
n	50		

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

Note : Geometric mean ($\overline{Y}$) of *mrugbahar* sweet orange production was 99.63 quintals per garden and its price (Py) was Rs.957.03 per quintal

indicated decreasing return to scale. The results are in conformity with the results obtained by Khan (1983)

Marginal product of explanatory variable :

Resource productivity with respect to various explanatory variables were estimated and are also presented in Table 1. It was obvious from the table that marginal productivity with respect to area was 16.34 quintals followed by that of machine labour (1.522 q), bullock labour (0.932 q), manure (0.119 q) and hired human labour (0.089 q). It inferred that if area under *mrugbahar* sweet orange increased by one hectare over its geometric mean, it would lead to increase sweet orange production by 16.34 quintals. Similarly, per unit of machine labour, bullock labour, manure and hired human labour increased, it caused to increase the production of sweet orange by 1.522, 0.932, 0.119 and 0.089 quintals, respectively.

Resource use efficiency of explanatory variable :

In regard to resource use efficiency it was evident from Table 1 that use of bullock labour indicated the highest MVP to price ratio as 5.90 followed by machine labour (5.39), manure (2.85), potash (1.95), hired human labour (1.06), irrigation (0.96) and area (1.09). It inferred that whereas higher the MVP to price ratio, the priority must be given from higher to lower ratios to increase these resources in order to get the value of unity. On the contrary, where MVP to price ratio is negative, the use of resource could be reduced. The results are in conformity with the results obtained by Bansode(2001), Dayanand and Hiremath (1995), Hiremath *et al.* (1994).

Optimum use of explanatory variable :

In regard to optimum resource use it was observed that optimum use of manure was 300.34 quintals followed by irrigation (11823.26 m^3), hired human labour (109.65 man days), machine labour (16.95 hr.) and potash (125.91 kg).

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