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Resource productivity and resource use efficiency in grape wine production

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ABSTRACT

In all 32 grape winery owners were selected from Pune, Nasik and Sangli districts of Maharashtra. Data were collected from 32 grape winery owners by personal interview method for the year 2009-2010. Cobb-Douglas production function was fitted to the data. The results revealed that the regression coefficients of hired human labour, raw grape, potassium metabisulphate, water quantity and KH_2PO_4 were 0.011, 0.494, 0.116, 0.005 and 0.267, respectively which were positive and significant. Marginal productivity with respect to hired human labour, raw grape, potassium metabisulphate, KH_2PO_4 and glycol was 9.321, 3.163, 597.674, 1034.330 and 208.293 litres, respectively. It inferred that if hired human labour increased by one person, raw grape by one quintal, potassium metabisulphate by one kg, KH_2PO_4 by one kg and glycol by one litre that would lead to increase grape wine production by 9.321, 3.163, 597.674, 1034.330 and 208.293 litres, respectively. The sum of the production elasticities (bi) was found to be 0.655 which indicated decreasing return to scale.

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Grapewine is a health drink resulting from complete or partial alcoholic fermentation of grape. India has grape wine production about 2.25 crore litres of which Maharashtra has 2.11 crore liters of grape wine production. In present scenario, table-wine accounts for 85 per cent of market and expensive varieties of vintage-wine accounts for 15 per cent. In Maharashtra, at present there are 58 winery units. Out of that about 30 are in Nasik followed by 11 in Pune, 10 in Sangali, 3 in Buldhana and 1 in Osmanabad districts. Grape wine production is the function of variable resources like raw grape, labour and different chemicals. In production process, some resources are under utilization while other resources are over utilization (Julian and Heien, 2001). In this situation, grape wine production business might be in loss. In order to overcome the problem of resource management, the present study of resource productivity and resource use efficiently in grape wine production has been undertaken.

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METHODOLOGY

Multistage sampling design was adopted for selection of districts and grape winery owners. In the first stage, Pune, Nasik, and Sangli districts were selected purposely on the basis of availability of winery units. In second stage, eight winery units from Pune district, eight from Northern-Nasik, eight from Southern-Nasik and eight from Sangli districts were selected. Thus, in all 32 grape winery units were selected. Data were collected from the winery owners by personal interview method with the help of pretested schedule. The data pertained to the year 2009-2010. Use of resources namely, human labour, raw grape, yeast and chemicals were taken into consideration. Cobb-Douglas production function was fitted to the data to estimate the resource productivity and resource use efficiency as follows:

$$Y = ax_1b_1\ x_2b_2 \ldots\ x_nb_ne^u$$

In this functional form Y is the dependent variable, Xi showed independent resource variables; 'a' as the constant representing intercept of the production function and bi indicated the regression coefficient of the respective resource variable. The regression coefficient was obtained from this function directly representing the elasticity of production which remains constant throughout the relevant range of inputs. The sum of coefficients *i.e.* bi indicates nature of return to scale. This function can easily be

transformed, into a linear form by working logarithmic transformation.

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

For fitting production function for grape wine, eight variables were considered as important factors by solving the problem of multicollinearity in estimating production function. The equation fitted was the following formula:

$$Y = a x_1^{b1} \cdot x_2^{b2} \cdot x_4^{b4} \cdot x_5^{b5} \cdot x_6^{b6} \cdot x_7^{b7} \cdot x_8^{b8}$$

where, Y = Wine production in litre, a = Intercept of production function, bi = Partial regression coefficients of the respective resource variable (i= 1, 2,3,……..8), X_1 = Hired human labour in man day, X_2 = Raw grapes in kg, X_3 = Potassium meta bi-sulphate in kg, X_4 =Yeast in kg, X_5 = Water quantity in liter, X_6 = Pectoletic enzyme in kg, X_7 = KH_2PO_4 in kg, X_8 = Glycol in litre. Then t-value was tested at n-1 and n-k-1 degree of freedom *i.e.* explanatory or independent variable (k) and number of observations or number of grape winery owners (n). R is coefficient of multiple determination. Intercept (a) is the mean of grape wine production obtained in the absence of selected variables and regression coefficients (bi) are coefficients of independent variables. Regression coefficients were tested for significance by applying t test at n-k-1 degree of freedom. Thus, t_{n-k-i} = b/SE, where, b = regression coefficient of particular variable, SE = standard error of that variable.

ANALYSIS AND INTERPRETATION

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

Elasticity of production :

Regression coefficients with respect to various explanatory variables were calculated and are presented in Table 1. It was observed that regression coefficient of raw grape was 0.494 which was positive and highly significant at one per cent level. It inferred that if one per cent increased in use of raw grape over its geometric mean, it would lead to increase in wine production by 0.494 per cent. Regression coefficient of KH_2PO_4 was 0.267 which was also positive and significant at one per cent level of significance. It inferred that if there is one per cent increase in use of KH_2PO_4 over its geometric mean, it would lead to increase in wine production by 0.267 per cent. Regression coefficients with respect to yeast, glycol, pectoletic enzyme were non-significant. Coefficient of determination (R) was 0.734 which indicated that the variation was 73.40 per cent due to variation in all independent variables. It was clear that each explanatory variable on its own was not very important but together they explained significantly part of variation in wine production. The sum of partial regression coefficient was 0.655 which indicated decreasing return to scale.

Marginal product of grape wine :

Resource productivity with respect to various explanatory variables were estimated and presented in Table 1. The marginal productivity with respect to hired human labour was 9.321 litres followed by that of raw

Table 1 : Estimates of Cobb-Douglas production function in grape wine production

Sr. No.	Independent variable	Regression coefficient	Standard error (SE)	't' value	Geometric mean (Xi)	Marginal product (litre)	Marginal value product (Rs.)	Price of input (Rs.)	MVP to price ratio
1.	Hired human labour	0.011	0.010	1.100	141.287	9.321	929.46	100.00	9.29
2.	Raw grape	0.494	0.194	2.568**	18696.656	3.163	315.38	18.43	17.11
3.	Potassium meta bi-sulphate	0.116	0.117	0.991	23.238	597.674	59594.07	270.11	220.62
4.	Yeast	-0.056	0.023	-2.400*	31.753	-211.158	-21054.60	6209.85	-3.390
5.	Waier quantity	0.005	0.003	1.660	5030.124	0.119	11.86	0.60	19.77
6.	Pectoletic enzyme	-0.062	0.025	-2.454*	1.890	-3927.670	-391628.02	9915.61	-39.496
7.	KH_2PO_4	0.267	0.138	1.934	30.907	1034.33	103133.15	300.00	343.77
8.	Glycol	-0.120	0.110	-1.090	68.978	208.293	-20768.949	95.00	-218.620

Intercept (log a) = 4.900

R^2 = 0.734

F-value = 7.944**

Return to scale =0.655

n = 3 2

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

Geometric mean ($\overline{Y}$) of grape wine production was 119730.60 liter per firm and its price (Py) was Rs.99.71 per liter

grapes (3.163 litres), potassium metabisulphate (597.674 litres), water quantity (0.119 liters), KH_2PO_4 (1034.330 litres). It inferred that, one man day increase in hired human labour, it would lead to increase in wine production with 9.321 litre. Similarly, per unit of raw grape, potassium met bi-sulphate, water quantity and KH_2PO_4, it would cause to increase in wine production by 3.163, 597.674, 0.119 and 1034.330 litres, respectively.

Resource use efficiency in grape wine production :

In regard to resource use effiency, it was also evident from Table 1 that use of KH_2PO_4 indicated the highest MVP to price ratio as 343.77 followed by potassium metabisulphate as 220.62, raw grapes as 17.11 and hired human labour as 9.29 which were greater than unity. It inferred that there was scope to increase use of the above variables by giving the priority to higher MVP to price ratio in wine production.

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