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Resource use efficiency and resource allocation on medium farm in cash crop production

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ABSTRACT

The study of resource productivity; resource use efficiency and optimum resources used with respect to various explanatory variables in cash crops cotton and sugarcane was undertaken on medium farm during agriculture year 2005-06 in Marathwada region of Maharashtra. The data were taken from cost of cultivation scheme Marathwada Agricultural University, Parbhani, the sample of 100 medium farm size farmers throughout the zone was tabulated and analyzed by appropriate statistical tools. The result revealed that, cotton area was positive and significant at 1 per cent level. Coefficient of multiple determination was (R^2) 0.58 which indicate 58 per cent variation in independent variable, the sum of elasticity was 1.21 which was indicated that increasing return to scale. Sugarcane area was also positive and significant at 1 per cent level, the sum of elasticity was 0.61 per cent which indicate decreasing return to scale coefficient of multiple determination was 0.61 which indicated that 61 per cent variation in explanatory variable.

Key words : Cotton, Sugarcane, Resource productivity resource use efficiency

INTRODUCTION

The targeted growth rate of agriculture is fixed at 4 per cent to achieve projected requirement of foodgrain, oilseeds, sugarcane, livestock and fishery product to the tune to be double by the end of 2011-12. Sustaining a 4 per cent growth rate in next decade will require much larger use of inputs particularly land, irrigation, fertilizers, pesticides, high yielding varieties etc. Due to top impact of WTO the agriculture land use charge might be titled towards allocation of more areas to cash crops, fruits, floriculture and medicinal plants.

The net farm income is mainly a function of farm size and net profit per unit area. The net profits per holding, at point of times, depend upon several factors such as the type of farming practices, the quantum of use of various inputs, the prices of inputs and products and the overall management efficiency of the operators.

Level of awareness of farmers increases with increased education facilities and extension programme. To make full use of rapidly increasing new technology, the adoption process of agricultural practices need to be accelerated. Economic analysis makes the farmers learn more of alternative course of action. The scientific management process acts as a useful educational tool through gathering more information on new alternatives and testing each recommendations on economic standards.

Present scenario challenges the scientists to enhance land use efficiency in order to increase the per unit returns from agriculture. There is a great need to pay attention to increasing land utilization efficiency, net sown area, resource use efficiency of inputs, are governed by several factors such as socio-economic characters of farmers, cropping pattern availability and quality of resources, types of resources like soil, water, varieties used etc. managers, workers labours, cost of resources, market prices, other enterprises like fishery, poultry, dairy etc. and market policies given by government.

The main aim of farmers to get more profit or returns from the inputs by using resources efficiently, the investigation on analysis of medium farm in Marathwada region of Maharahstra was carried out.

MATERIALS AND METHODS

Marathwada region of Maharashtra was purposively selected in order to study the farm business analysis. Multiple stage sampling design was used for selection of zone, tehsils, villages and farms. Twenty eight tehsils under the assured rainfall zone were selected from the eight districts of region because of their involvement in cost of cultivation scheme. From each cluster villages, the two farmers of medium categories were selected. Thus, total 100 sample farms were selected. Data pertains to the year 2006-07. Technique like tabular analysis, budgeting technique, non-linear and multiple regression analysis, frequency and percentage method were used to analyze the data.

Strong inter-correlations among independent variables were identified for solving problem of collinearity in estimating production function. The variables which had non-significant correlation significant with respect to cotton and sugarcane production were also dropped in estimating production function. Thus for cotton six and for sugarcane eight independent variables were included

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in both linear and Cobb-Douglas production functions. On the basis of goodness of fit (R^2), Cobb-Douglas production function was found to be the best fit to the data to estimate the resource productivity, resource use efficiency and optimum resource use. The fitted equation was as follows:

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

where, Y = production of cotton and sugarcane (q/ha), a=intercept, b_i = partial regression coefficient of specific resource (i=1,2,…..,9),X_1=area of crop(ha/farm), X_2=Hired labour (man day/farm), X_3=seed(kg/farm), X_4=nitrogen(kg/farm), X_5=phosphorus (kg/farm), X_6=potassium(kg/farm), X_7=family labour(man day/farm), X_8=irrigation(m^3/farm),X_9= Plant Protection(lit./farm), and e= error term. The function was transformed into log-linear form as follows:

$$\log Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 \text{ ——— } b_n \log X_n + u \log e$$

RESULTS AND DISCUSSION

Estimates f Cobb-Douglas production function in rainfed cotton production:

Regression coefficient with relation to various explanatory variables were estimated with 't' values and are presented in Table 1. It was observed that the regression coefficient of hired human labour was 0.487 which was positive and significant at 5 per cent level. It was inferred that if 1 per cent increase in use of nitrogen, over its geometric mean level, it would lead to increase rainfed cotton production by 0.487 per cent. Similarly, seed indicated positive regression coefficient as 0.568 which were also found significant at 5 per cent level. It was inferred that if use of seed was increased by 1 per cent, it would lead to increase the production of rainfed cotton by 0.568 per cent. Area was positive but non significant. Nitrogen, phosphorus and plant protection were negative regression coefficient and non significant. Area was positive but non significant. Nitrogen, phosphorus and plant protection were negative regression coefficient and non significant. Coefficient of multiple determination (R^2) was 0.58 which indicated that 58.00 per cent variation in rainfed cotton production was explained due to variation in all independent variables. The sum of regression coefficient was 1.21 which indicated increasing return to scale. 'F' value was highly significant (9.38). It was clear that each explanatory variable on its own was not very important but together they explained significantly part of variation in rainfed cotton production.

Resource productivity, resource use efficiency and optimum resource use with respect to various explanatory variables were estimated and are also presented in Table 1. It is obvious from Table 1, that marginal productivity with respect to area of rainfed cotton was the highest as 1.23 quintals followed by that of seed (0.96 q) and hired human labour (0.013 q). It was inferred that if area of rainfed cotton was increased by one of hectare over its geometric mean level, it would lead to increase the production of rainfed cotton with 1.23 quintals and similarly, per unit increased of seed and hired human labour was increased, it would cause to increase the production of rainfed cotton 0.96 q and 0.013 q, respectively.

In regard to resource use efficiency, it was also evident from table that use of seed in rainfed cotton indicated the highest MVP to price ratio (1.93), followed by area (0.89) and hired human labour (0.43). MVP to price ratio of area was greater than unity that the land resource could be increased

In regard to optimum use, it was observed that use of seed was optimum as 3.51 kgs, followed by area 0.92 hectares and hired human labour 50.16 man days. It was implied that optimum resource use with respect to these variables were less than existing resource level.

Estimates of Cobb-Douglas production function in Sugarcane production:

Regression coefficient with respect to various independent variable was estimated and are presented in Table 2. It was observed that, elasticity of area under sugarcane production was positive (0.587) and significant at 1 per cent level. It inferred that if 1 per cent increase in area under sugarcane, over its geometric mean, it would lead to increase sugarcane production by 0.587 per cent. The marginal productivity with respect to area was highest as 39.16 tones, it was indicated that if area increased by one hectare over its geometric mean level, it would lead to increase the production of sugarcane by 39.16 tones. The marginal value product and price of land resource were Rs.33291.77 and Rs.10886.41, respectively. The MVP to price ratio with respect of area was 3.058 which is greater than one represents that the land resource could be increased. It was observed that use of area was optimum as 3.39 hectare Coefficient of multiple determination (R^2) was 0.61 which indicated that 61.00 per cent variation in sugarcane production was explained due to variation in all independent variables. 'F' value was highly significant (4.25). It was clear that each explanatory variable units own was not very important but together they explained significantly part of variation in sugarcane production. The sum of regression coefficient was 0.61 which means decreasing return to

Table 1: Estimates of Cobb-Douglas production function for partial regression coefficients in returns to resource productivity, resource use efficiency and optimum resource use in rainfed cotton production

Sr. No.	Independent variable	Partial regression coefficient (bi)	Standard error bi (SE)	't' value	Geometric mean of input (xi)	Marginal product (q)	Marginal value product (Rs.)	Price of input (Rs.)	MVP to price ratio	Optimum resource use
1.	Area of rainfed cotton (ha/ farm)	0.615	0.351	1.75	1.54	1.23	2467.98	4127.63	0.59	0.92
2.	Hired human labour (man day/farm)	0.487	0.233	2.09*	114.81	0.013	26.21	60.00	0.43	50.16
3.	Seed(kg/farm)	0.568	0.279	2.03*	1.81	0.96	1939.35	1000.00	0.93	3.51
4.	Nitrogen (kg/farm)	-0.262	0.206	-1.26	72.44	-0.011	-22.35	11.30	-197	--
5.	Phosphorus (kg/farm)	-0.039	0.044	-0.90	28.84	-0.0041	-8.35	20.00	-0.41	--
6.	Plant protection (lit /farm)	-0.153	0.159	-0.96	34.67	-0.013	-27.276	200.00	-0.13	--

Intercept (log a) -0.003
F value 9.38**
R^2 0.58
Return to scale (Σ bi) 1.21

NOTE : Geometric mean ($\overline{Y}$) of rainfed cotton production was 3.09 q per farm and price was Rs.2000/q

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

scale.

Regression coefficient of phosphorus was negatively significant (- 0.053) which indicated that there was excessively use of phosphorus. Regression coefficient of nitrogen, potassium, machine labour and hired human labour's were positive but non significant. Bullock labour and irrigation's elasticity was negative and non significant. The marginal productivity with respect to machine labour was highest as 3.68 tones followed by potassium, nitrogen and hired human labour were 0.463, 0.078 and 0.0056 tones, respectively. It was inferred that if machine labour was increased by one hour at its geometric mean level, it would lead to increase the production of sugarcane with 3.68 tones. Similarly, per unit of potassium, nitrogen and hired human labour was increased, it would cause to increase the production of sugarcane 0.463, 0.078 and 0.0056 tones, respectively.

Resource use efficiency and optimum use with

Table 2 : Estimates of Cobb-Douglas production function for partial regression coefficients in returns to resource productivity, resource use efficiency and optimum resource use in sugarcane production

Sr. No.	Independent variable	Partial regression coefficient (bi)	Standard error bi (SE)	't' value	Geometric mean of input (xi)	Marginal product (q)	Marginal value product (Rs.)	Price of input (Rs.)	MVP to price ratio	Optimum resource use
1.	Area of Sugarcane (ha/farm)	0.587	0.217	2.699**	1.111	39.16	33291.77	10886.41	3.058	3.39
2.	Hired human labour (man day/farm)	0.0088	0.132	0.066	115.08	0.0056	4.818	60.00	0.0803	9.24
3.	Bullock labour (Pair day/farm)	-0.030	0.021	-1.43	0.85	-2.61	-2223.9	175.00	-12.708	--
4.	Machine labour(hrs)	0.070	0.236	0.296	1.41	3.68	3128.18	200.00	15.64	22.05
5.	Nitrogen (kg/farm)	0.036	0.021	1.730	33.88	0.078	66.95	11.30	-5.92	200.74
6.	Phosphorus (kg/farm)	-0.053	0.025	-2.071*	9.33	-0.42	-1605.55	20.00	-80.27	--
7.	Potassium (kg/farm)	0.013	0.023	0.575	2.08	0.463	393.81	8.50	46.33	96.36
8.	Irrigation(m^3/farm)	-0.021	0.023	-0.913	7079.45	-0.00021	-0.186	2.50	-0.074	--

Intercept (log a) 1.89
F value 4.25**
R^2 0.61
Return to scale (Σ bi) 0.61

Note : Geometric mean ($\overline{Y}$)of sugarcane production was 74.13 tonne per farm and price was Rs.850/q

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

respect to various explanatory variables were estimated and are also presented in Table 2. It is obvious from the Table 2, that use of potassium in sugarcane production indicated highest MVP to price ratio (46.33) followed by machine labour (15.64), nitrogen (5.92) and hired human labour (0.0803) whereas the MVP to price ratio was greater than unity that the resource could be increased.

In regards to optimum use, it was observed that use of potassium was optimum as 96.36 kgs, followed by machine labour 22.05 hours, nitrogen 200.74 kgs and hired human labour 9.24 man days. It was implied that optimum resource use with respect to these variables was less than existing resource level.

With regards to rainfed cotton, 'F' value was highly significant (9.38). The sum of elasticity was 1.21 which indicated that increasing returns to scale. Coefficient of multiple determination (R^2) was 0.58 which indicated that 58.00 per cent variation in explanatory variables. Hired human labour and seed was positive and significant at 5 per cent level. The marginal productivity were 0.013 quintals and 0.96 quintals, respectively which indicated per unit increased in resources production of rainfed cotton increased by 0.013 quintals and 0.96 quintals, respectively. MVP to price ratio of seed was 1.93 which was greater than one indicated that the seed increased for production of rainfed cotton. In case optimum use, seed and hired human labour were 3.51 kg and 50.16 man days, respectively. Area was positive but non significant. Nitrogen, phosphorus and plant protection were negative and non significant.

In regards to sugarcane, 'F' value was highly significant (4.25). The coefficient of multiple determination (R^2) was 0.61 which indicated that 61.00 per cent variation in explanatory variables. The sum of regression coefficient was 0.61 which indicated decreasing returns to scale. Area of sugarcane was positive and significant at 1 per cent level. The marginal productivity was 39.16 tones means as area increased by one hectare production increased by 39.16 tones. The MVP to price ratio was 3.05 which is greater than one indicated that the area under sugarcane could be increased. In case of optimum use, area was optimum as 3.39 hectares. Phosphorus was negatively significant which indicated excessively used of these resources. Hired human labour, machine labour, nitrogen, and potassium were positive but non significant.

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