



Resource use Efficiency and Allocative Efficiency in Sugarcane Cultivation in Nellore district of Andhra Pradesh

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ABSTRACT

The results, revealed that land coupled with human labour on small farms of main and ratoon, human labour on large farms of main crop, land, human labour and tractor service on large farms of ratoon, human labour on combined farms of main crop and land, human labour and tractor service on combined farms of ratoon crop contributed to the increase in yields.

Key words : Allocative efficiency, Resource use efficiency.

Sugarcane is one of the most important commercial crops of the country. In India, during 2011-12, the area under sugarcane crop was 5.09 million hectares with a total production of 347.87 million tonnes (Directorate of Economics and Statistics & Ministry of Agriculture, 2012). The sugar industry is the second largest agro industry in India, next to textiles.

In Andhra Pradesh, Sugarcane is grown in 2.40 lakh hectares. It is largely grown in Vishakapatnam, West Godavari, Medak, Chittoor, Krishna, Vizayanagaram, Nizamabad, Srikakulam and Nellore Districts with 90 per cent of the area under this crop. About 167.30 lakh tonnes of sugarcane is produced in the state (2011-12) (Directorate of Economics and Statistics & Ministry of Agriculture, 2012). From this about 1,118,000 tonnes of sugar is produced. The present study was carried out to analyse the resource use efficiency in the production of sugarcane.

MATERIAL AND METHODS

The study was conducted in Nellore district of Andhra Pradesh. The study covered two mandals and four villages with 80 farmers growing sugarcane. The sample farmers were stratified into small and large. Data pertained to the agricultural year 2006-2007 were collected through survey method with the help of pre-tested schedules. The Cobb-Douglas production function which gave best fit, was selected to establish the input-output relationship.

The Cobb-Douglas production function is specified in the following power form.

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} \dots e^m$$

Y = Yield in tonnes

X₁ = Land in hectares

X₂ = Human labour in mandays

X₃ = Tractor power in hours

X₄ = Farm yard manure in tonnes

X₅ = Fertilizers in kgs.

a = Intercept

m = Stochastic disturbance term

e = Napier base

b₁ to b₅ partial elasticity coefficients of x₁ to x₅ inputs.

RESULTS AND DISCUSSION

The regression coefficients of different inputs used in the production function were estimated and the results are presented in Table-1.

Resource productivity in main/planted crop Small farms

It is observed from Table-1 that out of five independent variables included in the model, land (X₁) and human labour (X₂) were positively significant at 5 per cent level. The regression coefficients are the elasticity coefficients of production in Cobb-Douglas production function, as they show percentage response of output due to one per cent change in input. For example, one per cent increase in land and human labour, keeping

Table 1 Regression coefficients of the input factors in sugarcane.

Sl. No.	Particulars	Main Crop			Ratoon Crop		
		Small	Large	Combined	Small	Large	Combined
1.	Number of farmers	40	40	80	40	40	80
2.	Intercept (a)	0.6645	-0.7441	-0.0957	-0.0442	0.3276	0.2476
3.	Land in hectares (X_1)	0.4799*	-0.1850	0.1902	0.1560*	0.3200*	0.2601**
		(0.233)	(0.2935)	(0.1763)	(0.0718)	(0.0981)	(0.0654)
4.	Human Labour in mandays (X_2)	0.4621*	0.8249*	0.7705**	0.7619**	0.4784**	0.4503**
		(0.2194)	(0.3233)	(0.1671)	(0.0754)	(0.1755)	(0.924)
5.	Tractor power in hours (X_3)	-0.0020	-0.0273*	-0.0165*	0.0532	0.2157*	0.1860*
		(0.0108)	(0.0115)	(0.0080)	(0.0494)	(0.0951)	(0.0581)
6.	FYM in tonnes (X_4)	0.0017	0.2105	0.0069	0.0039	-0.1873	0.0059
		(0.0079)	(0.1781)	(0.0083)	(0.0032)	(0.1139)	(0.0073)
7.	Fertilizers in kgs (X_5)	0.0152	0.1815	0.0355	0.0260	0.1294	0.1278
		(0.0383)	(0.2043)	(0.0381)	(0.0354)	(0.0924)	(0.0460)
8.	Adjusted coefficient of multiple determination (\bar{R}^2)	0.928	0.924	0.954	0.988	0.922	0.967

Note: Figures in parentheses indicate standard errors.

* Significant at 5 per cent level

** Significant at 10 per cent level

other variables constant, would result in an increase of 0.4799 and 0.4621 per cent in the yield of sugarcane. The regression coefficients of farm yard manure (X_4) and fertilizers (X_5) were positively related but found non-significant, while that of tractor power (X_3) had negative elasticity and non-significant.

The adjusted coefficient of multiple determination (\bar{R}^2) was 0.928. This indicates that the variables included in the model explained about 92.80 per cent of variation in the production of sugarcane on small farms.

Large farms

In the case of large farms, the adjusted coefficient of multiple determination was 0.924 thereby indicating that the selected variables explained 92.40 per cent of variation in sugarcane production (Table-1). Of the five variables included in the function, human labour (X_2) was positively significant at 5 per cent level. This implies that keeping other variable constant, one per cent

increase in human labour over its geometric mean level, would result in an increase of 0.8249 per cent in the yield. Tractor power (X_3) was negatively significant at 5 per cent level indicating that one per cent increase in tractor power would lead to a decline in the yield of sugarcane by 0.0273 per cent. The other variables viz., farm yard manure (X_4) and fertilizers (X_5) were positively related but non-significant while land (X_1) was negatively related and non-significant.

Combined farms

It was found that human labour (X_2) was positively significant at 10 per cent level (Table-1). This implies that keeping other variables constant, one per cent increase in human labour over its mean level would result in an increase of 0.7705 per cent in the output. The variable, tractor power (X_3) was significant at 5 per cent level but with negative sign, which means that one per cent increase in tractor power would bring down the yield by 0.0165 per cent. Other variables viz., land (X_1), farm yard manure (X_4) and fertilizers (X_5) were positive but found non-significant.

Table 2. Allocative efficiency of resources in Sugarcane Main/Planted Crop.

Sl. No.	Particulars	Small			Large			Combined		
		MVP	MFC	MVP/MFC	MVP	MFC	MVP/MFC	MVP	MFC	MVP/MFC
1.	Land (X_1)	21,385.31	15,000.0	1.42	-	-	-	-	-	-
2.	Human labour (X_2)	150.12	80.00	1.88	270.00	80.00	3.37	248.40	80.00	3.10
3.	Tractor Power (X_3)	-	-	-	-172.80	250.00	-0.69	-82.08	250.00	-0.32
4.	FYM (X_4)	-	-	-	-	-	-	-	-	-
5.	Fertilizers (X_5)	-	-	-	-	-	-	-	-	-

MVP : Marginal Value Product.

MFC : Marginal Factor Cost.

The adjusted coefficient of multiple determination (\bar{R}^2) was 0.954 indicating that the variables included in the model explained about 95.40 per cent of variation in the sugarcane yields on combined farms.

Resource productivity in ratoon Small forms

As observed from Table-1 that out of five variables included in the function, the variables, land (X_1) and human labour (X_2) were positively significant at 5 per cent and 10 per cent levels respectively revealing that one per cent increase in land (X_1) and human labour (X_2), keeping others constant would increase sugarcane yield by 0.1560 and 0.7619 per cent respectively. The other variables viz., tractor power (X_3), farm yard manure (X_4) and fertilizers (X_5) were non-significant.

The adjusted coefficient of multiple determination (\bar{R}^2) was 0.988 indicating that the variables included in the function explained about 98.80 per cent of variation in the sugarcane yield.

Large Farms

It is apparent from Table-1 that the regression coefficients of land (X_1), human labour (X_2) and tractor power (X_3) were positively significant at 5 per cent, 10 per cent and 5 per cent levels respectively. This means that one per cent increase in land (X_1), human labour (X_2) and tractor power (X_3) over their geometric mean levels, keeping other factors constant, would result in an increase of 0.32, 0.4784 and 0.2157 per cent respectively in the yields of sugarcane. The

coefficient of farm yard manure was negative but found non-significant while fertilizers (X_5) was positively non-significant.

The adjusted coefficient of multiple determination (\bar{R}^2) was 0.922 indicating that variables included in the model explained 92.20 per cent of variation in the yield.

Combined farms

On combined farms, the regression coefficients of land (X_1) human labour (X_2) and tractor power (X_3) were positively significant at 10 per cent, 10 per cent and 5 per cent levels respectively. This means that one per cent increase in land (X_1), human labour (X_2) and tractor power (X_3) over their mean levels, keeping others constant would increase the sugarcane yield by 0.2601, 0.4503 and 0.1860 per cent respectively. The other variables namely farm yard manure (X_4) and fertilizers (X_5) were positive but not-significant and indicated that the change in the levels of these resources did not affect the yield.

The adjusted coefficient of multiple determination (\bar{R}^2) was 0.967. This would indicate good fit of Cobb-Douglas production function to the data and explained about 96.70 per cent of variation in the output of sugarcane ratoon.

Allocative efficiency in sugarcane production-planted crop

Small Farms

It is seen from Table-2 that the ratios of MVP to MFC in the case of land and human labour

Table 3. Allocative efficiency of resources in Sugarcane – Ratoon Crop.

Sl. No.	Particulars	Small			Large			Combined		
		MVP	MFC	MVP/MFC	MVP	MFC	MVP/MFC	MVP	MFC	MVP/MFC
1.	Land (X_1)	6,647.40	15,000	0.44	14,908.32	15,000.00	0.99	11,588.40	15,000.00	0.77
2.	Human labour (X_2)	306.72	80.00	3.83	219.24	80.00	2.74	194.40	80.00	2.43
3.	Tractor Power (X_3)	-	-	-	2,149.20	250.00	8.60	1,915.92	250.00	7.66
4.	FYM (X_4)	-	-	-	-	-	-	-	-	-
5.	Fertilizers (X_5)	-	-	-	-	-	-	17.28	-	1.30

MVP : Marginal Value Product.

MFC : Marginal Factor Cost.

were 1.42 and 1.88 respectively. This implies that every additional rupee spent on land and human labour would add Rs. 1.42 and Rs. 1.88 to the returns in sugarcane planted crop. It indicates that there was under utilisation of these resources in the cultivation of sugarcane.

Large Farms

The MVP/MFC ratio was more than unity for human labour showing greater potentiality for its use. For every additional rupee spent on human labour would fetch an additional income of Rs. 3.37. The negative ratio of the MVP to MFC for tractor power indicated that this factor was used at higher levels than necessary in sugarcane production. (Tiwari and Dheer, 1994).

Combined farms

On combined farms, MVP to MFC ratio of greater than one was found in respect of human labour. Scope existed for its further use as each additional rupee of investment on human labour would add Rs. 3.10 to the income. Similar findings were reported by Haque, 2006.

Allocative efficiency in sugarcane production-ratoon crop

Small farms

The MVP/MFC ratio of human labour was more than unity revealing that an additional rupee investment on human labour would add Rs. 3.83 to the gross income. The ratio of MVP/MFC was less than unity in the case of land.

Large farms

It is seen from Table-3 that the ratio of MVP to MFC in the case of human labour was 2.74. This would mean that every additional rupee spent on human labor would add Rs. 2.74 to the returns. This implies that there was under utilisation of human labour. The MVP/MFC ratio for land was 0.99.

Combined farms

The MVP/MFC ratio of more than unity was noticed for human labour, tractor power and fertilizers. Scope existed for their further use as each additional rupee of investment on human labour, tractor power and fertilizers would add Rs. 2.43, Rs. 7.66 and Rs. 1.30 respectively to the income. The MVP/MFC ratio for land was 0.77. Since the MVP was less than MFC use of land resource should be reduced.

CONCLUSIONS

1) The conclusions that could be derived from the above analysis was that land coupled with human labour on small farms of main and ratoon, human labour on large farms of main crop, land, human labour and tractor service on large farms of ratoon, human labour on combined farms of main crop and land, human labour and tractor service on combined farms of ratoon crop contributed to the increase in yields. In fact human labour was an important cost item in the cultivation of sugarcane.

2) The results of allocative efficiency highlighted that the MVP/MFC ratios were more than unity for human labour on all categories farms both in main and ratoon crop, tractor power on large and combined farms and fertilizers on combined farms of ratoon crop indicating the scope of their further use. The ratio of MVP to MFC was more than unity for land on small farms in the cultivation of main crop. However the same in the case of ratoon was less than unity on all the size groups. The results also revealed that there was over utilisation of tractor power on large and combined farms in the cultivation of main crop.

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