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A Study on Resource Use Efficiency of Sugarcane Farms: Evidence from Village Level Study in Orissa, India

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A B S T R A C T

Keywords	
Resource, Efficiency, Sugarcane farms, Village	Sugarcane is a major cash crop of India, particularly in UP, Maharastra, Tamil Nadu, Karnataka, Andhra Pradesh, Bihar, Gujurat, and Foot hils of Uttarakhand. Sugarcane crop has an productivity of 70 tonnes/ha and an area of 4.2 mha. It plays a pivotal role in the national economy. Sugarcane is considered as one of the best cash crops in Orissa. It is grown in all the 30 districts of Orissa. The selected district Dhenkanal occupied 08th position in area (1.10 thousand ha), 09th position in productivity (72.10 thousand MTs) and 08th position in yield (68510 kg/ha) in 2013-14. The establishment of a sugar factory in Dhenkanal district has increased the prospect of this crop in the surrounding area. The difference between marginal value product (MVP) to FC (Factor Cost) was significantly lower and negative for human labour on marginal and small farms in both the regions revealing that this resource was used in excess and its use should be curtailed to realize higher return from this crop. The ratio of MVP to FC was more than unity and significant for area, fertilizers and irrigation indicating that use of these inputs should be increased to achieve higher output.
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Introduction

Sugarcane is the main source of sugar in India and holds a prominent position as a cash crop. It contributes approximately 56 per cent of total sugar production in the world. The sugar factories located in various parts of the country work as nucleus for development of rural areas by mobilizing rural resources and generating employment, transport and communication facilities. Over 45 million farmers are dependants and a large mass of agricultural labour are involved in sugarcane cultivation, harvesting and ancillary activities.

The industry employs over 0.5 million skilled and un-skilled workmen, mostly from the rural areas. Sugarcane is considered as one of the best cash crops in Orissa. It is grown in all the 30 districts of Orissa. Among these districts, Cuttack (5.45 thousand ha), Koraput (5.24 thousand ha), Nayagarh (4.45 thousand ha), Nawarangpur (3.85 thousand ha), Ganjam (2.48 thousand ha) are leading districts in sugarcane cultivated areas in the year 2004-05. The production of sugarcane in 2004-05 was to the extent of 496.03 thousand

MTs in Koraput followed by 325.03 thousand MTs in Cuttack, 276.27 thousand MTs in Nayagarh, 191.94 thousand MTs in Ganjam. The productivity varied from 94589 kg/ha in Korapur, 85800 kg/ha in Kalahandi, 83200 kg/ha in Gajapati and 82288 kg/ha in Kendrapara.

Materials and Methods

Sample design

The multi-stage stratified random sampling technique was adopted in the study. In the first stage two blocks namely Dhenkanal Sadar and Kankadahada were selected randomly, in the second stage, 16 villages were randomly selected at the rate of 8 villages per block. This constituted 5 per cent of the total number of villages of two selected blocks. In the final stage, list of sugarcane farmers was prepared separately for both types of sample villages and 10 farm households from each of the 16 sample villages were selected randomly.

Marginal value product

A resource is considered to be used most efficiently if its marginal value product is just sufficient to affect its cost.

Thus equality of marginal value product to factor cost is the basic condition to ascertain efficient resource use. In Cobb-Douglas production function, marginal value product (MVP) of X1, the ith input factor is given by the following formula.

$$\mathsf{MVP\ of\ } X_i = b_i \times \frac{\overline{Y}}{\overline{X}_i}$$

$i = 1, 2, 3 \dots n$

b_i = regression coefficient of ith factor

X_i = level of use of ith factor and the value of the factor input xi taken at its Geometric Mean

Y = estimated level of output when each input is held at its Geometric Mean.

Results and Discussion

An analysis of basic characteristics of the sample farms is considered to be of significance as it provides relevant background information against which the analysis is to be attempted. The detailed structures of the sample farms according to farm size groups have been discussed.

Size of holding

The distribution of holding according to different size groups is given in Table 1.

The average size of holding was estimated to be 2.44 ha for Dhenkanal Sadar (Region-I) and 1.89 ha in Kankadahada Block (Region-II) of the sample district. The operational size of holding of marginal, small, medium and large farmers are found to be 0.91, 1.56, 2.68 and 6.34 ha as against 0.85, 1.51, 2.73 and 6.21 ha respectively.

Type of ownership of land

It may be noted from the table that more than three-fourth of their total operational holdings accounted for owned land while the remaining were by way of leased in land on a share cropping basis. This clearly indicates that there is negligible extent of tenancy among the farmers in the area under study. On an average, the percentage of owned and leased in land worked out to 80.74 and 19.26 per cent in Dhenkanal Sadar as compared to 78.84 per cent and 21.16 per cent in Kankadahad Block. And between size groups, the proportion of leased in land increased with

decrease in size of holding. This was mainly due to the fact that the marginal and small farmers were interested to make their units viable by making labour investments in their farms (Table 2).

Size of family

Human labour engaged in farming is generally family members and in the peak season, hired labourers are engaged to assist the operational work.

Table 3 shows the average size of family members in different size groups in the study area.

As can be seen from the table that the size of family per farm increased less than proportionately with the increase in the size of holding. In region-I on an average, the family size worked out to 5.62, 7.81, 8.01 and 8.44 for marginal, small, medium and large farmers respectively.

On the other hand in region-II, the average size of the family is worked out to 5.71, 6.92, 7.57 and 7.92 for the above respective farms. The average numbers of family members per farm are 7.47 and 6.75 for region-I and region-II respectively.

Family labour

Family labour constitutes the major proportion of total labour utilized in agricultural operations of the farm.

Table 4 shows the variation in number of family labourers available for farm work in different size groups of farms.

Table 4 has revealed that more of family labour was available for agriculture work in the lower size group as compared to higher size group. In region-I the average number of

family labour available for agricultural operations in different categories of farm sizes were 1.58, 2.35, 2.87 and 2.88 in the marginal, small, medium and large farms respectively.

The magnitude in region-II was 1.82, 2.38, 2.91 and 2.99 respectively. This shows that the number of dependents in agriculture was more in marginal and small size farms than medium and large size farms. This meant that a substantial proportion of earners in large farm categories were engaged in non-agricultural pursuits. The marginal and small farms have no other alternatives but to depend upon agricultural occupation.

Bullock labour

Bullock labor provides drought power for undertaking various operations of farm. Table 5 shows the average number of bullocks and area operated by a pair of bullocks in different size groups.

The table indicates that there was a positive correlation between the farm size and the availability of bullocks per farm. But it was reversed when viewed on per hectare availability of bullock labourers among the sample farms. The average number of bullocks in marginal, small, medium and large size farms was worked out to 1.86, 2.22, 3.68 and 3.92 respectively in region-I. The corresponding figures in region-II are 1.52, 2.89, 3.01 and 3.28 in the respective farm categories.

As regards the average area commanded by a pair of bullocks it worked out to 0.81 for marginal, 0.86 for small, 1.16 for medium and 1.31 for the large farms with the average 1.0 ha in region-I. In region-II such magnitudes are 0.94, 1.00, 1.23 and 1.56 ha for the respective farm categories with average 1.07 ha.

Table.1 Distribution of holding in different size groups of sample farms of blocks

Size groups	Dhenkanal Sadar (Region-I)		Kankadahada (Region-II)	
	Total No. of sample farms	Average size of operational holding (in ha.).	Total No. of sample farms	Average size of operational holding (in ha.).
I (below 1.00 ha)	18	0.91	26	0.85
II (1.01 to 2.00 ha)	28	1.56	29	1.51
III (2.01 to 4.00 ha.)	22	2.68	20	2.73
IV (4.00 and above)	12	6.34	5	6.21
Pooled	**80**	**2.44**	**80**	**1.89**

Table.2 Distribution of own and leased in land in different size groups of sample farms (in ha)

Size groups	Dhenkanal Sadar (Region-I)			Kankadahada(Region-II)		
	Average size of operational holding	Own land	Leased in land	Average size of operational holding	Own land	Leased in land
I	0.91 (100)	0.76 (83.53)	0.15 (16.48)	0.85 (100)	0.71 (83.53)	0.14 (16.47)
II	1.56 (100)	1.21 (77.56)	0.35 (22.44)	1.51 (100)	1.36 (90.00)	0.15 (9.93)
III	2.68 (100)	2.31 (86.31)	0.37 (13.69)	2.73 (100)	1.58 (57.88)	1.15 (42.12)
IV	6.34 (100)	5.92 (93.38)	0.42 (6.62)	6.21 (100)	5.97 (96.14)	0.24 (3.86)
Pooled	**2.44 (100)**	**1.97 (80.74)**	**0.47 (19.26)**	**1.89 (100)**	**1.49 (78.84)**	**0.40 (21.16)**

(Figures in parentheses are percentages)

Table.3 Distribution of average size of family

Size groups	Dhenkanal Sadar (Region-I)		Kankadahada(Region-II)	
	No. of family members per farm	No. of family members per hectare	No. of family members per farm	No. of family members per hectare
I	5.62	6.92	5.71	6.65
II	7.81	4.81	6.92	4.87
III	8.01	3.19	7.57	3.14
IV	8.44	3.05	7.92	3.01
Pooled	**7.47**	**4.58**	**6.75**	**4.90**

Table.4 Distribution of family labour in different size groups of sample farms

Block	Size groups	Total no. of earners/ farm	No. of agril. Earners/ farm	Percentage of agril. Earners to total earners	No. of earners per ha.	No. of earners in agril. Per ha.
Dhenkanal Sadar (Region-I)	I	1.92	1.58	82.13	2.21	1.98
	II	3.01	2.35	78.16	2.01	1.76
	III	3.73	2.87	76.98	1.62	1.43
	IV	3.87	2.88	74.52	1.41	1.29
	Pooled	**3.09**	**2.40**	**78.18**	**1.86**	**1.65**
Kankadahada (Region-II)	I	2.21	1.82	82.35	2.62	2.12
	II	3.12	2.38	76.28	2.33	1.96
	III	3.78	2.91	76.98	1.98	1.78
	IV	3.91	2.99	76.47	1.67	1.57
	Pooled	**3.04**	**2.37**	**78.44**	**2.30**	**1.94**

Table.5 Distribution of bullock labour in sample farms and average cultivated area per pair of bullocks

Size groups	Dhenkanal Sadar(Region-I)			Kankadahada(Region-II)		
	No. of bullocks per farm	No. of bullocks per ha	Area per pair of bullocks (ha)	No. of bullocks per farm	No. of bullocks per ha.	Area per pair of bullocks (ha)
I	1.86	2.46	0.81	1.52	2.12	0.94
II	2.22	2.32	0.86	2.89	2.01	1.00
III	3.68	1.72	1.16	3.01	1.62	1.23
IV	3.92	1.53	1.31	3.28	1.28	1.56
Pooled	**2.80**	**2.07**	**1.00**	**2.50**	**1.90**	**1.07**

Table.6 Per farm distribution of fixed assets in different size groups of sample farms (in Rupees)

Blocks	Size group	Land	Live-stock	Farm building	Agril. Improvements and machineries	Non-agril. Assets	Financial assets	Total
Dhenkanal Sadar (Region-I)	I	26694.07	2490.05	1959.79	592.39	547.16	1023.82	33307.29
	II	44842.53	4195.84	4722.92	1770.91	1113.08	1704.00	58349.27
	III	74761.71	6743.93	8579.03	3380.31	2011.80	3300.18	98776.95
	IV	173992.23	15205.22	21556.76	8380.66	5010.19	8233.88	232378.94
	Pooled	**68359.35**	**6164.17**	**7686.72**	**2939.79**	**1817.46**	**2969.39**	**89936.89**
Kankadahada (Region-II)	I	23064.89	2416.99	1726.95	467.77	435.27	862.86	28974.74
	II	39731.89	4124.44	3949.44	1487.59	874.17	1492.35	51659.88
	III	70933.94	7133.95	7365.68	2798.58	1724.19	3009.42	92965.75
	IV	161555.76	16183.14	16848.41	7052.14	4335.01	7406.73	213381.19
	Pooled	**49729.62**	**5075.57**	**4887.38**	**1831.68**	**1160.33**	**2036.68**	**64721.26**

Table.7 Per hectare distribution of fixed assets in different
size groups of sample farms (In Rupees)

Blocks	Size group	Land	Live-stock	Farm building	Agril. Improvements and machineries	Non-agril. Assets	Financial assets	Total
Dhenkanal Sadar (Region-I)	I	29334.14	2736.32	2153.62	650.98	601.28	1125.08	36601.42
	II	28745.21	2689.64	3027.51	1135.2	713.51	1092.31	37403.38
	III	27896.16	2516.39	3201.13	1261.31	750.67	1231.41	36857.07
	IV	27443.57	2398.3	3400.12	1321.87	790.25	1298.72	36652.83
	Pooled	**28448.98**	**2608.80**	**2934.52**	**1088.93**	**709.99**	**1168.90**	**36960.12**
Kankadahada (Region-I)	I	27135.17	2843.52	2031.71	550.32	512.08	1015.13	34087.93
	II	26312.51	2731.42	2615.52	985.16	578.92	988.31	34211.84
	III	25983.13	2613.17	2698.05	1025.12	631.57	1102.35	34053.39
	IV	26015.42	2605.98	2713.11	1135.61	698.07	1192.71	34360.9
	Pooled	**26478.961**	**2730.45**	**2452.514**	**863.23**	**577.806**	**1038.31**	**34141.273**

Table.8 Percentage distribution of fixed assets in different size groups of sample farms

Blocks	Size group	Land	Live-stock	Farm building	Agril. Improvements and machineries	Non-agril. Assets	Financial assets	Total
Dhenkanal Sadar (Region-I)	I	80.14	7.48	5.88	1.78	1.64	3.07	100.00
	II	76.85	7.19	8.09	3.04	1.91	2.92	100.00
	III	75.69	6.83	8.69	3.42	2.04	3.34	100.00
	IV	74.87	6.54	9.28	3.61	2.16	3.54	100.00
	Pooled	**76.97**	**7.06**	**7.94**	**2.95**	**1.92**	**3.16**	**100.00**
Kankadahada (Region-II)	I	79.60	8.34	5.96	1.61	1.50	2.98	100.00
	II	76.91	7.98	7.65	2.88	1.69	2.89	100.00
	III	76.30	7.67	7.92	3.01	1.85	3.24	100.00
	IV	75.71	7.58	7.90	3.30	2.03	3.47	100.00
	Pooled	**77.56**	**8.00**	**7.18**	**2.53**	**1.69**	**3.04**	**100.00**

Table.9 Marginal value products (MVP) factor costs (FC)

Blocks	Particulars	Marginal			Small			Medium			Large			Pooled		
		MVP	FC	MVP / FC	MVP	FC	MVP/ FC	MVP	FC	MVP/ FC	MVP	FC	MVP/ FC	**MVP**	**FC**	**MVP/ FC**
Dhenkanal Sadar (Region-I)	Area under the crop	18230.53	9829.34	1.85	18786.24	9344.63	2.01	17834.80	9631.44	1.85	16534.21	9886.45	1.67	**18061.75**	**9613.84**	**1.88**
	Human labour	-3.92	1.00	-3.92	-0.42	1.00	-0.42	3.41	1.00	3.41	3.11	1.00	3.11	**0.38**	**1.00**	**0.38**
	Seeds	1.08	1.00	1.08	1.26	1.00	1.26	-5.28	1.00	-5.28	-6.22	1.00	-6.22	**-1.70**	**1.00**	**-1.70**
	Manure & Fertilizer	1.12	1.00	1.12	1.53	1.00	1.53	4.67	1.00	4.67	5.55	1.00	5.55	**2.90**	**1.00**	**2.90**
	Irrigation	2.45	1.00	2.45	1.19	1.00	1.19	2.32	1.00	2.32	2.19	1.00	2.19	**1.93**	**1.00**	**1.93**
Kandahada (Region-II)	Area under the crop	16035.28	8618.31	1.86	16293.46	8747.17	1.86	15332.16	8792.14	1.74	15539.37	8864.24	1.75	**15922.10**	**8723.85**	**1.83**
	Human labour	-3.78	1.00	-3.78	-0.38	1.00	-0.38	3.60	1.00	3.60	4.22	1.00	4.22	**-0.20**	**1.00**	**-0.20**
	Seeds	1.16	1.00	1.16	1.34	1.00	1.34	-4.98	1.00	-4.98	-5.17	1.00	-5.17	**-0.71**	**1.00**	**-0.71**
	Manure & Fertilizer	1.21	1.00	1.21	1.62	1.00	1.62	5.07	1.00	5.07	6.13	1.00	6.13	**2.63**	**1.00**	**2.63**
	Irrigation	2.17	1.00	2.17	1.08	1.00	1.08	2.18	1.00	2.18	2.03	1.00	2.03	**1.77**	**1.00**	**1.77**

Farm assets

The distribution of farm assets on per farm, per hectare and percentage basis is given in Tables 6 to 8. The table revealed that among the different farm sizes, the large size farms has a higher value of assets both per farm and per hectare than medium and small farms in both the sample regions.

As may be seen from the tables that in region-I the average value of assets were estimated to be Rs.33307.24 and Rs.36601.42 for marginal, Rs.58349.27 and Rs.37403.38 for small, Rs.98776.95, Rs.36857.07 for medium farms and Rs. 232378.94 and 36652.83 for large farms both per farm and per hectare respectively.

In region-II, the value of the assets were estimated to be Rs. 28974.74 and Rs. 34087.93 for marginal, Rs. 51659.88 and Rs. 34211.84 for small, Rs. 92465.75 and Rs.34053.39 for medium and Rs.213381.19 and Rs.34360.90 for large farms both per farm and per hectare respectively.

With regard to the composition of assets, land accounted for an overwhelming proportion to total investments irrespective of farm categories. On an average, it worked out to 80.14, 76.85, 75.69 and 74.87 per cent for the marginal, small, medium and large farms respectively. Such magnitudes in region-II are 76.60, 76.91, 76.30 and 75.71 per cent for the respective farms.

Next to land, was farm buildings followed by livestock. The investment on these two items were of the order of 7.94 and 7.06 per cent respectively in region-I. In region-II such magnitudes are 7.18 and 8.00 respectively.

The percentage share of investments on rest of the items in both the regions was quite meager ranging from 2 to 3 per cent only.

Resource use efficiency

In order to examine the resource use efficiency marginal value products of the resources were estimated. The general approach for judging the efficiency of resource use has been the comparison of marginal return with marginal cost. If the ratio is less than one, it indicates much of the particular input is being used and vice-versa. Maximum efficiency of resource occurs when the returns from the additional unit of input is equal to cost of that additional input i.e. marginal value product to factor cost ratio is equal to unity.

The estimated marginal value product, marginal factor cost and their ratios are given in Table 9. It may be noted from the table that the ratio of marginal value product to factor cost for the area under sugarcane was more than unity on all farms except on large farms in the both regions.

The marginal value product to factor cost ratio of human labour was more than unity on large farms and less than unity on pooled farms. However, the ratio was negative on marginal, small and medium farms indicating thereby an excess use of human labour on these farms. The marginal value product to factor cost ratio for seed was more than unity on marginal and small farms, but it was less than unity on pooled farms. The ratio for manure and fertilizers was more than unity on all the size group of farms.

The ratio of marginal value product to factor cost of irrigation was more than unity on all the farms indicating thereby that there exists scope of increasing irrigation facilities on all the categories of sample farms for increasing returns from sugarcane.

The foregoing analysis clearly shows that there is disequilibrium in the production of sugarcane by the sample farms in the area under study. The difference between marginal value product and factor cost was significantly lower and negative for human labour on marginal, small and medium farms revealing that this resource was not being used at optimum level.

The ratio of less than unity suggests that this resource should be curtailed in this crop enterprise to realize higher returns. The ratio of

marginal value productivity to factor cost was more than unity and significant for area, fertilizers and irrigation indicating thereby that use of these inputs should be increased in the respective categories of farms to achieve higher output.

Hence reorganization of resources cannot but help realizing higher level of productivity. This confirmed the third hypothesis of the study.

The Ratio of marginal value product (MVP) to factor cost (FC) for area under sugarcane was more than unity on all farms. The ratio of MVP to of human labour was more than unity on medium and large farms and less than unity on pooled farms.

However, this ratio was negative on marginal and small farms indicating there by an excess use of human labour on these farms in both the regions. The ratio of MVP to FC for seed was more than unity on small and medium farms but it was less than unity on pooled farm.

The ratio for manure and fertilizers was more than unity on all the farms in both the regions. The ratio of MVP to FC for irrigation was more than a unity on all farms indicating there by scope of increasing the irrigation facilities on all categories of sample farms more particularly in region-II for increasing returns farm sugarcane. Thus the foregoing analysis clearly indicated the disequilibrium in the production of sugarcane by sample farms in the areas under study.

The difference between MVP and FC was significantly lower and negative for human labour on marginal and small farms in both the regions revealing that this resource was not being used at optimum level. The ration less than unity suggests that the use of this resources should be curtailed in this crops enterprise to realize higher return.

The ratio of MVP to FC was more than unity and significant for area, fertilizers and irrigation indicating that use of these inputs should be increased in the respective farm size classes to achieve higher output. Hence, reorganization of resources would help in realizing higher level of productivity. This confirms the third theses of the study.

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