

## Economics of Production of Sugarcane in Orissa

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### Abstract

Sugarcane is a major cash crop of India, particularly in UP, Maharastra, Tamil Nadu, Karnataka, Andhra Pradesh, Bihar, Gujrat, and Foot hills of Uttarakhand. Sugarcane crop has a 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 4<sup>th</sup> position in area (1.49 thousand ha) & in production (99.06 thousand MTs) and 5<sup>th</sup> position in yield (668.50 qtls/ha) in 2005-06. This study was carried out in Dhenkanal district, Orissa. The study area to find out status and constraints of sugarcane cultivation. A sample of 160 farmers was randomly selected from two blocks i.e. Dhenkanal & Kankadahad. The establishment of a sugar factory in Dhenkanal district has increased the prospect of this crop in the surrounding area. The average size of holding was 2.44 ha. in region-I and 1.89 ha. in region-II. The land was unequally distributed among different categories of farms. The net return over variable costs per hectare were ₹ 38220.96 in region-I and ₹ 34380.10 in region-II. The average yield of sugarcane per hectare was 73.88 tonnes and 69.88 tonnes in region –I and region-II respectively.

**Keywords:**-Economic, production, sugarcane, cash crop

Sugarcane is a major cash crop of India, particularly in UP, Maharastra, Tamil Nadu, Karnataka, Andhra Pradesh, Bihar, Gujrat, and Foot hills 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. However paltering yield level declining factor productivity, increasing production cost and slashing sugar prices in the industrial market in the recent years pose a real concern to crop diversification in sugar based production.

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. Sugar is one of the oldest commodities in the world and traces its origin in 4th century AD in India and China. India is the largest consumer (18 million tonnes) and the second largest producer of sugar after Brazil. The Indian sugar Industry is one of the largest producers of white crystal sugar with massive enterprise of sugar factories located throughout the country with an annual turnover of ₹ 150 billion. 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 (1.31 thousand ha), Koraput (3.62 thousand ha), Nayagarh (2.52 thousand ha), Nawarangpur (1.16 thousand ha), Ganjam (1.92 thousand ha), Dhankanal (1.49 thousand ha) are leading districts in sugarcane cultivated areas in the year 2005-06. The production of sugarcane in 2005-06 was to the extent of 306.96 thousand MTs in Koraput followed by 151.10 thousand MTs in Ganjam, 150.43 thousand MTs in Nayagarh, 99.60 thousand MTs in Dhankanal. Productivity of sugarcane varies from 41 tonnes/hectare in Nuapada to 84.913 tonnes/hectare in Koraput district in 2005-06. The Dhenkanal district occupied the fourth position in area & in production and fifth position in productivity of sugarcane during 2005-06. The area under sugarcane can be increased in the study area if it proves to be remunerative crop and its market clearance is quick.

However paltering yield level declining factor productivity, increasing production cost and slashing sugar prices in the industrial market in the recent years pose a real concern to crop diversification in sugar based production. The yield of sugarcane in Orissa can be increased if proper farming practices with proper seed can be taken up. Further, the improvement in irrigation system and motivation of farmers can result in more production of sugarcane. In view of the above perspectives, a study on “Economics of production and marketing of sugarcane in Orissa” was undertaken with the following objectives.

### **Objectives**

- (i) To study the resource base of the sample farmers in the study area.
- (ii) To analyze the growth rates in area, production and productivity of sugarcane in the sample district and state.

### 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.

### 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.

**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.).
1. (below 1.00 ha)	18	0.91	26	0.85
2. (1.01 to 2.00 ha)	28	1.56	29	1.51
3. (2.01 to 4 .00 ha.)	22	2.68	20	2.73
4. ( 4.00 and above )	12	6.34	5	6.21
<b>Pooled</b>	<b>80</b>	<b>2.44</b>	<b>80</b>	<b>1.89</b>

#### Type of Ownership of Land

Information relating to the land ownership are given in Table 2. 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 : 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	<b>2.44</b> <b>(100)</b>	<b>1.97</b> <b>(80.74)</b>	<b>0.47</b> <b>(19.26)</b>	<b>1.89</b> <b>(100)</b>	<b>1.49</b> <b>(78.84)</b>	<b>0.40</b> <b>(21.16)</b>

(Figures in parentheses are percentages)

### Size of Family

Human labour engaged in farming are 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.

**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
<b>I</b>	5.62	6.92	5.71	6.65
<b>II</b>	7.81	4.81	6.92	4.87
<b>III</b>	8.01	3.19	7.57	3.14
<b>IV</b>	8.44	3.05	7.92	3.01
Pooled	<b>7.47</b>	<b>4.58</b>	<b>6.75</b>	<b>4.90</b>

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 number 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 : 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.
Dhenkana I 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
	<b>Pooled</b>	<b>3.09</b>	<b>2.40</b>	<b>78.18</b>	<b>1.86</b>	<b>1.65</b>
Kankadaha da (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
	<b>Pooled</b>	<b>3.04</b>	<b>2.37</b>	<b>78.44</b>	<b>2.30</b>	<b>1.94</b>

**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 were 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 labour 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.

**Table 5 : Distribution of bullock labour in sample farms and average cultivated area peer 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
<b>Pooled</b>	<b>2.80</b>	<b>2.07</b>	<b>1.00</b>	<b>2.50</b>	<b>1.90</b>	<b>1.07</b>

The Table 5 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.

### Capital Used

Capital is one of the important factors of production. The success in farming largely depends upon the availability of capital. For the present study the level of capital used by the sample farms are presented under three sub-heads.

- (i) Total value of farm assets
- (ii) Capital expenditure and
- (iii) Current farm expenses

### Farm Assets

The distribution of farm assets on per farm, per hectare and percentage basis are given in Tables 6 to 9.

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 ₹ 33307.24 and ₹ 36601.42 for marginal, ₹ 58349.27 and ₹ 37403.38 for small, ₹ 98776.95, ₹ 36857.07 for medium farms and ₹ 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 ₹ 28974.74 and ₹ 34087.93 for marginal, ₹ 51659.88 and ₹ 34211.84 for small, ₹ 92465.75 and ₹ 34053.39 for medium and ₹ 213381.19 and ₹ 34360.90 for large farms both per farm and per hectare respectively.

**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)	1	26694.07	2490.05	1959.79	592.39	547.16	1023.82	33307.29
	2	44842.53	4195.84	4722.92	1770.91	1113.08	1704.00	58349.27
	3	74761.71	6743.93	8579.03	3380.31	2011.80	3300.18	98776.95
	4	173992.23	15205.22	21556.76	8380.66	5010.19	8233.88	232378.94
	<b>Pooled</b>	<b>68359.35</b>	<b>6164.17</b>	<b>7686.72</b>	<b>2939.79</b>	<b>1817.46</b>	<b>2969.39</b>	<b>89936.89</b>
Kankadah ada (Region-II)	1	23064.89	2416.99	1726.95	467.77	435.27	862.86	28974.74
	2	39731.89	4124.44	3949.44	1487.59	874.17	1492.35	51659.88
	3	70933.94	7133.95	7365.68	2798.58	1724.19	3009.42	92965.75
	4	161555.76	16183.14	16848.41	7052.14	4335.01	7406.73	213381.19
	<b>Pooled</b>	<b>49729.62</b>	<b>5075.57</b>	<b>4887.38</b>	<b>1831.68</b>	<b>1160.33</b>	<b>2036.68</b>	<b>64721.26</b>

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.

**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	Finan- cial 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
	<b>Pooled</b>	<b>28448.98</b>	<b>2608.80</b>	<b>2934.52</b>	<b>1088.93</b>	<b>709.99</b>	<b>1168.90</b>	<b>36960.12</b>
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
	<b>Pooled</b>	<b>26478.961</b>	<b>2730.45</b>	<b>2452.514</b>	<b>863.23</b>	<b>577.806</b>	<b>1038.31</b>	<b>34141.273</b>

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

Blocks	Size group	Land	Live-stock	Farm building	Agril. Improve- ments and machineries	Non- agril. Assets	Finan- cial 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
	<b>Pooled</b>	<b>76.97</b>	<b>7.06</b>	<b>7.94</b>	<b>2.95</b>	<b>1.92</b>	<b>3.16</b>	<b>100.00</b>
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
	<b>Pooled</b>	<b>77.56</b>	<b>8.00</b>	<b>7.18</b>	<b>2.53</b>	<b>1.69</b>	<b>3.04</b>	<b>100.00</b>

### Capital Expenditure

The payments made towards acquisition of farm assets like land improvement, purchase of livestock's, implements and machinery's, non-agriculture assets etc. during the year are called capital expenditure. Tables 9 to 11 present the nature of capital expenditure incurred by the sample farms during the period of study.

At the aggregate level, the average amount of capital expenditure reported by the sample farmers was ₹ 4169.49 per farm and ₹ 1677.68 per hectare in region-I

and 2933.32 and 1529.11 in region-II. As may be seen from the table the large farms, among all farm sizes invested a higher amount both per farm and per hectare than other size categories during the period. On an average, the large size farms have incurred capital expenditure as high as ₹ 11028.49 and ₹ 9905.32 in region-I and region-II respectively. The marginal size farms have incurred capital investment as low as ₹ 1414.33 and ₹ 1554.21 in both the regions respectively. The corresponding figures per ha. over ₹ 1739.51 and ₹ 1595.06 for large farms in the region-I and region-II respectively. The magnitude of investment per ha. marginal farms were ₹ 1554.21 and ₹ 1480.00 in both the regions respectively.

**Table 9 : Per farm distribution of capital expenditure in different size groups of sample farms (In rupees)**

Blocks	Size groups	Land improvement	Livestock	Agril. Implements and machineries	Non-agril. Assets	Total
Dhenkanal Sadar (Region-I)	I	674.96	547.51	102.40	89.46	1414.33
	II	1314.41	924.00	214.05	178.64	2631.10
	III	2407.47	1476.01	405.62	351.29	4640.39
	IV	5798.06	3369.39	1046.16	814.88	11028.49
	<b>Pooled</b>	<b>2143.67</b>	<b>1357.90</b>	<b>366.43</b>	<b>301.49</b>	<b>4169.49</b>
Kankadahada (Region-II)	I	599.51	497.56	89.89	71.03	1258.00
	II	1185.97	817.09	182.06	149.61	2334.73
	III	2180.37	1387.19	370.22	298.42	4236.20
	IV	5163.74	3094.26	892.50	754.83	9905.32
	<b>Pooled</b>	<b>1492.58</b>	<b>998.09</b>	<b>243.55</b>	<b>199.10</b>	<b>2933.32</b>

**Table 10 : Per hectare distribution of capital expenditure in different size groups of sample farms (In rupees)**

Blocks	Size groups	Land improvement	Livestock	Agril. Implements and machineries	Non-agril. Assets	Total
Dhenkanal Sadar (Region-I)	I	741.71	601.66	112.53	98.31	1554.21
	II	842.57	592.31	137.21	114.51	1686.6
	III	898.31	550.75	151.35	131.08	1731.49
	IV	914.52	531.45	165.01	128.53	1739.51
	<b>Pooled</b>	<b>846.00</b>	<b>573.86</b>	<b>139.72</b>	<b>117.52</b>	<b>1677.09</b>
Kankadahada (Region-II)	I	705.31	585.37	105.75	83.57	1480
	II	785.41	541.12	120.57	99.08	1546.18
	III	798.67	508.13	135.61	109.31	1551.72
	IV	831.52	498.27	143.72	121.55	1595.06
	<b>Pooled</b>	<b>765.57</b>	<b>544.58</b>	<b>120.96</b>	<b>98.00</b>	<b>1529.11</b>

**Table 11 : Percentage distribution of capital expenditure in different size groups of sample farms**

Blocks	Size groups	Land improvement	Livestock	Agril. Implements and machineries	Non-agril. Assets	Total
Dhenkanal Sadar (Region-I)	I	47.72	38.71	7.24	6.33	100.00
	II	49.96	35.12	8.14	6.79	100.00
	III	51.88	31.81	8.74	7.57	100.00
	IV	52.57	30.55	9.49	7.39	100.00
	<b>Pooled</b>	<b>50.44</b>	<b>34.22</b>	<b>8.33</b>	<b>7.01</b>	<b>100.00</b>
Kankadaha da (Region-II)	I	47.66	39.55	7.15	5.65	100.00
	II	50.80	35.00	7.80	6.41	100.00
	III	51.47	32.75	8.74	7.04	100.00
	IV	52.13	31.24	9.01	7.62	100.00
	<b>Pooled</b>	<b>50.07</b>	<b>35.61</b>	<b>7.91</b>	<b>6.41</b>	<b>100.00</b>

Among various items included in capital expenditure, in region-I land improvement emerged as one of the important items, which took the lion’s share (50.44 per cent) followed by expenditure on livestock (34.22 per cent). Among the remaining items purchase of implements and machineries was relatively a more important item of capital expenditure. The proportion of capital expenditure on non-agricultural assets was found to be very small (7.01 per cent). A similar trend is observed in region-II in respect of distribution of items of capital expenditure.

### **Current Farm Expenditure**

The current farm expenditure comprises the non-cash and cash expenditures. The non-cash component constitutes items like, family labour wages, owned bullock labour, value of home grown seeds and manure’s etc. The cash component constitutes the amount of money spent by the farmer for the purchase of seeds, fertilizers, plant protection materials, irrigation charges, livestock maintenance, machineries and hiring of human and bullock labour required in the farm. In view of this, it is essential to study the distribution of non-cash expenditure in various size groups of farms.

### ***Non-Cash Expenditure***

The distribution of non-cash expenditure among different size groups of farms on per farm, per hectare and percentage basis are given in Tables 12, 13 and 14 respectively.

**Table 12 : Per farm distribution of non-cash expenditure in different size groups of sample farms (in Rupees)**

Blocks	Size groups	Family labour	Owned bullock labour	Owned seeds	Owned manures	Total
Dhenkanal Sadar (Region—II)	I	4168.27	453.79	—	660.33	5282.40
	II	6613.98	703.48	—	1015.31	8332.77
	III	10997.67	1233.63	—	1642.17	13873.48
	IV	22603.43	2850.02	—	3863.03	29316.48
	<b>Pooled</b>	<b>9667.63</b>	<b>1115.07</b>	—	<b>1534.98</b>	<b>12317.69</b>
Kankada hada (Region—II)	I	3228.56	365.70	—	612.39	4206.65
	II	5529.24	647.20	—	989.84	7166.28
	III	9853.42	1162.63	—	1653.32	12669.36
	IV	22278.06	2640.80	—	3702.77	28621.64
	<b>Pooled</b>	<b>6909.37</b>	<b>809.17</b>	—	<b>1202.59</b>	<b>8921.13</b>

The table shows that the large size farms appeared to have incurred non-cash expenditure per farm relatively more as compared to medium, small and marginal size farms. But on a per hectare basis, the marginal and small size farms had reported a higher level of such expenditure than their counterparts in medium and large size farms.

**Table 13 : Per hectare distribution of non-cash expenditure in different size groups of sample farms (in Rupees)**

Blocks	Size Groups	Family labour	Owned bullock labour	Owned seeds	Owned manures	Total
Dhenkanal Sadar (Region—II)	I	4580.52	498.67	—	725.64	5804.83
	II	4239.73	450.95	—	650.84	5341.52
	III	4103.61	460.31	—	612.75	5176.67
	IV	3565.21	449.53	—	609.31	4624.05
	<b>Pooled</b>	<b>4177.80</b>	<b>464.05</b>	—	<b>650.97</b>	<b>5292.81</b>
Kankada hada (Region—II)	I	3798.31	430.23	—	720.46	4949.00
	II	3661.75	428.61	—	655.52	4745.88
	III	3609.31	425.87	—	605.61	4640.79
	IV	3587.45	425.25	—	596.26	4608.96
	<b>Pooled</b>	<b>3688.38</b>	<b>428.24</b>	—	<b>660.44</b>	<b>4777.06</b>

As may be seen from the table that the average non-cash expenditure per farm for marginal, small, medium and large size groups were worked out to ₹ 5282.40, ₹ 8332.77, ₹ 13873.48 and ₹ 29316.48 in region-I and ₹ 4206.65, ₹ 7166.28, ₹ 12669.36 and ₹ 28621.64 in region-II respectively. The corresponding figures per hectare were ₹ 5809.83 for marginal ₹ 5341.52 for small, ₹ 5176.67 for medium and ₹ 4624.05 for large size groups of farms in region-I and ₹ 4949.00, ₹ 4745.88, ₹ 4640.79 and ₹ 4608.93 for the respective farm sizes in region-II. The high level of

non-cash expenditure on marginal and small size farms per hectare were obviously due to the concentration of family labours in these farms.

**Table 14 : Percentage distribution of non-cash expenditure in different size groups of sample farms**

Blocks	Size groups	Family labour	Owned bullock labour	Owned seeds	Owned manures	Total
Dhenkanal Sadar (Region-II)	I	78.91	8.59	0.00	12.50	100.00
	II	79.37	8.44	0.00	12.18	100.00
	III	79.27	8.89	0.00	11.84	100.00
	IV	77.10	9.72	0.00	13.18	100.00
	<b>Pooled</b>	<b>78.93</b>	<b>8.77</b>	<b>0.00</b>	<b>12.30</b>	<b>100.00</b>
Kankada hada (Region-II)	I	76.75	8.69	0.00	14.56	100.00
	II	77.16	9.03	0.00	13.81	100.00
	III	77.77	9.18	0.00	13.05	100.00
	IV	77.84	9.23	0.00	12.94	100.00
	<b>Pooled</b>	<b>77.21</b>	<b>8.96</b>	<b>0.00</b>	<b>13.83</b>	<b>100.00</b>

Among different items included in non-cash expenditure family labour constituted on an average 78.93 per cent in region-I and 77.21 per cent in region-II followed by owned bullock labour (8.77 per cent and 8.96 per cent), and owned manures (12.30 per cent and 13.83 per cent) in that order. Thus family labour accounted for the bulk of non-cash expenditure in the sample farms in both the regions.

### Cash Expenditure

The distribution of cash expenditure among different size group of farms on per farm, per hectare and percentage basis are given in Tables 15 to 17.

The tables revealed that the average cash expenditure per farm in marginal, small, medium and large farms were estimated to be ₹ 32435.02, ₹ 56293.57, ₹ 98037.59 and ₹ 235466.33 in region-I and ₹ 30544.50, ₹ 54265.67, ₹ 98548.96 and ₹ 224589.80 in region-II respectively. On a per hectare basis these figures were ₹ 35642.88 for marginal, ₹ 36085.62 for small, ₹ 36581.19 for medium and ₹ 37139.00 for large farm in region-I as against ₹ 35934.70, ₹ 35937.53, ₹ 36098.51 and ₹ 36165.83 in region-II respectively. Thus large farms in both the regions were reported to have incurred higher level of cash expenditure both per farm and per hectare compared to their counterparts in marginal and small farm categories. Among the different items included in cash expenditure hired human labour and fertilizers

**Table 15 : Per farm distribution of cash expenditure in different size groups of sample farms (In rupees)**

Blocks	Size group	Hired human labour	Hired bullock labour	Purchased seeds	Fertilizers and manures	Irrigation charges	Plant protection	Transport	Miscellaneous	Interest on working capital	Total
Dhnekanal Sadar (Region-I)	I	14555.68	186.83	6395.56	5521.46	1833.93	773.61	1401.59	346.57	1419.78	<b>32435.02</b>
	II	25858.48	397.88	10896.80	9444.99	3175.33	1319.59	2262.50	538.39	2399.61	<b>56293.57</b>
	III	45563.43	648.37	18775.60	16314.23	5643.33	2252.83	3806.48	876.98	4156.33	<b>98037.59</b>
	IV	110637.25	1585.95	44362.95	38591.96	13393.38	5295.68	9258.18	2064.75	10276.25	<b>235466.33</b>
	<b>Pooled</b>	<b>41451.03</b>	<b>597.49</b>	<b>17070.61</b>	<b>14823.28</b>	<b>5084.92</b>	<b>2049.80</b>	<b>3542.74</b>	<b>817.30</b>	<b>3843.74</b>	<b>89280.92</b>
Kankadahada (Region-II)	I	12091.84	95.41	5963.07	5081.04	1721.48	701.89	3289.71	316.46	1283.59	<b>30544.50</b>
	II	21650.76	191.30	10540.57	9097.28	3083.80	1210.37	5723.13	517.43	2251.03	<b>54265.67</b>
	III	39341.18	409.64	19099.22	16433.24	5747.39	2185.86	10293.14	887.28	4152.03	<b>98548.96</b>
	IV	89498.64	1072.40	43527.57	37377.74	13047.02	4956.64	23105.24	2001.30	10003.25	<b>214589.80</b>
	<b>Pooled</b>	<b>27207.21</b>	<b>269.79</b>	<b>13254.23</b>	<b>11393.52</b>	<b>3929.64</b>	<b>1523.13</b>	<b>7161.15</b>	<b>637.32</b>	<b>2896.38</b>	<b>68272.37</b>

**Table 16 : Per hectare distribution of cash expenditure in different size groups of sample farms (In rupees)**

Blocks	Size group	Hired human labour	Hired bullock labour	Purchased seeds	Fertilizers and manures	Irrigation charges	Plant protection	Transport	Miscellaneous	Interest on working capital	Total
Dhnekanal Sadar (Region-I)	I	15995.25	205.31	7028.09	6067.54	2015.31	850.12	1540.21	380.85	1560.20	35642.88
	II	16575.95	255.05	6985.13	6054.43	2035.47	845.39	1450.32	345.12	1538.21	36085.6
	III	17001.28	241.93	7005.82	6087.4	2105.72	840.51	1420.33	327.25	1550.87	36581.1
	IV	17450.67	250.15	6997.31	6087.05	2112.52	835.28	1460.28	325.67	1620.86	37139.80
	<b>Pooled</b>	<b>16693.47</b>	<b>239.52</b>	<b>7002.31</b>	<b>6071.35</b>	<b>2061.81</b>	<b>843.30</b>	<b>1463.79</b>	<b>345.32</b>	<b>1559.04</b>	<b>36280.4</b>
Kankadahada (Region-II)	I	14225.69	112.25	7015.38	5977.69	2025.27	825.75	3870.25	372.31	1510.11	35934.71
	II	14338.25	126.69	6980.51	6024.69	2042.25	801.57	3790.15	342.67	1490.75	35937.5
	III	14410.69	150.05	6996.05	6019.5	2105.27	800.58	3770.38	325.01	1520.89	36098.5
	IV	14412.02	172.69	7009.27	6018.95	2100.97	798.17	3720.65	322.27	1610.83	36165.8
<b>Pooled</b>	<b>14324.39</b>	<b>130.71</b>	<b>6997.53</b>	<b>6007.75</b>	<b>2056.16</b>	<b>808.99</b>	<b>3806.90</b>	<b>346.61</b>	<b>1512.08</b>	<b>35991.1</b>	

**Table 17 : Percentage distribution of cash expenditure in different size groups of sample farms per hectare**

Blocks	Size group	Hired human labour	Hired bullock labour	Purchased seeds	Fertilizers and manures	Irrigation charges	Plant protection	Transport	Miscellaneous	Interest on working capital	Total
<b>Dhnekanal Sadar (Region-I)</b>	I	44.88	0.58	19.72	17.02	5.65	2.39	4.32	1.07	4.38	100.00
	II	45.94	0.71	19.36	16.78	5.64	2.34	4.02	0.96	4.26	100.00
	III	46.48	0.66	19.15	16.64	5.76	2.30	3.88	0.89	4.24	100.00
	IV	46.99	0.67	18.84	16.39	5.69	2.25	3.93	0.88	4.36	100.00
	<b>Pooled</b>	<b>46.01</b>	<b>0.66</b>	<b>19.30</b>	<b>16.73</b>	<b>5.68</b>	<b>2.33</b>	<b>4.03</b>	<b>0.95</b>	<b>4.30</b>	<b>100.00</b>
<b>Kankadahada (Region-II)</b>	I	39.59	0.31	19.52	16.63	5.64	2.30	10.77	1.04	4.20	100.00
	II	39.90	0.35	19.42	16.76	5.68	2.23	10.55	0.95	4.15	100.00
	III	39.92	0.42	19.38	16.68	5.83	2.22	10.44	0.90	4.21	100.00
	IV	39.85	0.48	19.38	16.64	5.81	2.21	10.29	0.89	4.45	100.00
	<b>Pooled</b>	<b>39.80</b>	<b>0.36</b>	<b>19.44</b>	<b>16.69</b>	<b>5.71</b>	<b>2.25</b>	<b>10.58</b>	<b>0.96</b>	<b>4.20</b>	<b>100.00</b>

together accounted for the bulk of total cash expenditure (62.74 per cent in region-I and 56.49 per cent in region-II) incurred by the sample farms. Next to this, was seeds (10.30 to 19.44 per cent), implements and machineries (4.79 per cent), irrigation charges (2.80 per cent) and plant protection measures (2.43 per cent) in that order.

### Gross Farm Output and Net farm Income

The gross farm output (or income) was estimated by multiplying output of different enterprises by their respective prices and then by adding them all, it was arrived at in respect of each farm category. Subsequently, the net farm income was obtained by deducting current farm expenses from the gross farm output. Tables 18 and 19 present the same.

**Table 18 : Distribution of gross farm output, current farm expenses and net farm income in different size groups of sample farms (In rupees per farm)**

Blocks	Size groups	Gross farm output	Current farm expenditure	Net return over variable cost
Dhenkanal Sadar (Region-I)	I	73071.18	37717.42	35353.76
	II	124692.05	64626.34	60065.71
	III	213751.44	111911.06	101840.38
	IV	499503.24	264782.81	234720.43
	Pooled	<b>193790.36</b>	<b>101598.60</b>	<b>92191.76</b>
Kankadahada (Region-II)	I	64599.66	34751.15	29848.52
	II	113634.14	61431.95	52202.19
	III	202790.95	111218.32	91572.64
	IV	456867.22	253211.45	203655.77
	Pooled	<b>141439.21</b>	<b>77193.50</b>	<b>64245.71</b>

At the aggregate level, the net farm income per farm and per hectare were worked out to ₹ 92191.76 and ₹ 38220.96 in region-I and ₹ 64245.71 and ₹ 34380.10 in region-II respectively. The average net farm income for the marginal, small, medium and large farms were estimated to be ₹ 35353.76, ₹ 60065.71, ₹ 101840.38 and ₹ 234720.43 in region-I as against ₹ 29848.52, ₹ 52202.19, ₹ 91572.64 and ₹ 203655.77 in region-II respectively. But on per hectare basis these figures are ₹ 38850.29, ₹ 38503.66, ₹ 38000.14 and ₹ 37022.15 in region-I and ₹ 35115.90, ₹ 34570.99, ₹ 33583.09 and ₹ 32794.81 in region-II respectively. Thus, the average net farm income on per farm basis showed an increase with increase in the size of the farms but decreased when viewed on a per hectare basis. This shows that the net farm income earned by the marginal and small farms per hectare were higher

than that realized by their counterparts in medium and large farms. This might be due to the fact that because of the larger area under irrigation and use of fertilizer, the marginal and small farms could manage to earn higher level of net farm income than the other two categories of sample farms.

**Table 19 : Distribution of gross farm output, current farm expenses and net farm income in different size groups of sample farms  
(In rupees per hectare)**

Blocks	Size groups	Gross farm output	Current farm expenditure	Net return over variable cost
Dhenkanal Sadar (Region-II)	I	80298.00	41447.71	38850.29
	II	79930.80	41427.14	38503.66
	III	79758.00	41757.86	38000.14
	IV	78786.00	41763.85	37022.15
	<b>Pooled</b>	<b>79794.18</b>	<b>41573.22</b>	<b>38220.96</b>
Kankadaha da (Region-II)	I	75999.60	40883.7	35115.9
	II	75254.40	40683.41	34570.99
	III	74282.40	40739.31	33543.09
	IV	73569.60	40774.79	32794.81
	<b>Pooled</b>	<b>75148.29</b>	<b>40768.19</b>	<b>34380.10</b>

### Production Function Analysis

With a view to examining the efficiency of various input factors employed in the production of sugarcane, production function analysis was carried out.

Cobb-Douglas function was selected for this study because of its relative advantages over other production functions. With this function, elasticities of production are computed directly. The sum of elasticities ( $\sum b_i$ ) indicates the nature of return to scale. If the sum of elasticities is equal to one, greater than one and less than one, it indicates constant, increasing and decreasing returns to scale respectively.

Zero order correlation matrices for all the variables were worked out to study the problem of multicollinearity. It was found that the interaction between inputs was low enough to have any impact on sugarcane output. The results of the Cobb-Douglas production function are presented in Table 20.

The results revealed that the regression co-efficient associated with land area were found to be positive and significant in all size categories in both the regions. This was also reflected when all size groups were pooled together, indicating thereby that if area under this crop is increased the returns per hectare will also increase.

**Table 20: Regression co-efficient of inputs, return to scale and co-efficient of multiple determination for sugarcane farms**

Items	Dhenkanal Sadar (Region-I)				Kankathada (Region-II)				
	Marginal farms	Small farms	Medium farms	Large farms	Marginal farms	Small farms	Medium farms	Large farms	
Area and other crops	1.087* (0.233)	2.126* (0.342)	1.366* (0.098)	1.706* (0.413)	0.897* (0.2016)	1.507* (0.137)	1.687* (0.046)	1.328* (0.303)	0.6344* (0.2136)
Bullock labour	0.313* (0.021)	0.216* (0.032)	0.283 (0.081)	1.086 (1.203)	0.769 (0.532)	0.244* (0.025)	1.084 (1.165)	1.188 (1.781)	0.811 (0.723)
Human labour	-2.063* (0.628)	2.176* (0.733)	0.061 (0.078)	1.434 (0.367)	0.321* (0.066)	-2.698* (0.823)	1.849 (0.313)	2.014 (0.498)	0.401* (0.073)
Fertilizers & manure	0.631* (0.102)	0.724* (0.133)	0.716* (0.202)	0.838* (0.197)	0.677* (0.135)	0.618* (0.122)	0.609* (0.145)	0.718* (0.181)	0.603* (0.159)
Irrigation	0.428* (0.093)	0.449* (1.087)	0.533* (0.092)	0.468* (0.086)	0.379 (0.021)	0.434* (0.088)	0.399 (0.027)	0.452* (0.036)	0.316 (0.075)
Seeds	1.234 (1.196)	1.609 (1.012)	-2.036 (1.925)	-3.017 (1.811)	2.872 (1.578)	-1.989 (1.733)	-3.122 (1.936)	-3.827 (1.364)	-2.938 (1.626)
$\Sigma b_i$	1.645	1.894	1.673	1.792	1.830	1.708	1.836	1.899	1.803
$R_2$	0.83	0.87	0.81	0.83	0.833	0.78	0.79	0.74	0.77
N	18	28	22	12	80	29	20	5	80

\* Significant at 1 per cent level

Figures without any asterics are not statistically different from zero.

Figures in parenthesis are standard errors.

Regression co-efficient associated with bullock labour, fertilizers and irrigation on marginal, small and medium farms and human labour, fertilizer on large farms were positive and significant indicating thereby that these resources contributed significantly to the returns of this crop. However seeds did not enter as one of the significant variable in any of the farm size groups and regions. The negative and significant co-efficient of human labour on marginal and small farms indicated that these farms are using this input in excess quantity. When the data for all farm size groups were pooled together, human labour, fertilizers and irrigation were found to have positive and significant relationship with returns from sugarcane.

The value of  $R_2$  (Co-efficient of Multiple determination) was found to be 0.83, 0.87, 0.81, 0.83 and 0.83 in region-I for marginal, small, medium, large farms respectively as compared to 0.78, 0.76, 0.79 and 0.74 for the respective farmers in region-II. It indicates that 83, 87, 81 and 83 percent of variation in gross return could be explained by all the explanatory variables included in the equation in region-I as compared to 78, 76, 79 and 74 percent in region-II.

The sum of elasticities were 1.645, 1.894, 1.673 and 1.792 for marginal, small, medium and large farms in region-I respectively indicating increasing return to scale. Increasing return to scale is also observed in region-II with magnitude 1.708, 1.737, 1.836 and 1.899 for the respective farm sizes. A comparison revealed that in region-I has advantage over region-II with higher magnitude of returns to scale.

## **Conclusion**

The above analysis revealed that economic of sugarcane production in Dhenkanal district of Orissa has been fluctuating though it has potential as per the perception of sampled farmers. It emerged from the study that the net farm income earned by the marginal and small farms per hectare was higher than that realized by their counterparts in medium and large farms. This might be due to large area under irrigation and higher use of fertilizer by the farmer groups than the later. The marginal and small farms managed to earn more net return than other two categories of sample farms in both the regions. The other measures of farm incomes, like family labour income farm business income farm investment income etc. exhibited inverse relationship with farm size in both the regions excepting few cases.

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