

RESEARCH PAPER

# Economics of organic and inorganic jaggery production in Kolhapur district of Maharashtra

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## ABSTRACT

A research was conducted in Karaveer and Panhala tahsils of Kolhapur district of Maharashtra to study the economics of organic and inorganic jaggery production in 2011-12. The study revealed that the per unit resource use and their cost was estimated to Rs. 679483.24 and Rs.3240745.98 in respect of organic and inorganic jaggery processing unit, respectively. It is interesting to note that the cost on account of resource use was found more in inorganic jaggery than organic jaggery production, this may be due to the crushing days of organic jaggery units was much less than that of inorganic jaggery production also complete absence of hydrous powder and very less use of phosphoric acid in case of organic jaggery. It is also revealed that the per quintal cost of jaggery production was Rs. 2768.97 and Rs. 2834.31 for organic and inorganic jaggery, respectively. The per unit establishment cost for organic and inorganic jaggery was Rs. 806120 and Rs. 808509, respectively. This implied that the establishment cost was observed more or less similar in both the type of jaggery production. The per quintal cost of jaggery processing was less for organic (Rs. 2768.97) than the inorganic jaggery (Rs. 2834.31) this was due to higher cost of chemicals which required in inorganic jaggery production. The per quintal net profit was highest in organic than inorganic jaggery production. This was due to very less cost of chemicals and more net return per quintal prices obtained. The Break-even point for organic and inorganic jaggery production in physical terms was 247.68 qtls. and 337.97 qtls., in monetary terms it was Rs. 891646 and Rs. 1115300, respectively. The chemical cost had negative affect on net price received per quintal of jaggery.

**KEY WORDS :** Capital investment, Cost of production, Breakeven analysis, B:C ratio, Multiple regression analysis

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Sugarcane (*Saccharum officinarum* L.) is important cash as well as sugar crop in the world. In sugarcane cultivation Brazil ranks first, India ranks second and also is an important commercial crop of the country occupying around 4.94 million hectares of land with an annual cane production of around 339.16 million tones, with producers of white sugar, seed and feed and jaggery are 70.70 per cent, 11.90 per cent and 17.40 per cent, respectively (Anonymous, 2011).

India occupies first position in production of jaggery in the world. In financial year 2009-2010, total production

of jaggery in India was around 80 lakh tones. Jaggery and Khandsari are the major agro processing industries found in rural sector of our country. About 25-30% of sugarcane produced in the country is utilised for production of jaggery (Anonymous, 2011). Even today, jaggery production in India is about 7-10 million tonnes per annum, while its per capita consumption is about 5 kg/year in the last two decades, the consumption of jaggery has fallen significantly by almost half of what it was consumed two decades back (2012). It provides employment to about 2.5 million peoples. In India it boosts-up the rural economic system, the transportation cost of raw material is low, and there is no need of highly technical machinery and labour.

Maharashtra is one of the leading producers of jaggery apart from sugar. Large numbers of jaggery production units are located in state. In Maharashtra, about 11 to 12 per cent sugarcane was being used for jaggery preparation during the year 2005-2006 and jaggery from Maharashtra is also well known for its quality, which has wide demand in international market.

## **METHODOLOGY**

### **Location of study :**

The Kolhapur a district was purposively selected for present study due to the fact large number (702) of jaggery producing units are present in the area. From selected district the Karveer and Panhalatahsils were found promising in production of organic as well as inorganic jaggery, for this reason the study was undertaken in above mentioned tahsils of Kolhapur district. The large numbers of jaggery producing units were available in Kolhapur district this may be due to plenty of quality sugarcane required for jaggery production is available as raw material to jaggery producing units.

### **Selection of villages :**

The village wise list of jaggery producer from each tahsils units was obtained from office of the "Shri Chhatrapati Shahu Sahakari Gur Kharedi Vikri Sangha, Kolhapur". Then villages were arranged in descending order according to number of jaggery producers in that villages. Two villages from each tahasil were selected randomly for the present study and the selected villages are Chikali, Vadanage, Porle and Kotoli.

### **Selection of jaggery producers :**

From the list of jaggery producers, producers were classified in to two categories based on method of processing used for making the jaggery.

#### *Organic jaggery :*

Jaggery produced from sugarcane (Without chemical) without chemical other than Phosphoric acid Bhendi powder and lime in its processing.

#### *Inorganic jaggery:*

Jaggery produced from sugarcane using different chemical powders in its processing.

From every village eight jaggery producing units from each category were selected randomly. Thus total sample size was 64 jaggery producers comprised of 32 jaggery producers from each category spread over 4 villages of the study area.

### **Sample design :**

The sample design adopted for the investigation was two stage random sampling with sample village as a primary unit and jaggery producers as a secondary and ultimate unit of sampling.

### **Collection of data :**

The primary information relating aspects like capital investments, raw material required, chemicals required and labour for the year 2011-12 was collected by survey method through personal interviews with the sample jaggery producers with the help of questionnaire specially designed for the purpose.

### **Method of analysis :**

The analytical procedure followed to accomplish the objectives under the study is explained below.

### **Cost of production of jaggery :**

The data collected from 64 sample of jaggery producers were compiled and tabulated suitably to individual sample category. The data were further analyzed to obtain sample means relative to different aspects of processing of jaggery. The estimates of capital assets, fixed investments, working costs, marketing costs and net returns etc. were obtained on per quintal basis for the individual category of jaggery producers.

The data were also analyzed to find out the fixed

costs, variable costs, total costs and returns from production of organic as well as inorganic jaggery. A cross sectional comparison of costs and returns of the activity was done separately in order to find out the extent of profitability of the jaggery producing units. A tabular method of estimation was used in the most part of the investigation.

The standard cost concepts used are as below

*Total variable cost :*

Variable cost includes the cost of raw materials *i.e.* the cost of sugarcane used for jaggery preparation, cost of chemicals, labour cost involved in processing, electricity charges etc.

*Total fixed cost:*

Fixed cost includes depreciation on shed equipments, buildings; machinery and interest on fixed capital etc. are included in fixed capital.

*Total cost:*

Total cost is the addition of total variable cost and total fixed cost required for jaggery production.

*Interest on working capital:*

Interest on working capital was charged at the rate of 11 per cent per annum. The interest on working capital

was, however, charged for the period of 4 months in case of inorganic jaggery while actually period required for preparation of organic jaggery.

*Depreciation on assets:*

The duration for calculating depreciation of asset was also considered 4 months. The straight line method was used for calculation of depreciation on different assets.

*Interest on fixed capital :*

Interest on fixed capital was charged @ 13 per cent per annum and is taken for only four months.

**Income/Return analysis :**

*Gross returns:*

The gross returns are calculated by multiplying total quantity of jaggery with its market price.

*Net returns at various costs :*

*Net returns at variable costs :*

Net returns at variable cost have been estimated by subtracting the variable cost from the gross returns.

*Net returns at fixed cost :*

Net returns at fixed cost have been estimated by subtracting the fixed cost from the gross returns.

Sr. No.	Particulars	Unit	Price (Rs.)
1.	Sugarcane	Per Tonne	2500
2.	Sugarcane cutting		
	Male	Per day	250
	Female	Per day	250
3.	Transportation of sugarcane		
	Bullock carts	Per day	300
4.	Human labour required in jaggery processing		
	Gulvi (Skilled labour)	Per day	380
	Adkari (Skilled labour)	Per day	200
	Female	Per day	150
5.	Chemicals/Clarifying agents		
	Hydrous powder	Kg	160
	Phosphoric acid	Kg	175
	Bhendi powder	Kg	600
	Lime	Kg	15
	Edible oil	Kg	55
	Milk	Litre	40
	Milk powder	Kg	50

**Net returns :**

Net returns have been estimated by subtracting the total cost from gross returns.

**Benefit : Cost ratio over total cost :**

Benefit: Cost ratio over total cost has been obtained by dividing the gross returns by the total costs.

**Break even analysis :**

The break even analysis is the level at which total revenue equals to total cost. In present study, to determine minimum capacity of jaggery making enterprises break even analysis was carried out,

$$BEQ = \frac{TFC}{P - VC}$$

where,

BEQ : Break even quantity.

TFC : Total annual fixed cost (Rs.)

P : Price per unit.

VC : Variable cost per unit (Rs.)

Formula for monetary terms as follows.

$$BEP = \frac{TFC}{[1 - VC/P]}$$

where,

BEP : Break even point

TFC : Total annual fixed cost (Rs.)

P : Price per unit

VC : Variable cost per unit (Rs.)

**Multiple regression analysis:**

The multiple regression analysis was used for price received per quintal of organic and inorganic jaggery producers to its factors of production. The raw material (X1), labour cost (X2) and chemical cost (X3) were independent and the net return per quintal of jaggery production was dependant factors of production. To know which factor of production is significant or non-significant.

**Chow's test :**

To know the homogeneity between the organic and inorganic jaggery, factors of production the Chow's test was applied. The steps involved the following steps.

Step I: Combine all the N1 and N2 observations of two samples and run single 'Pooled' regression from the regression, obtain residual sum of the squares (RSS),

say S1 with df = N1 + N2 - K where K is the number of parameters estimated.

Step II: Run the two individual regression (1) and (2) and obtain RSS, say S2 and S3 with df = N1 - K and N2 - K, respectively. Add these two SS, S2 + S3 with df = N1 + N2 - 2K

Step III: Apply the 'F' test as follow:

$$F = \frac{[\sum S1 - (\sum S2 + \sum S3)] / K}{[(\sum S2 + \sum S3) / (N1 + N2 - 2K)]}$$

With df = K and N1 + N2 - 2K

If the computed 'F' exceed the critical 'F' hypothesis that the two regressions are the same can be rejected. In other words, such regression differs, either in the intercepts or slopes or both.

**ANALYSIS AND DISCUSSION**

In consonance with the objectives of the study, the data collected from various sources were subjected to various statistical tools and techniques to draw meaningful conclusions. The major findings of the study are presented in this chapter as under.

**Average value of capital assets owned by sample jaggery producers :**

The average value of capital assets owned by jaggery producers is presented in Table 1. The information regarding to the value of capital assets gives an idea about economic condition of sample of jaggery producers. At overall level the value of total capital assets owned by the sample jaggery producer was Rs. 6276166. Also at overall level the value of capital asset owned by the sample jaggery producers was high for the land was 86.76 per cent, followed by buildings 9.86 per cent, machinery 1.88 per cent, livestock and implement 1.41 per cent and 0.39 per cent, respectively.

In comparison of category the total capital assets owned by inorganic jaggery producers were high (Rs. 6395403) than that of organic jaggery producers unit (Rs. 6156929).

From the above, it was clear that only land has contributed Lion's share in the value of capital assets owned by jaggery producer.

**Capital investment pattern of jaggery processing units :**

The investment made for the establishment of jaggery processing units included investment on

infrastructure, machinery and equipments. Initial investment pattern in jaggery production unit was estimated and is presented in Table 2. The space (land) was most important factor contributing more or less similar share *i.e.* Rs. 403711 (50.08 %) and Rs. 409297 (50.62 %) for establishing organic and inorganic jaggery units, respectively. The results also revealed that, initial investment on shed was higher after land as Rs. 87031 (10.80 %) and Rs. 84063 (10.40 %) for category I and category II. The investment on *Katta* was found to be Rs. 56250 (6.98 %) and Rs. 56844 (7.03 %), on cane crusher Rs. 44231 (5.49 %) and Rs. 44438 (5.50 %), on furnace 42906 (5.32 %) and Rs. 42344 (5.24 %) on Roof Rs. 37406 (4.64 %) and Rs. 39281 (4.86 %), on *Kahil* (boiling pan) Rs. 34813 (4.32 %) and Rs. 35000 (4.33 %) followed by investment on Generator machine Rs. 23250 (2.89 %) and Rs. 23313 (2.88 %), respectively all for organic and inorganic jaggery processing units.

It could be seen from the above discussion that a per unit total investment of Rs. 806120 was needed for the establishment at organic jaggery processing units and Rs. 808509 in case of inorganic jaggery processing units. This clearly showed that there was no much large difference in establishing the both type of jaggery units and also the capital investment for the both type of unit.

### Resource use and cost incurred in jaggery production :

The information on per unit per season resource use and their cost in jaggery making is worked out and presented in Table 3.

Category wise per unit cost were estimated to Rs. 679483.24 and Rs. 3240745.98 in respect of organic and inorganic jaggery processing unit, respectively. It is interesting to note that the cost on account of resource

use was found more in inorganic jaggery than organic jaggery production, this may be due to the crushing days of organic jaggery units was much less than that of inorganic jaggery production that resulted more jaggery production in case of inorganic than organic jaggery production. The total cost of labour required for jaggery processing unit for organic and inorganic was Rs. 130854.14 and Rs. 580120.63 for 578.27 man days and 2571.93 man days of organic and inorganic, respectively. The unskilled labour costs for operation like sugarcane cutting was Rs. 38522.66 and Rs. 180511.88 for organic and inorganic, respectively. The labour cost on account of transportation of sugarcane from field to jaggery processing unit was Rs. 22241.17 and Rs. 106023.13, for cane crushing Rs. 15941.25 and Rs. 72601.88, heating of juice Rs. 11054.06 and Rs. 42039.06, transportation of residue Rs. 8302.73 and 37497.19 for organic and inorganic, respectively.

On other hand the skilled labour like *Gulvi* and *Adkari* engaged in processing of jaggery also play important role in jaggery making. The cost incurred on *Gulvi* was Rs. 12791.80 (1.88 %) and 42512.50 (1.31 %) of organic and inorganic processing unit, respectively.

The second component of skilled labour *i.e.* *Adkari*. The cost on *Adkari* was found less (Rs. 22000.47) in case of organic than inorganic jaggery units (Rs. 98935). The most valuable factor in resource use structure was raw material or sugarcane which accounted for Rs. 541328.13 and Rs. 2529437.50; also the share of fuel and electricity supply was 0.46 per cent and 0.67 per cent in total cost of production of jaggery organic and inorganic, respectively.

In the process of jaggery making different types of Clarifying agents and chemicals are used which is playing vital role in resource use structure. It is also seen from

**Table 1 : Average value of capital assets owned by sample of jaggery producers**

Sr. No.	Particulars	Organic jaggery	Inorganic jaggery	Overall
		Value (Rs.)	Value (Rs.)	Value (Rs.)
1.	Land	5197461 (84.42)	5442344 (85.10)	5319902 (86.76)
2.	Building	619169 (10.06)	617975 (9.66)	618572 (9.86)
3.	Irrigation structure	108059 (1.76)	104106 (1.63)	106083 (1.69)
4.	Livestock	89602 (1.46)	87746 (1.37)	88674 (1.41)
5.	Machinery	118168 (1.92)	118325 (1.85)	118247 (1.88)
6.	Implements	24470 (0.40)	24907 (0.39)	24689 (0.39)
	Grand total	6156929 (100.00)	6395403 (100.00)	6276166 (100.00)
7.	Value of assets excluding land	959468 (15.58)	953059 (14.90)	956264 (15.24)

Figures in the parentheses are percentages to the total

table that very less amount of cost on account of material used was found in case of organic jaggery (Rs. 3660.82) than inorganic (Rs. 108031.41) because of absence of hydrous powder and less quantity of phosphoric acid in case of organic jaggery production.

Among individual contribution of chemicals used in case of inorganic jaggery highest contribution was made by hydrous powder Rs. 75845.31 followed by phosphoric acid Rs. 13782.43, lime Rs. 6108.55, bhendi powder Rs. 5774.06, milk powder Rs. 3454.12 and edible oil Rs. 2225.94.

As regards to organic jaggery processing units the

only organic material and clarifying agents were used for preparation of jaggery. Among the organic material the cost on account of bhendi powder was Rs. 1656.59 followed by phosphoric acid Rs. 656.65, milk powder 472.51, milk Rs. 341.25 and edible oil Rs. 215.32.

To sum up that labour use, electricity, chemicals and clarifying agents were less for organic jaggery production as compared to inorganic jaggery production with complete absence of hydrous powder and less quantity of phosphoric acid in case of organic jaggery. On the whole, it is concluded that the resource use in comparison with organic and inorganic jaggery

**Table 2 : Capital investment in establishment of jaggery processing units**

Sr. No.	Items	Organic jaggery		Inorganic jaggery	
		Number/units	Value (Rs.)	Number /units	Value (Rs.)
1.	Land (ha)	0.25	403711 (50.08)	0.25	409297 (50.62)
2.	Shed	1	87031 (10.80)	1	84063 (10.40)
3.	Furnace	1	42906 (5.32)	1	42344 (5.24)
4.	<i>Katta</i>	1	56250 (6.98)	1	56844 (7.03)
5.	Roof	1	37406 (4.64)	1	39281 (4.86)
6.	<i>Vafa</i>	1	19125 (2.37)	1	18875 (2.33)
7.	<i>Chimney</i>	1.63	19719 (2.45)	1.56	20297 (2.51)
8.	Cane crusher	1	44231 (5.49)	1	44438 (5.50)
9.	Generator machine	1	23275 (2.89)	1	23313 (2.88)
10.	Electric motor	1.22	17141 (2.13)	1	15688 (1.94)
11.	Juice storage tank	1	3486 (0.43)	1	3525 (0.44)
12.	Filter plates	1.34	423 (0.05)	1.41	402 (0.05)
13.	Iron scrapper	1.44	555 (0.07)	1.81	607 (0.08)
14.	Different shape of block				
	0.5 kg	12.19	148 (0.02)	13.43	179 (0.02)
	1 kg	36.09	555 (0.07)	37.34	571 (0.07)
	2 kg	27.19	533 (0.07)	29.69	513 (0.06)
	5 kg	34.84	763 (0.09)	36.25	776 (0.10)
	10 kg	27.50	711 (0.09)	27.65	772 (0.10)
	<i>Vadisache</i>	0.38	128 (0.02)	0.25	102 (0.01)
	<i>Modak</i>	0.94	14 (0.001)	1.06	19 (0.002)
15.	<i>Kahil</i> /boiling pan	1	34813 (4.32)	1	35000 (4.33)
16.	Plastic pipes (ft)	1	1425 (0.18)	1	1559 (0.19)
17.	<i>Zarya</i>	2.75	774 (0.10)	2.78	793 (0.10)
18.	Oil engine	0.22	4297 (0.53)	0.15	2990 (0.37)
19.	Water tank	1	3825 (0.47)	1	3444 (0.43)
20.	<i>Hate</i>	4.09	1395 (0.17)	3.91	1439 (0.18)
21.	<i>Bhare</i>	2.25	972 (0.12)	2.38	953 (0.12)
22.	Ash-spade	2.66	259 (0.03)	2.19	183 (0.02)
23.	Crates	1.19	250 (0.03)	1.09	244 (0.03)
	Total		806120 (100.00)		808509 (100.00)

Figures in the parentheses are percentages to the total

production, the raw material (78 to 79 %) revealed major contribution to followed by labour use (17 to 19 %), chemicals and fuel and electricity.

The similar trend was found in both categories except less chemicals and clarifying agents used in case of organic jaggery production.

### Cost and returns from jaggery production :

The cost incurred and returns obtained from jaggery production are described under the following sub-headings.

### Cost of jaggery processing :

The costs incurred in jaggery production it could be seen from the Table 4 that the total variable cost in case

of inorganic jaggery production worked out to be Rs. 3240745.98 which is four times more than to in organic jaggery (Rs. 679483.24) processing units. In the total cost, the cost of Sugarcane was the prime cost taking 78.39 per cent and 77.77 per cent in organic and inorganic jaggery processing units, respectively. Labour, fuel and electricity charges were the other important items of cost accounting for 18.95 per cent and 0.46 per cent in organic and it was 17.84 per cent and 0.66 per cent in case of inorganic processing unit. The contribution of total fixed cost, in the total cost (Rs.11063.29 and Rs. 11571.87 in organic and inorganic) was very major when it is compared with the variable cost. The percentage of fixed cost to the total cost was only 1.60 and 0.36 in organic and inorganic jaggery producers.

Table 3 : Average category wise resource use and cost incurred on jaggery processing unit					
Sr. No.	Particulars	Organic jaggery		Inorganic jaggery	
		Quantity	Value (Rs.)	Quantity	Value (Rs.)
1.	Raw material				
	Sugarcane used (tons)	216.53	541328.13 (79.67)	1011.78	2529437.50 (78.05)
2.	Labour cost				
	Sugarcane cutting (man days)	150.59	38522.66 (5.67)	704.05	180511.88 (5.57)
	Sugarcane transportation (man days)	71.40	22241.17 (3.27)	341.53	106023.13 (3.27)
	Crushing (days)	77.70	15941.25 (2.35)	357.84	72601.88 (2.24)
	Juice heating (man days)	54.54	11054.06 (1.63)	207.78	42039.06 (1.30)
	<i>Gulvi</i> (days)	37.88	12791.80 (1.88)	124.06	42512.50 (1.31)
	Transportation of residue (man days)	74.65	8302.73 (1.22)	336.09	37497.19 (1.16)
	<i>Adkari</i> (man days)	111.52	22000.47 (3.24)	500.56	98935 (3.05)
	Total (man days)	578.27	130854.14 (19.26)	2571.93	580120.63 (17.90)
3.	Chemicals				
	Hydrous Powder (kg)	-	-	456.36	75845.31 (2.34)
	Phosphoric Acid (ml)	3.84	656.65 (0.10)	159.54	13782.43 (0.43)
	Total		656.65 (0.10)		89627.74 (2.77)
4.	Clarifying agents				
	Lime (kg)	12.17	318.50 (0.05)	230.85	6108.55 (0.19)
	<i>Bhendi</i> Powder (kg)	2.59	1656.59 (0.24)	5.81	5774.06 (0.18)
	Edible Oil (kg)	4.24	215.32 (0.03)	30.23	2225.94 (0.07)
	Milk powder (kg)	11.91	472.51 (0.07)	27.98	3454.12 (0.11)
	Milk (lit.)	9.75	341.25 (0.05)	26.28	841 (0.03)
	Total		3004.17 (0.44)		18403.67 (0.57)
	Chemicals and Clarifying agents		3660.82 (0.54)		108031.41 (3.33)
5.	Fuel and electricity				
	Diesel (lit.)	11.92	655.89 (0.10)	94.43	5194.34 (0.16)
	Electricity		2490.52 (0.37)		16365.23 (0.50)
	Total	26.455	3146.41 (0.47)	124.06	21559.57 (0.67)
6.	<i>Khadi</i> cloths	-	493.75 (0.07)	-	1596.88 (0.05)
	Grand total		679483.24 (100.00)		3240745.98 (100.00)

Figures in the parentheses are percentages to the total

The main component of fixed cost was land depreciation and interest on fixed capital. Whereas raw material, labour cost and electricity charges in case of variable cost in both categories of jaggery production.

To sum up it concluded that in both the categories of jaggery production the major items of production cost were raw material cost (sugarcane), labour cost and cost on account of chemicals with exception in less chemical and clarifying agents used in organic jaggery these results

were supported by Varute (2006).

#### Returns from jaggery production :

Per unit per season gross returns from organic and inorganic jaggery production were calculated and presented in Table 4. It was clear from the table that gross returns from organic jaggery production were Rs. 891419.55 with net returns Rs. 200873.01. The B:C ratio for organic jaggery was found 1.29.

**Table 4 : The category wise per season pattern of costs and returns from jaggery production**

Sr. No.	Particulars	Unit	Organic jaggery producer		Inorganic jaggery producer	
			Units required	Cost (Rs.)	Units required	Cost (Rs.)
1.	Land	ha.	0.26	4037.11 (0.58)	0.24	4722.66 (0.15)
2.	Depreciation of building	-	-	1885.30 (0.27)	-	1876.30 (0.06)
3.	Interest on fixed capital	-	-	5140.88 (0.75)	-	4972.92 (0.15)
	Total fixed cost	-	-	11063.29 (1.60)	-	11571.87 (0.36)
4.	Sugarcane cost	Tons	216.52	541328.13 (78.39)	1011.78	2529437.50 (77.77)
5.	Total chemicals and clarifying agents cost	-	-	3660.82 (0.53)	-	108031.41 (3.32)
6.	Total labour cost	-	-	130854.14 (18.95)	-	580120.63 (17.84)
7.	Fuel and electricity charges	-	-	3146.41 (0.46)	-	21559.57 (0.66)
8.	Khadi cloths	-	-	493.75 (0.07)	-	1596.88 (0.05)
	Total variable cost	-	-	679483.24 (98.40)	-	3240745.98 (99.64)
	Total cost	-	-	690546.53 (100.00)	-	3252317.85 (100)
	Returns	-	-	-	-	-
1.	Crushing days	-	26.51	-	124.06	-
2.	Jaggery produced	Ton	24.94	891419.55	114.74	3774770.29
3.	Net returns	-	-	200873.01	-	522452.44
4.	B:C ratio	-	-	1.29	-	1.16
5.	Per kg cost of jaggery (Rs.)	-	-	28.03	-	28.40
6.	Recovery %	-	-	11.42	-	11.39

Figures in the parentheses are percentages to the total

**Table 5 : Per quintal cost and returns from organic and inorganic jaggery production**

Sr. No.	Particulars	Organic jaggery		Inorganic jaggery	
		Cost	Per cent to total (%)	Cost	Per cent to total (%)
1.	Sugarcane cost	2170.63	78.39	2204.34	77.77
2.	Chemicals and clarifying agents	14.68	0.53	94.15	3.32
3.	Labour charges	524.70	18.95	505.56	17.84
4.	Khadi cloths	1.98	0.07	1.39	0.05
5.	Fuel and electricity charges	12.62	0.47	18.79	0.66
6.	Land value	16.19	0.58	4.12	0.15
7.	Depreciation	7.56	0.27	1.64	0.06
8.	Interest on fixed capital	20.61	0.74	4.33	0.15
	Total cost	2768.97	100.00	2834.31	100.00
1.	Total returns @-	3574.46	-	3289.61	-
2.	Net returns	805.49	-	455.30	-
3.	B:C ratio	1.29	-	1.16	-

Figures in the parentheses are percentages to the total



**Table 6 : Break-even analysis**

Sr. No.	Particulars	Category	
		Organic jaggery	Inorganic jaggery
1.	In Physical terms (q)	247.68	337.97
2.	In Monetary terms (Rs.)	891646	1115300

**Table 7 : Results of the chows test applied for the organic and inorganic jaggery production**

Sr. No.	Particulars		Organic jaggery	Inorganic jaggery	Overall
1.	Raw material	X <sub>1</sub>	0.93*** (0.1317)	0.80*** (0.1332)	0.7838*** (0.0945)
2.	Labour	X <sub>2</sub>	1.01** (0.4637)	-0.036 <sup>NS</sup> (0.4043)	0.57* (0.3366)
3.	Chemical	X <sub>3</sub>	0.39 <sup>NS</sup> (2.2274)	-3.06*** (0.7844)	-3.44*** (0.2964)
4.	Intercept	A	1020.11 (278.3713)	1825.34 (252.1103)	1617.97 (160.9334)
5.	Co-efficient of multiple determination	R <sup>2</sup>	0.75	0.92	0.88
6.	F value		29.52	117.75	126.71
7.	Number of observation	N	32	32	64
8.	D.F.		31	31	63
9.	Residual sum of square		338559.03	111628.51	599782.46
	Chow's F test		-	-	6.4243**

Figures in bracket are Std. errors of the co-efficients and \*\*\*, \*\* and \* indicates significance of values at P=0. 1, 0.05 and 0.01, respectively  
NS=Non-significant

In case of inorganic jaggery production, gross returns were obtained Rs. 3774770.29 and net returns to Rs. 522452.44. The estimated B:C ratio was 1.16. Though the production of organic jaggery was less than inorganic jaggery, more price and less cost of production of organic jaggery resulted into better B:C ratio than inorganic jaggery production indicating that organic jaggery production with adequate size was profitable proposition.

#### Per quintal cost and returns from organic and inorganic jaggery production :

From the Table 5, it can be revealed that per quintal cost of jaggery production was Rs. 2768.97 and Rs. 2834.31.

Sugarcane cost and labour cost were the major items of total cost, contributing 78.39 per cent and 18.95 per cent in organic production and 77.77 per cent and 17.84 per cent, in inorganic jaggery production. The land value, depreciation and interest on fixed capital more in case of organic jaggery because of its less production than inorganic jaggery. It is also noted from the table that the per quintal net returns from organic jaggery Rs. 805.49 was more than inorganic jaggery Rs. 455.30.

#### Break-even analysis :

The break-even point was worked out for the estimating the minimum quantity of organic and inorganic

jaggery that should be produced in order to have no profit no loss in the business. The Break-even point for sample jaggery producers was calculated and presented in Table 6.

The break-even point gives the size of business. It is observed from the table for the organic jaggery breakeven point was 247.68 qtls. in physical terms and Rs. 891646 in monetary terms, for inorganic jaggery it was 337.97 qtls. in physical terms and Rs. 1115300 in monetary terms. It indicated that minimum quantity of jaggery, each category have to produce to equal costs and returns. The time period required for achieving the break-even level of output was relatively longer for inorganic jaggery units (146 days), when compared to organic jaggery (105 days).

#### Functional analysis :

In functional, analysis effect of all factors, which are thought to influence the dependent variable, (e.g. here, Net price received per quintal of jaggery) influencing the dependent variable are considered simultaneously. In the present study multiple regression analysis technique employed simultaneously for entire factors under consideration, also the result on Chow's test applied to know the homogeneity between the parameters of the production functions are presented in Table 7.

At overall level, it can be revealed from the table independent variable viz., raw material (X<sub>1</sub>), labour (X<sub>2</sub>)

and chemical cost ( $X_3$ ) explained the variation in the net price per quintal of extent of 88 per cent, which is 75 per cent and 92 per cent for organic and inorganic jaggery, respectively. At overall level only chemical cost ( $X_3$ ) were negatively significant. The regression co-efficient for organic jaggery of raw material ( $X_1$ ), labour ( $X_2$ ) were positive and significant indicating but chemical cost ( $X_3$ ) were non-significant in case of inorganic jaggery production only raw material ( $X_1$ ) is significant but labour cost ( $X_3$ ) is non-significant.

The pooled regression taken for employing chow test t and the result revealed that it is 5 per cent level of significant (6.4243\*\*).

In summary, it is concluded that the chemical cost affect negatively on net price received per quintal of jaggery production. Similar work related to the present work was also done by Imandi (2011); Jadhav (2012); Kallappa (2011); Maheswarappa *et al.* (1998); Muralidharan (1981); Patil *et al.* (2005) and Rao and Ravikumar (2005).

#### Conclusion :

The present investigation was intended to depict the picture of the Organic and Inorganic jaggery producer in Kolhapur districts, the prominent jaggery producing district of Maharashtra state. The enterprise has assumed a place of pride in the economy of the tract. In the light of the empirical evidence brought out by the study, the following conclusions are drawn.

The per quintal cost of jaggery processing was less for organic (Rs. 2768.97) than the inorganic (Rs. 2834.31) this was due to higher cost of chemicals which required in inorganic jaggery production. The per quintal net profit

was highest in organic than inorganic jaggery production. This was due to very less cost of chemicals and more net return per quintal prices obtained. The Break-even point for organic and inorganic jaggery production in physical terms was 247.68 qtls. and 337.97 qtls., in monetary terms it was Rs. 891646 and Rs. 1115300, respectively.

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