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# Economic Analysis of Jaggery Production in Punjab

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**Abstract**

*The study examined the economic analysis of jaggery production in Punjab. Primary data were collected from two districts Gurdaspur and Hoshiarpur selected through probability proportion to size technique. From these two districts 30 jaggery producers were selected using simple random sampling technique. The study revealed that 66.67 per cent of jaggery producers were cultivator-cum-jaggery producers, primarily operating on small scale with sugarcane as a subsidiary crop, while large, non-cultivator producers treated jaggery as a primary business. The overall benefit-cost ratio (BCR) and the total cost of jaggery production on sample jaggery producing units were 1.48 and Rs 4,574 per quintal respectively. The inverse relationship of estimated BCR as well as cost of jaggery production with size of production unit, indicated presence of significant scale economies in this cottage industry. Inconsistency in jaggery quality, high interest rate on credit and labour shortages were identified as the key challenges faced by jaggery producers. Overall, jaggery production proved profitable but constrained by operational and financial hurdles, particularly for smaller producers.*

**Keywords:** Jaggery, Investment, Disposal, Constraints, Capital

**JEL Classification:** Q12, Q13, Q16, D24, O13, L66

## Introduction

India with contribution of one fourth of total production of world is the largest producer of sugarcane and the second largest consumer of sugar in world (Solomon, 2016). Sugarcane is the sole raw material for the largest agro-processing industry in the country providing employment to millions of people in the rural sector (Savant *et al,* 1999). Besides production of sugar, there are many by-products of the sugarcane industry such as bagasse, molasses*, khandsari*, ethanol, jaggery, etc. In India, 76 per cent of the sugarcane produced is utilized for making of sugar, 11 per cent is used for producing jaggery and the rest 13 per cent is utilized for seed, feed amd chewing, etc. The jaggery industry has been considered as one of the small scale and cottage industry in India. It is mostly produced in small scale units using traditional machinery under an unorganized agro-processing sector in the rural areas. Millions of sugarcane growers and others are employed by the labor-intensive jaggery business (Solomon, 2016). It makes use of local talent and resources, generates quick returns, and most importantly, it belongs to the mass consumer products industry (Nath *et al,* 2015).

A good quality jaggery has golden yellow colour, hard texture, crystalline structure, sweeter taste and less moisture content. High-quality jaggery typically consists of over 70 per cent sucrose, less than 10 per cent glucose and fructose, less than 5 per cent minerals, and no more than 3 per cent moisture (Nath *et al,* 2015). Quality or taste of jaggery can be enhanced with a variety of natural flavours, including ginger, black pepper, cardamom, and lemon, along with nutritious elements like proteins, vitamins, and phytochemicals. It can also be modified in texture and flavour through the addition of nuts, spices, cereals, and pulses. Additionally, it plays a role in producing alcoholic beverages such as palm wine. Quality jaggery, along with its value-added goods like jaggery chocolate and confections made of different combinations of cereals, have enormous export potential because they are a healthy and friendly sweetener (Singh *et al,* 2019).

The process of making jaggery has changed significantly over time, and in many regions of the country, power crushers have substituted the traditional *Kolhus*, which were used to crush sugarcane (Mohan and Agarwal, 2020). As a result, the industry's efficiency has increased, which led to a higher cane juice extraction rate. The sugar industry alleges that the government's discriminating laws have contributed to the diversion of significant amounts of sugarcane towards the jaggery sector, particularly during times of sugar shortage, and that the jaggery industry is a fierce competitor for sugarcane (Kandan *et al,* 2017).

The roadmap to achieve the higher income by sugarcane farmers is paved by efficient post-production management

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viz. processing and marketing. With changing market scenarios, consumers preferences and competition, jaggery industry provides new income generating opportunities through product diversification as well as in generating employment in the rural sector. This also helps in boosting entrepreneurship and making a farmer self-reliant.

During 2021-22, in Punjab, sugarcane was cultivated in about 86.8 thousand hectares of land (PAU, 2023). A significant proportion of sugarcane produced in State is being utilized in jaggary production units often set up along the road sides in the rural areas. With the increasing demand for jaggery in the market, it is becoming a good supplementary income for farmers and other stakeholders in state. However, concern is raised about the challenges experienced by sugarcane farmers who produce jaggery. In this backdrop, the present study has been taken up to explore and analyze the various facts about production and marketing of jaggery in Punjab State.

## Data Sources and Methodology

The study is based on primary data collected from various stakeholders involved in the jaggery production. A district-wise list of jaggery-making units in Punjab was obtained from the Department of Processing and Food Engineering, Punjab Agricultural University, Ludhiana. Based on this information, two districts, Gurdaspur and Hoshiarpur were selected using the technique of probability proportional to size. Fifteen jaggery producers were selected from each sample district by using simple random sampling technique, thus, the total sample size comprised of 30 jaggery producing units. A well structured schedule was prepared to record the observations from the selected respondents. It comprised general information, cost and cultivation of sugarcane, costs involved in jaggery production and returns from jaggery, constraints in jaggery production were also recorded.

Selected jaggery producers were classified into small, medium and large categories on the bases of their per annum total jaggery production by using cumulative cube root frequency method. Descriptive statistics like frequency, average and percentage were used in summarizing and interpreting the results. Cost and return analysis were conducted to assess the profitability of jaggery production. Benefit-Cost Ratio (BCR) was computed to evaluate the efficiency of investment in jaggery production units.

$$BCR = \frac{\text{Total costs}}{\text{Total returns}}$$

Garrett's ranking technique was employed for the analysis of jaggery production related constraints faced by the respondents. In this technique the ranking given by the sample respondents was converted into mean scores using the (Garrett and Woodworth, 1981) formula as following:

$$\text{Per cent position} = \frac{R_{ij}-0.5}{Nj} \times 100$$

Where,

$R_{ij}$ is rank given for $i^{th}$ constraint by the $j^{th}$ respondent and $N_j$ is total number of constraints ranked by $j^{th}$ respondent.

## Results and Discussion

Jaggery production is a traditional yet efficient process involving several stages of mechanical and manual operations. The journey begins with the extraction of sugarcane, which is harvested, cleaned, and then processed into jaggery through a series of crucial steps. The sugarcane is first crushed to extract the juice, which is then boiled in large open pans to remove impurities and concentrated into a thick syrup. This syrup is further processed to form jaggery blocks by cooling and solidifying. After the jaggery is formed, it is packaged and stored, ready for distribution.

### Cultivation status of sample jaggery producers

The cultivation status of sample jaggery producers reveals that, out of the total 30 jaggery producers, 20 (66.67%) were cultivator-cum-jaggery producers, while, the remaining 10 jaggery producers (33.33%) were non-cultivator jaggery producers (Table 1). Further, majority of cultivator-cum-jaggery producers were of small scale, while non-cultivator jaggery producers were generally medium to large scale jaggery producers. This was due to the fact that cultivators-cum-jaggery producers adopt jaggery production as a subsidiary occupation to farming, while non-cultivator jaggery producers had taken it as primary source of income.

### Land holding details of sample jaggery producer-cum-cultivators

Land holding details of sample cultivator-cum-jaggery producers in Punjab for 2023-24 reveals that the majority of the land used for jaggery production was owned by the producers (Table 2). On average, each sample jaggery producer cum cultivator had 11.25 acres of owned land, which accounted for 94.30 per cent of their total operational land (11.93 acres). In addition, a small proportion of 0.68 acres accounting for 5.70 of the total operational area was leased in. Thus, most cultivator-cum-jaggery producers in Punjab rely heavily on their own land for sugarcane cultivation.

### Farm investment

The farm investment of sample cultivator-cum-jaggery producers indicating the allocation of financial resources across various farm assets has been presented in Table 3. The investment made in tractor, with an average value of Rs. 3,79,250 per farm, accounted for the largest proportion i.e. 35.72 per cent of the total farm investment. Tractor-drawn implements followed with an investment of Rs. 2,11,455, making up 19.92 per cent of the total farm investments. Farm buildings also represented a significant portion of the investment, which accounted for 30.97 per cent (Rs. 3,28,850/farm) of total investments. Other investments included irrigation structures Rs. 1,16,986 (11.02%), other

**Table 1: Cultivation status of jaggery producers, Punjab, 2023-24**

**(No.)**

| Sr. No | Particulars | Category | | | Overall |
|---|---|---|---|---|---|
| | | Small | Medium | Large | |
| A | Cultivator-cum-jaggery producer | 10 (100.00) | 7 (70.00) | 3 (30.00) | 20 (66.67) |
| B | Non-cultivator jaggery producer | - | 3 (30.00) | 7 (70.00) | 10 (33.33) |
| | Total (A+B) | 10 (100.00) | 10 (100.00) | 10 (100.00) | 30 (100.00) |

*Note: Figures in the parentheses are per cent to their respective total*

**Table 2: Land holding details of jaggery producers cum cultivator, Punjab, 2023-24**

| Sr. No | Particulars | Value in Acres/Farm |
|---|---|---|
| A | Owned land | 11.25 (94.30) |
| B | Leased in land | 0.68 (5.70) |
| C | Total operational land (A+B) | 11.93 (100.00) |

*Note: Figures in the parentheses are per cent to total operational area*

machinery Rs. 22,021 (2.07%), and hand tools Rs. 3160 (0.30%). The total per farm investment amounted to Rs. 10,61,722.

**Cropping pattern**

During the Kharif season, sample jaggery producer-cum-cultivators mainly sown sugarcane and paddy crops which accounted for 24.19 per cent and 20.13 per cent of the gross cropped area (Table 4). Basmati (9.96%), maize (2.61%), moong (0.42%), and fodder (4.90%) were the other crops sown in the kharif season. In the rabi season**,** wheat was the major crop (29.56%) followed by rapeseed & mustard (3.08%) and fodder (5.16%). The cropping intensity stood at 160.77 per cent, reflecting the practice of growing more than one crop per year. However, the cropping intensity of sample respondents was less as compared to the cropping intensity of Punjab state (191%), the reason being that about one-fourth of gross cropped area on sample farms was under sugarcane (raw material in jaggery production) which is an annual crop.

**Cost of cultivation of sugarcane**

The item-wise information on cost of cultivation of sugarcane crop on sample farms has been provided in Table 5. The total cost of sugarcane cultivation per acre was Rs. 96,889, with variable costs accounting for 53.64 per cent (Rs. 51,973) and fixed costs making up the remaining 46.36 per cent (Rs. 44,916). Among the variable costs, the largest expenditure was on human labour Rs. 21,263 (21.95%), followed by costs for seed Rs. 9919 (10.24%) and plant

**Table 3: Average farm investment of jaggery producer-cum-cultivator, Punjab, 2023-24**

**(Per farm)**

| Particulars | No. | Value (Rs.) | % Share |
|---|---|---|---|
| Tractor | 0.85 | 379250 | 35.72 |
| Tractor drawn implements | 4.20 | 211455 | 19.92 |
| Other machinery | 3.55 | 22021 | 2.07 |
| Irrigation structure | 2.65 | 116986 | 11.02 |
| Hand tools | 9.23 | 3160 | 0.30 |
| Farm buildings | 2.90 | 328850 | 30.97 |
| Total | | 1061722 | 100.00 |

**Table 4: Cropping pattern and cropping intensity of jaggery producers-cum-cultivators, 2023-24**

**(acres/farm)**

| Sr. No | Particulars | Area |
|---|---|---|
| **A** | **Kharif season** | |
| 1 | Paddy | 3.86 (20.13) |
| 2 | Basmati | 1.91 (9.96) |
| 3 | Maize | 0.50 (2.61) |
| 4 | Sugarcane | 4.64 (24.19) |
| 5 | Moong | 0.08 (0.42) |
| 6 | Fodder | 0.94 (4.90) |
| | **Sub-total** | 11.93 (62.20) |
| **B** | **Rabi season** | |
| 1 | Wheat | 5.67 (29.56) |
| 2 | Rapeseed & mustard | 0.59 (3.08) |
| 3 | Fodder | 0.99 (5.16) |
| | **Sub-total** | 7.25 (37.80) |
| C | Gross cropped area | 19.18 (100.00) |
| D | Net sown area | 11.93 |
| E | Cropping intensity (%) | 160.77 |

*Note: Figures in the parentheses are percentage to the gross cropped area*

protection Rs. 4426 (4.57%). Additionally, tractor usage (both owned and hired) and irrigation costs also contributed significantly to the variable expenses. Among the fixed cost components, the rental value of land was the major contributor with Rs. 40,206 (41.50%), followed by depreciation of farm inventory at Rs. 1778 (1.84%) and interest on farm inventory at Rs. 2932 (3.03%). The sugarcane productivity on sample farms was observed to be 351.71 quintals per acre.

**Sugarcane disposal pattern**

Out of the total per farm sugarcane production of 1,631.93 quintals, a large proportion i.e. 75.34 per cent (1,229.59 q), was used in jaggery making, indicating that sample cultivators had grown sugarcane mainly to meet the raw material needs of their jaggery production units (Table 6). Sugarcane disposed at sugar mills was the second largest disposal, accounting for 262.29 quintals (16.08%), while a small amount 114.50 quintals (7.01%), was retained for own seed. Additionally, 25.55 quintals (1.56%) were consumed at home or given as gratis, etc.

**Post-harvest handling of sugarcane**

The total cost of post-harvest handling of sugarcane involved in jaggery production was Rs. 28.17 per quintal (Table 7). The largest share of this cost i.e. 55.02 per cent (Rs 15.50/q) was attributed to loading. Unloading and transportation costs accounted for 24.64 per cent (Rs. 6.94/q) and 20.34 per cent (Rs. 5.73/q) of the total post-harvesting costs. This cost structure shows that the primary expenditure in the post-harvest process is related to loading, followed by unloading and transportation, emphasizing the importance of these operations in the overall cost of bringing sugarcane

**Table 5: Cost of cultivation of sugarcane of jaggery producer-cum-cultivators, Punjab, 2023-24**

**(Per acre)**

| Sr. No | Particulars | Quantity | Value (Rs.) |
|---|---|---|---|
| **A** | **Variable cost** | | |
| 1 | Seed (q) | 22.04 | 9919 (10.24) |
| 2 | Seed treatment | - | 173 (0.18) |
| 3 | Urea (Kg) | 266.81 | 1602 (1.65) |
| 4 | DAP (Kg) | 99.49 | 2686 (2.77) |
| 5 | FYM (ton) | 3.22 | 1159 (1.20) |
| 6 | Plant protection | - | 4426 (4.57) |
| 7 | Human labour (hrs) | 369.99 | 21263 (21.95) |
| 8 | Owned tractor use (hrs) | 8.8 | 4744 (4.90) |
| 9 | Hired tractor use (hrs) | 1.64 | 2262 (2.33) |
| 10 | Irrigation (no) | 15.1 | 1627 (1.68) |
| 11 | Repair and maintenance cost of farm inventory | - | 355 (0.37) |
| 12 | Interest on variable costs @7% p.a for half crop period | - | 1758 (1.81) |
| | **Total variable cost (1 to 12)** | - | 51973 (53.64) |
| **B** | **Fixed cost** | | |
| 13 | Rental value of land | - | 40206 (41.50) |
| 14 | Depreciation cost pf farm inventory | - | 1778 (1.84) |
| 15 | Interest on Farm inventory @10% p.a | - | 2932 (3.03) |
| | Total fixed cost (13 to 15) | - | 44916 (46.36) |
| C | **Total cost of cultivation (A+B)** | - | 96889 (100.00) |
| D | Main product (q) | 351.71 | |

*Note: Figures in the parentheses are per cent to the total cost of cultivation*

**Table 6: Sugarcane disposal pattern of jaggery producer-cum-cultivators, Punjab, 2023-24**

**(Per farm)**

| Particulars | Quantity (q) |
|---|---|
| Retention for own seed | 114.50<br>(7.01) |
| Sold to sugar mill | 262.29<br>(16.08) |
| Used in jaggery making | 1229.59<br>(75.34) |
| Home consumption, gratis etc | 25.55<br>(1.56) |
| **Total production** | 1631.93<br>(100.00) |

*Note: Figures in the parentheses are per cent to their respective total*

to the jaggery production unit.

**Capital investment for the establishment of jaggery processing unit**

The total investment for setting up a jaggery production unit was Rs. 1,47,659 for small-scale producers, Rs. 2,39,332 for medium-scale producers, and Rs. 4,90,266 for large-scale producers, with an overall average of Rs. 2,92,419 per unit (Table 8). On an average jaggery production unit, the major investment components include the cane crusher (Rs 1,11,450), shed (Rs 61,200) and rental value of land used for establishment (Rs 28,274), which accounted for 38.11 per cent, 20.93 per cent and 9.67 per cent of the total investment respectively. Across categories, cane crusher was the largest investment with proportionate share on small, medium and large categories at 43.38 per cent, 44.00 per cent and 33.66 per cent respectively. A significantly higher share of Rs. 1,36,000 (27.47%) for shed was noticed in large category as compared to other categories because large category producers had build large and permanent sheds of bricks and cement while the small and medium producers used bamboo and straw for the construction of shed.

**Variable costs of jaggery production**

In jaggery production, the total variable costs involved for small, medium, large and overall producers was Rs. 3,95,974, Rs. 11,18,833, Rs. 24,71,342, and Rs. 1,328,716 respectively (Table 9). Amongst variable cost components, on an average jaggery production unit, raw material accounted for the largest share of 74.64 per cent (Rs. 9,91,829) of the total variable cost of jaggery production. Proportionate share on account of use of own cultivated sugarcane use in total variable cost decreased with the increase in scale of production and it accounted for 49.13 per cent, 23.29 per cent and 16.17 per cent of variable cost on small, medium, and large units respectively. Contrarily, the proportion of purchased sugarcane increased as the production size increases. This was due to the reason that jaggery producers who cultivate their own sugarcane were mostly of small size category, while the non-cultivator jaggery producers were of large size category. Other major costs include labour costs and fuel amounted to Rs. 1,59,776 and Rs. 1,15,466 which accounted for 12.02 per cent and 8.66 per cent of variable cost on an average jaggery producing unit respectively.

**Table 7: Post-harvest handling and transportation cost of sugarcane by jaggery producers-cum-cultivators, Punjab, 2023-24**

| Particulars | Rs/quintal |
|---|---|
| Loading | 15.50<br>(55.02) |
| Transportation | 5.73<br>(20.34) |
| Unloading | 6.94<br>(24.64) |
| **Total cost** | 28.17<br>(100.00) |

*Note: Figures in the parentheses are per cent to total*

**Table 8: Capital investment for the establishment of jaggery processing unit by jaggery producers, Punjab, 2023-24**
**(Per jaggery production unit)**

| Sr. no. | Particulars | Jaggery production category | | | | | | Overall | |
|---|---|---|---|---|---|---|---|---|---|
| | | Small | | Medium | | Large | | | |
| | | No | Value (Rs) | No | Value (Rs) | No | Value (Rs) | No | Value (Rs) |
| 1 | Rental value of land (Acres) used for establishment | 0.31 | 21950 (14.87) | 0.52 | 29142 (12.18) | 0.65 | 33730 (6.88) | 0.5 | 28274 (9.67) |
| 2 | Shed | 1 | 22300 (15.10) | 1 | 25300 (10.57) | 1.3 | 136000 (27.74) | 1.1 | 61200 (20.93) |
| 3 | Furnace | 1 | 5370 (3.64) | 1.3 | 11448 (4.78) | 1.7 | 23966 (4.89) | 1.36 | 13595 (4.65) |
| 4 | Electric motor | - | - | - | - | 0.1 | 1500 (0.31) | 0.03 | 500 (0.17) |
| 5 | Cane crusher | 1 | 64050 (43.38) | 1 | 105300 (44.00) | 1 | 165000 (33.66) | 1 | 111450 (38.11) |
| 6 | Diesel engine | 1 | 10703 (7.25) | 1 | 16840 (7.04) | 1 | 21150 (4.31) | 1 | 16231 (5.55) |
| 7 | Pan | 1 | 7350 (4.98) | 1.4 | 24300 (10.15) | 1.8 | 49400 (10.08) | 1.4 | 27017 (9.24) |
| 8 | Juice storage tank | 0.8 | 3214 (2.18) | 1.4 | 12145 (5.07) | 1.6 | 29575 (6.03) | 1.2 | 14978 (5.12) |
| 9 | Iron scrapper | 2.4 | 199 (0.13) | 5.5 | 573 (0.24) | 7.2 | 794 (0.16) | 5.37 | 522 (0.18) |
| 10 | Wooden sticks | 1.1 | 335 (0.23) | 1.4 | 417 (0.17) | 1.8 | 520 (0.11) | 1.43 | 424 (0.14) |
| 11 | Electric fittings | 4.3 | 1178 (0.80) | 6.1 | 1427 (0.60) | 7.9 | 2238 (0.46) | 6.2 | 1614 (0.55) |
| 12 | Plastic pipes (feet) | 32.2 | 772 (0.52) | 45 | 1048 (0.44) | 53.5 | 1394 (0.28) | 43.5 | 1071 (0.37) |
| 13 | Filter plates | 1 | 322 (0.22) | 1.4 | 422 (0.18) | 3.1 | 929 (0.19) | 3.2 | 558 (0.19) |
| 14 | Bucket | 2.9 | 777 (0.53) | 3.2 | 1030 (0.43) | 5.5 | 1804 (0.37) | 4.5 | 1204 (0.41) |
| 15 | Water tank | 1 | 7680 (5.20) | 1 | 7445 (3.11) | 1 | 7830 (1.60) | 1 | 7652 (2.62) |
| 16 | Rack | 1 | 1459 (0.99) | 1.7 | 2495 (1.04) | 3.4 | 14436 (2.94) | 2.4 | 6130 (2.10) |
| | Total | | 147659 (100.00) | | 239332 (100.00) | | 490266 (100.00) | | 292419 (100.00) |

*Note: Figures in the parentheses are per cent to their respective total*

**Table 9: Variable costs incurred for the production of jaggery by jaggery producers, Punjab, 2023-24**

**(Per unit)**

| Sr. no | Particulars | Jaggery production category | | | | | | Overall | |
|---|---|---|---|---|---|---|---|---|---|
| | | Small | | Medium | | Large | | | |
| | | Quantity | Value (Rs) | Quantity | Value (Rs) | Quantity | Value (Rs) | Quantity | Value (Rs) |
| I | Raw material (q) | | | | | | | | |
| 1 | Sugarcane (own cultivation) | 641.72 | 194550 (49.13) | 859.50 | 260575 (23.29) | 1318 | 399578 (16.17) | 940 | 284901 (21.44) |
| 2 | Sugarcane (purchased) | 151 | 59041 (14.91) | 1425 | 557175 (49.80) | 3848 | 1504568 (60.88) | 1808 | 706928 (53.20) |
| | Sub total | 792.72 | 253591 (64.04) | 2284.50 | 817750 (73.09) | 5166 | 1904146 (77.05) | 2748 | 991829 (74.64) |
| II | Chemicals and clarifying agent | | | | | | | | |
| 1 | Sodium bicarbamate (kg) | 20.84 | 1544 (0.39) | 64.38 | 4136 (0.37) | 154.89 | 10874 (0.48) | 80 | 5518 (0.44) |
| 2 | Bhendi powder (kg) | 85.30 | 4436 (1.12) | 197.50 | 12938 (1.16) | 416 | 27862 (1.13) | 233 | 15079 (1.13) |
| 3 | Sarson oil (L) | 10.35 | 946 (0.24) | 25.30 | 2096 (0.19) | 69.45 | 6254 (0.21) | 35 | 3099 (0.21) |
| | Sub total | - | 6926 (1.75) | - | 19170 (1.72) | - | 44990 (1.82) | - | 23695 (1.78) |
| III | Fuel | | | | | | | | |
| 1 | Diesel (lt.) | 158 | 13746 (3.47) | 456 | 39672 (3.31) | 774 | 67338 (2.72) | 463 | 40252 (2.96) |
| 2 | Electricity | - | 4110 (1.04) | - | 4940 (0.44) | - | 10440 (0.42) | - | 6497 (0.49) |
| 3 | Wood dust (qtl) | - | 12398 (3.13) | - | 49712 (4.43) | - | 142941 (5.78) | - | 68350 (5.21) |
| 4 | Straw (qtl) | - | - | - | - | 14 | 1100 (0.04) | 4.67 | 367 (0.03) |
| | Sub total | - | 30254 (7.64) | - | 94324 (8.18) | - | 221819 (8.97) | - | 115466 (8.66) |
| IV | Labour cost (Men days) | 198 | 91516 (23.11) | 355 | 149810 (13.39) | 598 | 238004 (9.63) | 384 | 159776 (12.02) |
| V | Add on ingredients | | | | | | | | |
| 1 | Peanuts (Kg) | 11.61 | 2171 (0.70) | 34.65 | 6514 (0.58) | 76.51 | 13389 (0.42) | 40.92 | 7358 (0.49) |
| 2 | Almonds (Kg) | 7.74 | 6153 (1.55) | 17.32 | 14080 (1.26) | 34.77 | 28616 (1.16) | 19.94 | 16283 (1.23) |
| 3 | Cashew (Kg) | 3.87 | 4733 (1.04) | 13.86 | 16216 (1.45) | 13.91 | 16734 (0.60) | 10.55 | 12561 (0.88) |
| 4 | Fennel (Kg) | 2.50 | 630 (0.16) | 3.46 | 969 (0.09) | 13.91 | 3644 (0.35) | 6.62 | 1747 (0.26) |
| | Sub total | - | 13687 (3.45) | - | 37779 (3.38) | - | 62383 (2.53) | - | 37949 (2.86) |
| **VI** | **Total variable cost (I to V)** | - | 395974 (100.00) | - | 1118833 (100.00) | - | 2471342 (100.00) | - | 1328716 (100.00) |

*Note: Figures in the parentheses are per cent to their respective total*

**Fixed costs of jaggery production**

Total fixed cost involved in a jaggery producing unit was Rs 77,409 (Table10). Component-wise, depreciation of assets (Rs. 29,471), rent on unit premises (Rs. 28,274), followed by repair and maintenance cost (Rs. 16,837) were the major expenses which accounted for 38.07 per cent, 36.53 per cent and 21.75 per cent of the total fixed cost respectively. On small units, the total fixed cost (Rs. 49,197) was significant contributed by rent of unit premises (44.62%), depreciation of assets (26.48%), and repair and maintenance costs (24.44%). Medium units incurred total fixed cost of Rs. 76,206, and the major components were depreciation (35.65%) and rent of premises (38.24%). On large units fixed cost of Rs. 106,823, had the largest share on account of depreciation (45.14%), followed by repair and maintenance (20.13%) and rent (31.58%).

**Total cost of jaggery production**

The total cost incurred by sample jaggery producers for the production of jaggery in Punjab during 2023-24 has been shown in Table 11. Overall, an average jaggery production unit in state incurred Rs 1406125 as total cost which was comprised by variable and fixed costs to the tune of 92.58 and 7.42 per cent respectively. In small units, the total cost was Rs. 4,45,170 per unit, with variable costs accounting for Rs. 3,95,973 (88.88%) and fixed costs making up Rs. 49,197 (11.12%). On per quintal basis, the total cost of jaggery production in small units was Rs. 5003, which comprised of variable costs and fixed costs at Rs. 4450 and Rs. 553 per quintal respectively. In medium size jaggery producing unit, the total cost was Rs. 11,95,039, with a high reliance on variable costs Rs. 11,18,833 (93.62%) and a smaller share of fixed costs Rs. 76,206 (6.32%). Per quintal total cost of jaggery production in these units (Rs. 4552) was comprised of Rs. 4262 and Rs. 290 as variable and fixed cost respectively. The total cost involved in large jaggery production unit was Rs. 25,78,165, with Rs. 24,71,342 (95.84%) of the costs attributed to variable costs and only Rs. 1,06,823 (4.16%) to fixed costs. On per quintal basis, the total cost in large units (Rs. 4170), comprised variable and fixed cost to the

**Table 10: Fixed costs incurred by jaggery producers in production of jaggery, Punjab, 2023-24**

**(Rs/jaggery production unit)**

| Particulars | Category | | | Overall |
|---|---|---|---|---|
| | Small | Medium | Large | |
| Rent of unit premises | 21950 (44.62) | 29142 (38.24) | 33730 (31.58) | 28274 (36.53) |
| Interest on fixed costs @10% p.a | 2195 (4.46) | 2914 (3.82) | 3373 (3.16) | 2827 (3.65) |
| Depreciation of assets | 13027 (26.48) | 27170 (35.65) | 48215 (45.14) | 29471 (38.07) |
| Repair and maintenance cost | 12025 (24.44) | 16980 (22.28) | 21505 (20.13) | 16837 (21.75) |
| **Total cost** | 49197 (100.00) | 76206 (100.00) | 106823 (100.00) | 77409 (100.00) |

*Note: Figures in the parentheses are per cent to their respective total*

**Table 11. Total cost incurred by jaggery producers for the production of jaggery, Punjab, 2023-24**

**(Rs)**

| Sr. no | Particulars | Category | | | | | | Overall | |
|---|---|---|---|---|---|---|---|---|---|
| | | Small | | Medium | | Large | | | |
| | | Per unit | Per quintal | Per unit | Per quintal | Per unit | Per quintal | Per unit | Per quintal |
| 1 | Variable costs | 395973 (88.88) | 4450 | 1118833 (93.62) | 4262 | 2471342 (95.84) | 3997 | 1328716 (92.58) | 4236 |
| 2 | Fixed cost | 49197 (11.12) | 553 | 76206 (6.32) | 290 | 106823 (4.16) | 173 | 77409 (7.42) | 338 |
| | Total cost | 445170 (100.00) | 5003 | 1195039 (100.00) | 4552 | 2578165 (100.00) | 4170 | 1406125 (100.00) | 4574 |

*Note: Figures in the parentheses are per cent to their respective total*

**Table 12: Returns from jaggery production in Punjab, 2023-24**

**(Rs/ unit)**

| Sr. no | Particulars | Small | Medium | Large | Overall |
|---|---|---|---|---|---|
| A | Total fixed cost | 49197 | 76206 | 106823 | 77406 |
| B | Total variable cost | 395973 | 1118833 | 2471342 | 1328716 |
| C | Total cost | 445170 | 1195039 | 2578165 | 1406122 |
| D | Total returns | 581386 | 1701080 | 3936171 | 2079464 |
| E | Net returns (D-C) | 136216 | 506041 | 1358006 | 673342 |
| F | BC Ratio | 1.31 | 1.42 | 1.53 | 1.48 |

tune of Rs. 3997 and Rs. 173 respectively.

**Returns from jaggery production**

The results revealed that jaggery production is a profitable venture; however, large producers benefit more due to economies of scale, leading to higher relative returns and better cost efficiency (Table 12). Per unit annual net returns from jaggery output increased with the scale of production, with large-scale producers earning the highest net returns of Rs. 13,58,006 followed by medium scale producers (Rs. 5,06,041) and small scale producers ( Rs. 1,36,216). Benefit-cost ratio (BCR) on small, medium and large jaggery production units computed at 1.31, 1.42 and 1.53 respectively indicated that larger scale operations were more efficient and yield better returns in comparison to their small size counterparts. Overall, the jaggery production in state yielded a BCR of 1.48.

**Disposal pattern of jaggery**

Overall jaggery producers in Punjab, the marketed surplus accounted for 98.91 per cent of total per unit production of 323.27 quintals of the jaggery (Table 13). Category-wise, marketed surplus accounted for 97.55 per cent, 98.53 per cent and 99.27 per cent of total jaggery production by small, medium and large size jaggery producers respectively. A small proportion of the production was retained for home consumption (ranging from 0.08% on large to 0.44% on small), give as kind payments to workers (0.06% on large to 0.31% on small), and gifted to relatives/friends (0.06% on large to 0.39% on small). Spoilage accounted for 1.30 per cent, 0.50 per cent and 0.53 per cent of the total jaggery production of small, medium and large size jaggery producers.

**Constraints faced by sample jaggery producers**

The key challenges faced by jaggery producers were primarily centered around quality inconsistency, financial constraints and labour unavailability. The most significant issue was the lack of uniformity in the quality of jaggery with 60 per cent of producers experiencing this as a high-level

**Table 13: Disposal pattern of jaggery by jaggery producers, Punjab, 2023-24**

**(q/ unit)**

| Sr. no | Particulars | Category | | | Overall |
|---|---|---|---|---|---|
| | | Small | Medium | Large | |
| I | Total production | 88.98 (100.00) | 262.54 (100.00) | 618.31 (100.00) | 323.27 (100.00) |
| II | Retention | | | | |
| 1 | Home consumption | 0.39 (0.44) | 0.44 (0.17) | 0.47 (0.08) | 0.45 (0.14) |
| 2 | Kind payment to workers | 0.28 (0.31) | 0.31 (0.12) | 0.4 (0.06) | 0.33 (0.10) |
| 3 | Given to relatives / friends | 0.35 (0.39) | 0.39 (0.15) | 0.38 (0.06) | 0.35 (0.11) |
| III | Spoilage | 1.16 (1.30) | 1.3 (0.50) | 3.28 (0.53) | 2.38 (0.74) |
| IV | Marketed surplus (I-II-III) | 86.80 (97.55) | 258.68 (98.53) | 613.78 (99.27) | 319.76 (98.91) |

*Note: Figures in the parentheses are per cent to their respective total*

**Table 14: Production related constraints faced by jaggery producers, Punjab, 2023-24**

| Problem | %age of jaggery producers facing different level of problem | | | | Mean score | Rank |
|---|---|---|---|---|---|---|
| | No | Low | Medium | High | | |
| Lack of uniformity in quality of jaggery | - | 10.00 | 30.00 | 60.00 | 83.00 | 1 |
| High rate of interest on credit | - | 23.33 | 50.00 | 26.67 | 79.00 | 2 |
| Unavailability of skilled labour | - | 16.67 | 46.67 | 36.67 | 78.50 | 3 |
| Lack of jaggery producer's associations | - | 26.67 | 53.33 | 20.00 | 75.50 | 4 |
| High initial investment cost | 26.67 | 63.33 | 10.00 | - | 69.50 | 5 |
| High maintenance cost | 73.33 | 26.67 | - | - | 66.50 | 6 |
| Seasonality in jaggery production | 86.67 | 13.33 | - | - | 63.75 | 7 |

constraint ranked 1 with mean score of 83.00 (Table 14). High interest rates on credit with mean score of 79.00(ranked 2) also posed a significant challenge, as 26.67 per cent of producers perceived it a high level problem. Another major concern was the unavailability of skilled labour Ranked 3 with mean score of 78.50 with 36.67 per cent of producers perceiving it a high level challenge. Additionally, lack of jaggery producer's associations (Ranked 4) was also perceived as medium to high level challenge by about 53 per cent and 20 per cent respondents respectively. Other issues faced by produces, though of low importance included high initial investment costs, high maintenance costs and seasonality in jaggery production.

## Conclusions and Policy Implications

The study highlights the economic viability of jaggery production, showing that it plays a crucial role in the disposal of sugarcane and provides a profitable outlet for farmers. The total cultivation cost of sugarcane was Rs. 97,774 per acre, with a yield of 351.7 quintals, out of this, 75.34 per cent was used for jaggery production. The overall capital investment in a jaggery production unit was Rs. 2,92,419, with major expenses on equipment like the cane crusher (Rs. 1,11,450). The overall benefit-cost ratio was 1.48, with large-scale producers achieving a ratio of 1.53, medium-scale at 1.42, and small-scale producers at 1.31 indicating significant scale economies in jiggery production. Annual net returns on average jaggery production unit in state at Rs. 6,73,332 indicated the profitability and the potential for growth and sustainability in the jaggery production sector. Jaggery producers face challenges such as quality inconsistency, high interest rates on credit, and a shortage of skilled labour. Other issues include the lack of producer associations, high initial and maintenance costs, and the seasonality of production. Addressing these constraints is crucial for improving the sustainability and growth of this industry in the state.

## References

Punjab Agricultural University (PAU) 2023. Package of practices for kharif crops of Punjab. Pp. 69 Punjab Agricultural University, Ludhiana. https://paup.bestbookbuddies.com/bib/196741.

Kandan S M, Ajmal M P, Vilas S V and Singh G 2017. A study on jaggery production export status and doubling farmer income in potential district of Maharashtra. *Indian Journal of Economics and Development* **13:** 531-35. DOI: 10.5958/2322-0430.2017.00126.3

Mohan N and Agarwal A 2020. New ventures of value-addition in jaggery processing for a dynamic sugar industry. *International Journal Engineering Research and Technology* **9:** 291-94. DOI : 10.17577/IJERTV9IS010179.

Nath A, Dutta D, Kumar P and Singh JP 2015. Review on recent advances in value addition of jaggery-based products. *Journal of Food Processing and Technology* **6:** 1-4. DOI: 10.4172/2157-7110.1000440.

Savant N K, Korndörfer G H, Datnoff L E and Snyder G H 1999. Silicon nutrition and sugarcane production: A review. *Journal of Plant Nutrition* **22:**1853-1903. https://www.tandfonline.com/doi/abs/10.1080/01904169909365761.

Singh P, Bhatnagar A, Singh M M and Singh A 2019. Validation of elite sugarcane varieties for quality jaggery production in subtropical India. *Sugar Tech* **21:**682-85. DOI: 10.1007/s12355-018-0647-6.

Solomon S 2016. Sugarcane production and development of sugar industry in India. *Sugar Tech* **18:**588-602. DOI: 10.1007/s12355-016-0494-2

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