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ECONOMIC ANALYSIS OF DATE PALM SAP AND JAGGERY PRODUCTION IN NADIA DISTRICT OF WEST BENGAL INDIA

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ABSTRACT

The domestic value of date palm jaggery is very high. It can be grown easily in waste lands, road side and house boundaries. Thus, this industry shows its requirement towards lower investment. This industry holds the probability of generating high economic profits by increasing the area under cultivation and growing high sap yielding varieties, which will eventually increase the income generation. The Nakashipara block of Nadia district has many people involved in the date palm jaggery industry, either in sap collection or in jaggery processing or in both. The present study has been conducted with the objectives to work out the cost of production of date palm sap (date palm juice) and date palm jaggeries. All the required data for the study have been collected by following the survey method. A cluster of two villages, Bilwagram and Birpur were purposively selected from Nakashipara block, Nadia, West Bengal to conduct the survey. From two villages 50 sap collectors cum processors were randomly selected with the help of Simple Random Sampling without Replacement Method (SRSWOR). It has been found that the cost of production of date palm sap in Bilwagram village is low compared to Birpur village and labour cost comprises the highest percentage (93.86) of the total cost. Higher profit and B/C ratio of 2.45 has been found in Bilwagram village. It is also observed that total average sale proceeds in a month of Rs.19590 with a profit of Rs.11118.5 and B/C ratio of 2.31 (Birpur and Bilwagram village). From the analysis of date palm jaggeries, highest cost of production of date palm jaggeries has been observed in Bilwagram village, where labour and fuel cost comprise the highest share. Higher profit and B/C ratio were found in case of Bilwagram village.

Keywords : Agro-based industry, Benefit–cost ratio, Date palm jaggery, Income generation, Sap production, Value addition.

Introduction

Gur (also known as "jaggery") is a natural, traditional sweetener that is produced by concentrating date palm and sugarcane juice, is known all over the India (FAO, 2002). Jaggery is the largest producer and consumer in India. More than 70% of the world's production is generated in India (Jagannadha Rao *et al.*, 2007). Of the 300 Mt of sugarcane produced in India, 53% is converted into white sugar, 36% into jaggery and khandsari, 3% into cane juice for chewing, and 8% into seed cane (Singh *et al.*, 2011).

Jaggery holds a place in India's diet and economy that goes well beyond that of a simple sweetener. It has been consumed on the subcontinent for over 3,000 years, historically valued not only for its taste but for its role in traditional and Ayurvedic medicine, where it is believed to aid digestion and detoxification. Unlike centrifugal white sugar, which is refined to near-pure sucrose, jaggery retains much of the mineral and micronutrient content of the parent juice, which has renewed scientific interest in it as a "healthier" natural sweetener in recent years. Economically, jaggery production remains largely decentralised and rural, sustaining the livelihoods of millions of small and

marginal sugarcane and palm growers who lack access to capital-intensive sugar mills, making it an important source of value addition and employment in the rural non-farm economy.

The palm (family *Palmae* or *Arecaceae*) includes 30 different palm species that are traditionally harvested in tropical regions of the world and is one of the most significant horticulture crops in many countries (McCurrach, 1960; Kamal, 1969; Dalibard, 2007). Bangladesh, which is located in a tropical area, is also home to a variety of palm trees that range in topography from steep to flat to muddy mangrove forests (Hussain, 2001). At least five exotic species are planted as avenue or garden plants in Bangladesh, while at least 20 kinds of palms naturally grow (Pasha, 2003). The date palm is also revered in the Christian and Jewish faiths and has ties to many religious rituals, including Passover and Palm Sunday (Musselman, 2007). Other than sugar production, the palm is also widely used for some other purposes such as mat making, fencing, animal feed and soil amendment (FAO, 2007).

Jaggery is produced in different forms viz., solid, liquid and powder or granular forms, which are described as (Nath *et al.*, 2015). The acceptable taste and nutritive value of jaggery have attracted man since ancient times. Jaggery is also called "Non-Centrifugal Sugar" or Artisan Sugar (Srilakshmi, 2003). It forms an important item of Indian diet for its high nutritive value and as a sweetening agent. White sugar contains only sucrose (99.70%), whereas jaggery has sucrose (51.00%), protein (0.25%), glucose (21.20%) and minerals (3.40%) in addition to traces of fats (0.02 to 0.03%), calcium (0.39%), vitamin A, vitamin B, Phosphate (0.025%) and provides energy 383 kcal/100gm jaggery (Srilakshmi, 2003).

Table 1: Nutritional and Medicinal Value of Jaggery.

Nutrients	Value
Protein (gm)	0.65
Energy (Kcal)	383
Potassium (mg)	805.5
Vitamin B Complex (mg)	0.94
Fat (gm)	0.48
Calcium (mg)	1167.42
Dietary Fibre (%)	0.28

(Source: Srilakshmi, 2003)

Materials and Methods

West Bengal was purposively selected as the study area for the present research. Within the state, Nadia district was purposively chosen owing to the substantial concentration of date palm sap collectors-

cum-processors engaged in this traditional occupation. The district lies between 22°53' and 24°11' N latitude and between 88°09' and 88°48' E longitude, and its soil is classified as Gangetic alluvium with a light texture, conditions favourable to the cultivation of date palm. Within Nadia district, Nakashipara block was purposively selected as a substantial proportion of the local population derives its livelihood from the date palm jaggery industry. Two villages, Bilwagram and Birpur, were purposively selected from Nakashipara block, from which 50 sap collectors-cum-processors were randomly selected to constitute the sample for the study.

The data collected were analysed using simple statistical tools, including averages and percentages, to summarize and interpret the results meaningfully. All computations were carried out using Microsoft Excel and Stata software.

Net gains from date palm jaggery production were estimated using the following relationship:

$$K = TVP - (FC + VC)$$

where K denotes net gains, TVP is the total value of product, FC is the annual fixed cost, and VC is the annual variable cost, including the cost of raw material.

The following set of data was collected from the 50 sample respondents: total labour cost (Rs./month), cost of clay pots (Rs.), cost of fuel (Rs./month), cost of preparing *baan* (Rs.), rent for trees (Rs./month), conveyance charge (Rs./month), total packing charge (Rs./month), cost of hired labour (Rs./month), total expenditure (Rs./month), total quantity of date palm sap (litres) and jaggery (kg) produced, market rate of date palm sap (Rs./litre) and jaggery (Rs./kg), total return (Rs./month), total profit (Rs./month), and the benefit-cost (B/C) ratio.

Results and Discussions

Cost of Production of Date Palm Sap (Monthly Account)

In this section of the study, various cost items related to the total cost of production of date palm sap are studied, which include cost of labour and cost of miscellaneous expenditure. These are out-of-pocket expenses. Table 2 presents the average cost of sap production for twenty-five respondents each from Birpur and Bilwagram villages, along with the combined average across both villages. Labour cost comprises the dominant share of total cost in both villages which are 93.86 per cent in Birpur and 94.11 per cent in Bilwagram with miscellaneous expenditure accounting for the remainder. The combined average total cost of sap production across both villages stands

at Rs. 8471.50 per month, of which 93.99 per cent is attributable to labour.

Table 2: Cost of Production of Date Palm Sap (Monthly Account) (Rs. /month).

Cost Items	Birpur village	Bilwagram village	Combined (Birpur & Bilwagram)
Labour Cost (Rs. /month)	8190.00 (93.86%)	7734.00 (94.11%)	7962.00 (93.99%)
Misc. Expenditure (Rs. /month)	535.20 (6.13%)	483.80 (5.88%)	509.50 (6.01%)
Total Cost (Rs. /month)	8725.20 (100%)	8217.80 (100%)	8471.50 (100%)

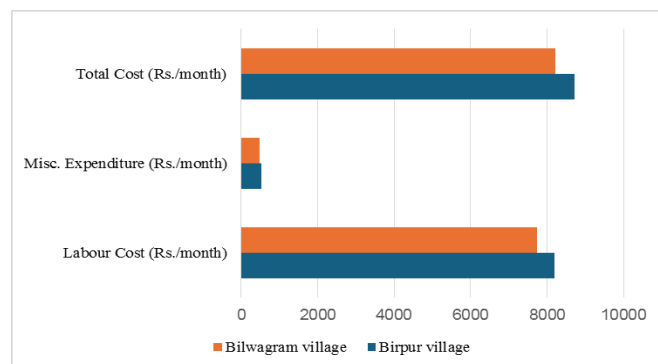


Fig. 1: Comparison of the Monthly Cost of Production of Date Palm Jaggery in Birpur and Bilwagram Villages.

Production, Rate and Value of Date Palm Sap:

Table 3 presents the monthly production, sale rate, return, profit and B/C ratio for date palm sap in both villages. On average, sap collectors in Birpur produced 856.80 litres per month, sold at Rs. 22.16 per litre, yielding a profit of Rs. 10,246.80 and a B/C ratio of 2.17. Bilwagram recorded a marginally higher output (868.80 l/month) at a better price (Rs. 23.36/l), translating into a higher profit of Rs. 11,990.20 and a superior B/C ratio of 2.45. The combined B/C ratio of 2.31 across both villages confirms the strong economic viability of date palm sap collection as an income-generating activity.

Table 3: Production, Rate and Value of Date Palm Sap (Monthly Account).

Particulars	Birpur village	Bilwagram village	Combined (Birpur & Bilwagram)
Qty. of Production (l/month)	856.80	868.80	862.80
Rate (Rs. /l)	22.16	23.36	22.76
Total Return (Rs. /month)	18972.00	20208.00	19590.00
Profit (Rs. /month)	10246.80	11990.20	11118.50
B/C Ratio	2.17	2.45	2.31

Cost of Production of Date Palm Jaggery (Monthly Account):

Having examined the cost structure of sap production, the cost of producing date palm jaggery

was analysed for the same 50 respondents (25 each from Birpur and Bilwagram). Table 4 details the break-up of costs of labour, clay pots, fuel, baan, rent for trees, conveyance, packing, and hired labour. Labour cost is again the single largest cost component in both villages (39.64% in Birpur, 39.97% in Bilwagram), followed closely by fuel cost (31.35% and 31.86%, respectively), reflecting the energy and labour-intensive nature of jaggery processing relative to sap collection alone.

Table 4: Cost of Production of Date Palm Jaggery (Monthly Account) (Rs. /month).

Cost Items	Birpur village	Bilwagram village	Combined (Birpur & Bilwagram)
Labour cost (Rs. /month)	7259.48 (39.64%)	8808.00 (39.97%)	8033.74 (40.55%)
Clay pot (Rs.)	907.80 (4.95%)	1005.60 (4.56%)	956.70 (4.82%)
Fuel (Rs. /month)	5742.80 (31.35%)	7020.20 (31.86%)	6431.50 (32.46%)
Baan (Rs.)	592.00 (3.23%)	727.60 (3.30%)	659.80 (3.33%)
Rent for trees (Rs./month)	1908.48 (10.42%)	2380.08 (10.80%)	2144.28 (10.82%)
Conveyance (Rs. /month)	1290.92 (7.04%)	1337.40 (6.07%)	1364.16 (6.88%)
Packing (Rs./month)	305.68 (1.66%)	398.00 (1.80%)	295.00 (1.48%)
Helping hand (Rs. /month)	307.00 (1.67%)	355.52 (1.61%)	288.10 (1.45%)
Total Cost (Rs. /month)	18313.24 (100%)	22032.40 (100%)	19811.20 (100%)

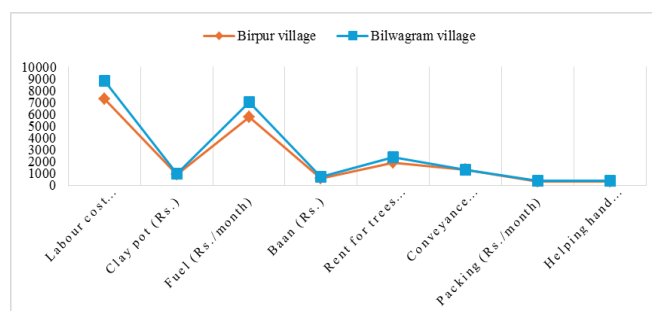


Fig. 2: Comparison of the Cost of Production of Date Palm Jaggery in Birpur and Bilwagram Villages.

Production, Rate and Value of Date Palm Jaggery

Table 5 presents the monthly production, sale rate, return, profit, and B/C ratio for jaggery in both villages. Bilwagram outperforms Birpur on all counts including higher output (301.98 kg/month vs. 290.20 kg/month), a better sale price (Rs. 123.40/kg vs. Rs. 96.20/kg), a higher profit (Rs. 14,669.12 vs. Rs. 9,116.40), and a superior B/C ratio (1.64 vs. 1.56). The combined B/C ratio of 1.60 confirms that jaggery processing remains a profitable value-addition activity

for rural households in the study area, notwithstanding its higher input costs relative to sap collection.

Table 5: Production, Rate and Value of Date Palm Jaggery (Monthly Account).

Particulars	Birpur village	Bilwagram village	Combined (Birpur & Bilwagram)
Qty. of Production (kg/month)	290.20	301.98	296.09
Rate (Rs. /kg)	96.20	123.40	109.80
Total Return (Rs. /month)	27512.20	36248.88	31880.54
Profit (Rs. /month)	9116.40	14669.12	11892.76
B/C Ratio	1.56	1.64	1.60

Conclusion

The present study provides a comprehensive economic assessment of date palm sap and jaggery production in Nadia district of West Bengal, with specific reference to Birpur and Bilwagram villages of Nakashipara block. The findings clearly establish that date palm-based enterprises are economically viable, low-investment, and income-generating activities for rural households.

The analysis of date palm sap production reveals that labour cost is the most dominant component of total cost, accounting for more than 93 per cent in both villages. Despite this high labour share, sap production remains highly profitable. Bilwagram village performs better than Birpur village in terms of lower cost of production, higher market price, greater profit, and a superior B/C ratio (2.45 compared to 2.17). On an overall basis, the combined B/C ratio of 2.31 indicates strong economic feasibility of sap extraction activities. This confirms that traditional sap collection, when supported by favourable prices and efficient labour use, can substantially enhance rural income.

The date palm jaggery production analysis also shows encouraging results. Although jaggery production involves higher total costs due to additional inputs such as fuel, clay pots, rent for trees, and transportation, it still generates significant net returns. Labour and fuel together account for nearly 70 per cent of the total cost, highlighting the energy- and labour-intensive nature of jaggery processing. Bilwagram village again outperforms Birpur village, with higher output, better price realization, greater profit, and a higher B/C ratio (1.64 against 1.56). The overall B/C ratio of 1.60 for both villages confirms that jaggery production is a profitable value-addition activity.

The study further reinforces the importance of date palm jaggery as a nutritious and traditional

sweetener, offering both economic and nutritional advantages over refined sugar. Its rich mineral content and role in traditional diets strengthen its market demand, especially in rural and semi-urban areas (Shrilakshmi, 2006; Nath *et al.*, 2015). The results align with earlier studies highlighting India's dominant role in jaggery production and consumption, and the potential of non-centrifugal sugar industries in supporting rural livelihoods (FAO, 2002).

In conclusion, the date palm sap and jaggery industry in Nadia district demonstrates strong economic potential with relatively low capital requirements. Expansion of date palm cultivation, adoption of improved planting material, efficient processing practices, and strengthened marketing infrastructure can substantially enhance profitability and sustainability of traditional palm-based enterprises. Evidence suggests that technological interventions, value addition, and institutional support are critical for improving rural livelihoods and employment generation in horticulture-based systems (FAO, 2017; Singh *et al.*, 2022).

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