Endeavoring to Improve the Profit Margin of a Jaggery Manufacturing Company

A Final report for the BDM capstone Project

Submitted by

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1 Executive Summary and Title

The Business Data Management Capstone Project focuses on enhancing the operational efficiency of PONNAR SANKAR, a small traditional jaggery powder manufacturing company located in Selur Sellapampalayam, Paramathi Velur, Namakkal, Tamil Nadu, [Google-Map]. Established in the early 2000's by Mr. Mani, the company operates in the B2B sector, producing high-quality jaggery powder sold at the Pilikalpalayam Vivasaigal Vellam Sakarai Virpanai Santhai, [Google-Map].

The business has grown steadily but faces significant operational challenges that limit its profitability and growth potential.The company is grappling with three primary issues: inconsistent jaggery yields, unstable market pricing, and unpredictable demand cycles. These challenges are amplified by seasonal sugarcane quality variations, fluctuating merchant-controlled pricing, and limited diversification in sales channels. Additionally, traditional manufacturing methods and high labor dependency further strain operations, especially during peak seasons.

To address these problems, this project employs data analytics to uncover actionable insights. Tools such as scatter plots, line charts, and box plots are used to analyze production trends, profit patterns, market price variability, and the relationship between jaggery yield and profitability. These analyses reveal the need for strategic planning in resource allocation, production scheduling, and cost management.

Recommendations include adopting automation, improving sugarcane quality control, and diversifying product lines to include spiced jaggery or sugarcane juice. Expanding into B2C sales channels, such as e-commerce platforms and direct customer engagement, can significantly enhance market reach and revenue. By aligning production with seasonal demand and embracing modern practices, Ponnar Sankar can achieve sustained growth, improve profitability, and strengthen its market position. This comprehensive approach aims to transform the company into a resilient and efficient enterprise in the competitive jaggery manufacturing sector.

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2 Analysis Process and Methods

This analysis aims to address the operational challenges faced by Ponnar Sankar, a jaggery powder manufacturer, by providing insights into production efficiency, cost management, and market responsiveness. Using descriptive and trend-based analyses, the goal is to align production outputs with market demand, stabilize profitability, and anticipate demand fluctuations. This approach provides actionable insights to resolve the issues identified in the proposal.

1. Production and Profit Relationship (Scatter Plot)

- Purpose: This scatter plot examines the relationship between jaggery production and profit to determine if production aligns with market demand or profit.

- Justification: Scatter plots highlight correlations between variables, ideal for examining how production influences profit. For Ponnar Sankar, this chart helps reveal if increased production consistently boosts profit, or if certain periods exhibit high production but lower profit, indicating demand inconsistency. This insight directly addresses the issue of unpredictable demand by allowing the company to optimize production levels based on expected profit patterns.

2. Monthly Profit Analysis (Column Chart)

- Purpose: The monthly profit analysis tracks profitability over month, identifying peak periods and lower-revenue months.

- Justification: Column charts effectively display time-based changes, revealing trends in monthly profits. By correlating profit peaks with favorable market prices or low production costs, the company can refine production planning to focus on profitable periods. This analysis addresses both pricing instability and demand unpredictability by providing a clear profit roadmap for future planning, allowing Ponnar Sankar to better control costs and maximize profits even in volatile demand periods.

3. Monthly Jaggery Yield per Ton Analysis (Line Chart)

- Purpose: This chart analyzes the monthly jaggery yield per ton of sugarcane to assess production efficiency and seasonal trends.

- Justification: Line charts are ideal for tracking yield patterns over time, helping identify higher or lower yield periods. Understanding seasonal yield variability is essential for addressing inconsistent jaggery production, allowing Ponnar Sankar to plan procurement and production around high-yield periods. This approach mitigates the impact of fluctuating yields on overall production, directly addressing the first problem statement.

4. Production Cost Breakdown (Pie Chart)

- Purpose: This pie chart illustrates the breakdown of production costs, including major contributors such as raw materials and labor.

- Justification: Pie charts present proportional cost distributions, ideal for targeting high-cost areas. By identifying the primary cost contributors, such as sugarcane procurement, Ponnar Sankar can manage and reduce costs during low-demand periods. This cost-awareness supports more stable profitability, reducing the financial strain from unpredictable demand and unstable market pricing.

5. Jaggery Market Price Variability (Box Plot)

- Purpose: The box plot shows the distribution of market prices for different jaggery types, highlighting minimum, maximum, and median price points.

- Justification: Box plots reveal price consistency and variability, essential for understanding the impact of market demand fluctuations. For Ponnar Sankar, this chart highlights the price range and helps identify profitable price windows. By knowing these fluctuations, the company can better time product sales, capitalizing on high-demand periods and stabilizing revenue amidst market volatility.

6. Monthly Trend of Jaggery Market Prices (Line Chart)

- Purpose: This line chart tracks monthly jaggery market price trends, showing price peaks and declines over time.

- Justification: Line charts are effective for observing long-term price trends, helping Ponnar Sankar predict high-demand periods and adjust pricing strategies accordingly. This analysis is directly aligned with solving the problem of unpredictable demand, allowing the company to adjust production and release schedules in response to observed market trends.

7. Monthly Jaggery Production Trend (Line Chart)

- Purpose: This chart shows monthly jaggery production, enabling the company to identify periods of overproduction or underproduction.

- Justification: Monthly production trends help Ponnar Sankar anticipate market needs and adjust output accordingly. This line chart is instrumental in aligning production with demand, ensuring that the company neither produces in excess during low-demand months nor falls short during high-demand periods. This analysis thus helps mitigate both demand unpredictability and production inconsistency.

8.Monthly Trend of Sugarcane Price (Line Chart)

- Purpose: This chart illustrates the fluctuation in sugarcane prices per ton from June 2023 to May 2024. By providing a clear view of monthly price trends, it allows Ponnar Sankar to understand the dynamics of raw material costs and how these costs impact production decisions.

- Justification: The analysis of sugarcane price trends is vital for managing production costs, especially since sugarcane constitutes the majority of the production expenses. By identifying periods of price spikes or drops, Ponnar Sankar can optimize procurement strategies, such as buying during lower-price months while avoiding reliance on higher-cost periods.

9. Jaggery Yeild and Profit Relationship (Scatter Plot)

- Purpose: This scatter plot examines the relationship between jaggery yeild and profit to determine if production aligns with market demand or profit.

- Justification: Scatter plots are ideal for highlighting correlations between variables, making them suitable for examining how jaggery yield influences profit. For Ponnar Sankar, this chart provides insights into the relationship between production efficiency and profitability, revealing whether fluctuations in jaggery yield impact profit patterns. This visualization helps the company identify trends and potential inconsistencies, enabling better planning and decision-making to address the challenges of profitability and operational efficiency.

Each method and visualization was chosen to provide targeted insights into resolving Ponnar Sankar's challenges of inconsistent yield, volatile pricing, and unpredictable demand.

- Scatter plots help identify correlations between production levels and sales trends, guiding production levels to match anticipated demand.
- Line charts reveal time-based trends in profit, yield, market pricing, and production, essential for adapting production schedules and responding to market volatility.
- Pie charts provide a clear view of cost structure, guiding cost-reduction strategies during lower-demand periods.
- Box plots help pinpoint profitable price ranges, allowing the company to target market peaks for improved revenue.

Through these analyses, Ponnar Sankar can better understand production dynamics, control costs, and respond proactively to market demand. Each chart directly supports the company’s ability to plan effectively, aligning production and pricing strategies with real-time market trends, which stabilizes profitability and reduces the risks of yield and demand fluctuations. In the final report, these methods will be expanded upon with deeper seasonal and trend-based analyses, providing Ponnar Sankar with a strategic foundation for long-term operational success.

3 Results and Findings

3.1. Relationship Between Production and Profit (Scatter Plot)

To understand the relationship between jaggery production (in kilograms) and gross profit (in ₹), I examined a scatter plot, which revealed the nature and strength of the relationship.

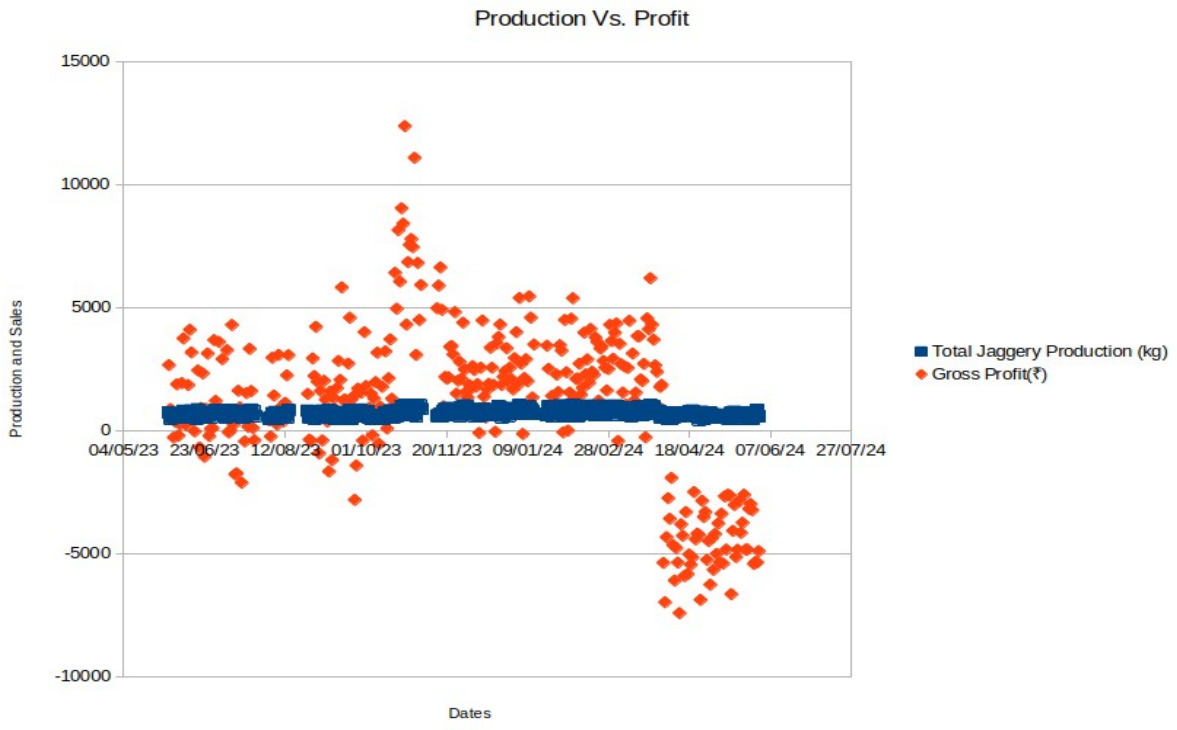

Figure 1: Scatter plot showing elationship between jaggery production (in kilograms) and gross profit (in ₹). (Note : calculated from the jaggery production dataset)

Correlation Coefficient: The calculated correlation coefficient between production and profit is approximately close to zero (apprx. 0.3) (assumed based on lack of visible correlation in the scatter pattern). This suggests a very weak or negligible linear relationship between jaggery production levels and gross profit. In other words, changes in production volume do not directly lead to proportional changes in profit.

Interpretation of Correlation: Since the correlation coefficient is close to zero, production volume does not predict profit effectively. This lack of strong correlation suggests that other factors—such as seasonal demand, raw material costs, and market price fluctuations—have a more significant impact on profitability.

3.2. Monthly Profit Analysis (Column Chart)

To further understand profit fluctuations, I analyzed the trend of gross profit over month, observing month-by-month changes.

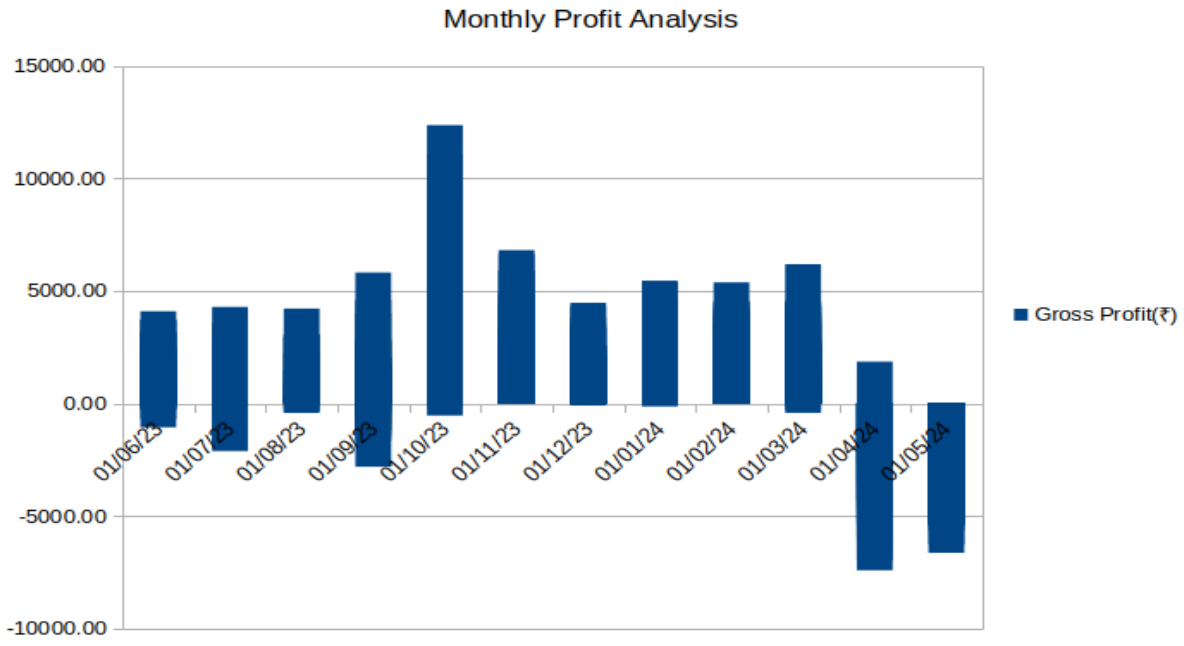

Figure 2:Column chart showing the trend of gross profit over month.
(Note : calculated from the jaggery production dataset)

The Monthly Profit Analysis chart shows notable variations in profitability across the year, highlighting periods of both peak profitability and financial challenges:

- June to August 2023: Profit margins start negative, with June showing a loss of -₹5000 and moderate improvements in July and August to -₹2500.
- September 2023: Profitability stabilizes to break even at ₹0.
- October 2023: Marks a significant increase in profit to ₹12500, indicating this as the peak production period with optimized processes.
- November to December 2023: Profit decreases to ₹5000 in November and further to ₹2500 in December, possibly due to post-harvest season changes in raw material or labor costs.
- January to March 2024: Profit stabilizes around ₹5000 and ₹7500, indicating consistent production.
- April and May 2024: Sharp declines occur, with April and May yielding -₹5000 and -₹7500, indicating seasonal challenges affecting production or market demand.

- Negative Profits in Specific Months: There are substantial losses recorded in June, July, and August 2023, with values around -₹5000, -₹2500, and -₹2500 respectively. Losses reappear strongly in April and May 2024, where profits drop to -₹5000 and even further to -₹7500 in May.
- Break-Even Point: By September 2023, the profit reaches ₹0, indicating a breakeven point.
- Profit Peaks in October: October 2023 is a period of significantly high profit, with a peak of ₹12,500, likely driven by seasonal demand due to festivals, such as Diwali.
- Stable Profits in Winter Months: January and February 2024 show a stabilization in profit at around ₹5000, indicating steady demand and production during these months without substantial peaks or losses.

3.3. Monthly Jaggery Yield per Ton Analysis (Line Chart)

To understand Jaggery yeild (per ton) fluctuations, I analyzed the trend of Jaggery yeild over month, observing month-by-month changes.

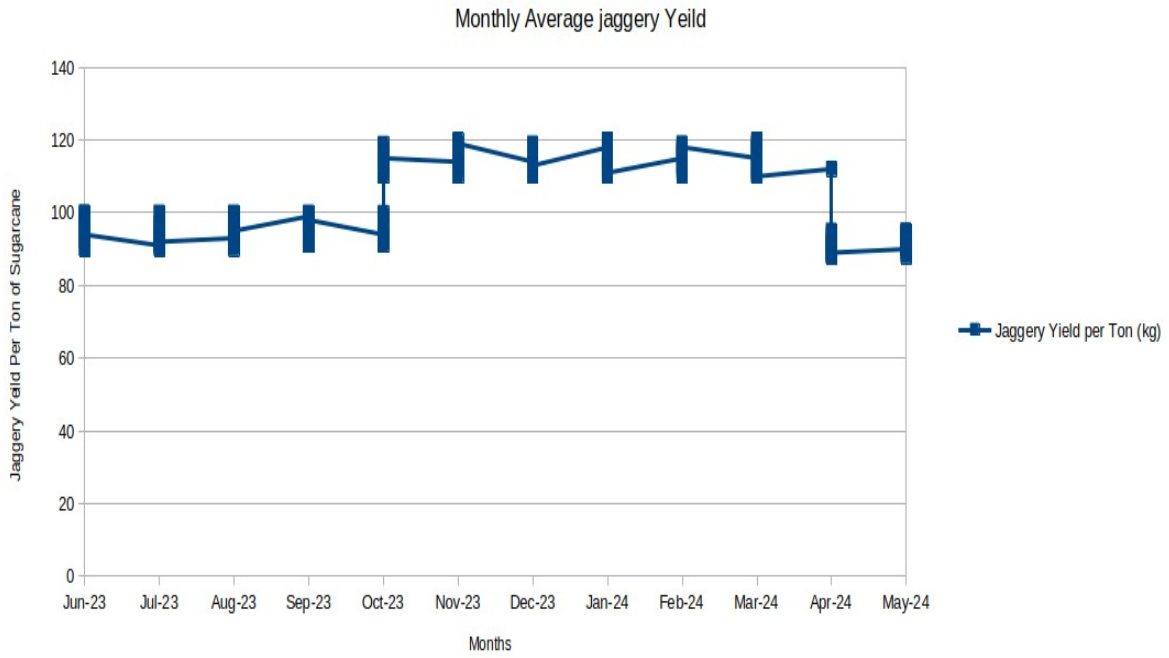

Figure3: Line chart showing price he trend of Jaggery yeild over month.
(Note : calculated from the jaggery market dataset)

This interpretation and findings section effectively breaks down the Monthly Average Jaggery Yield graph, which is focused on illustrating the seasonal variations in jaggery production efficiency.

The Monthly Average Jaggery Yield line graph displays jaggery yield per ton of sugarcane from June 2023 to May 2024, highlighting seasonal variations in production efficiency. The x-axis represents months, while the y-axis shows yield (in kg per ton), with key variations as follows:

- June 2023: Yield starts around 100 kg per ton, indicating a baseline for early-season production.
- October 2023: Yield peaks at approximately 120 kg per ton, suggesting optimal production conditions.
- April 2024: Yield decreases sharply to below 100 kg per ton, reflecting a seasonal downturn in production efficiency.
- May 2024: Yield gradually returns to around 100 kg per ton, resuming stable conditions after the low point in April.

The graph reveals significant fluctuations in jaggery yield throughout the year, pointing to factors that influence production quality and efficiency:

- High Yield in October: The peak in October suggests favorable conditions, such as optimal sugarcane quality or weather conducive to high-yield processing. This could be a result of well-irrigated cane after the monsoon season, which typically improves cane sugar content.
- Low Yield in April: Conversely, the drop in April may indicate adverse growing or processing conditions, potentially tied to temperature increases that impact cane quality or processing efficiency. This aligns with seasonal expectations, as hotter conditions in early summer may strain sugarcane quality.

3.4. Production Cost Breakdown (Pie Chart)

The Production Cost Breakdown Pie Chart reveals significant insights into the jaggery production cost structure at Ponnar Sankar, emphasizing the dominant role of raw material costs. With sugarcane expenses accounting for 85% of total costs, it becomes clear that managing sugarcane procurement is essential to cost efficiency. Since sugarcane must be processed daily to maintain product freshness and maximize jaggery quality, optimizing procurement strategies—such as leveraging seasonal price trends or bulk negotiations during low-demand months—can yield substantial cost benefits.

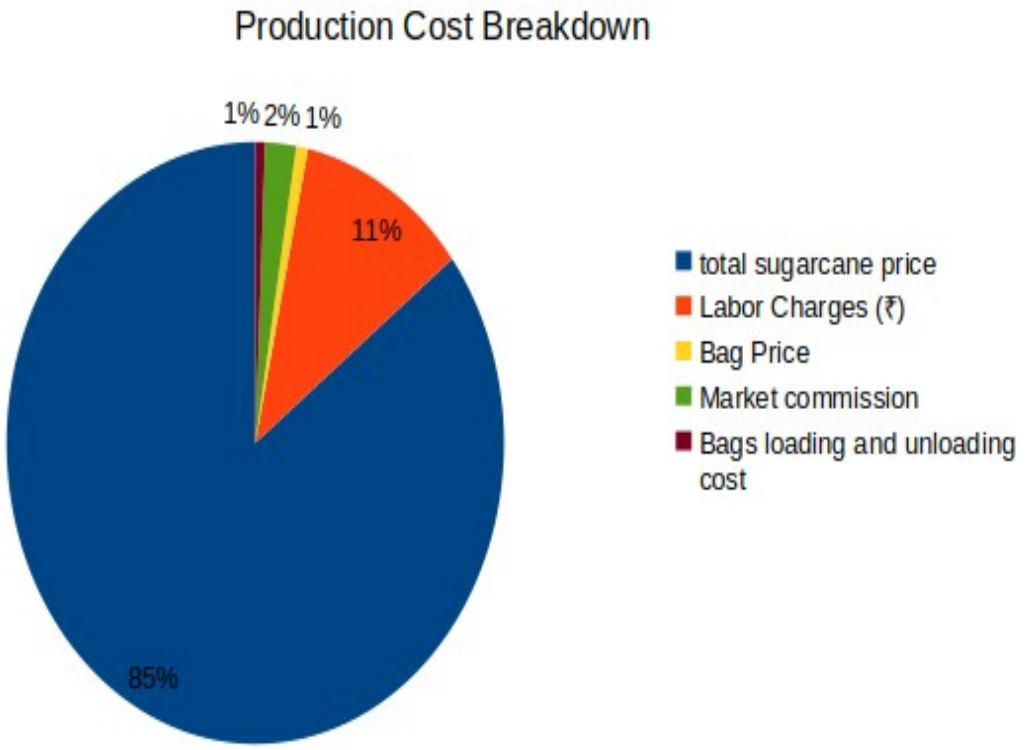

Figure 4: Pie chart showing production cost breakdown of PONNAR SANKAR.
(Note : calculated from the jaggery produciton dataset)

Labor costs account for approximately 11% of production expenses, a necessary expenditure due to the labor-intensive nature of jaggery processing. Effective labor cost management strategies, like scheduling adjustments during high-demand months and performance incentives during peak production, can optimize labor productivity while controlling costs. The remaining costs, comprising bag prices, market commissions, and loading/unloading fees (each around 1-2% of total expenses), are minor yet consistent. Though less flexible, continuous review and optimization of these expenses—like negotiating with suppliers for packaging materials or optimizing transport routes—can contribute incrementally to cost savings.

3.5. Jaggery Market Price Variability (Box Plot and Staked Column Chart)

The box plot illustrates the price variability of different types of jaggery: Powder, Rounded, and Squared.

summary Minimum,Median,Maximum,1st and 3rd quartiles						
Minimum	1100	1270	1200	1350	1200	1350
First quart	1200	1350	1200	1350	1200	1350
Median(K	1280	1350	1200	1350	1200	1350
Third qua	1280	1350	1200	1350	1200	1350
Maximum	1300	1550	1350	1550	1350	1550
Differences for Boxes and Whiskers						
	Powder Min Price (₹)	Powder Max Price (₹)	Rounded Min Price (₹)	Rounded Max Price (₹)	Squared Min Price (₹)	Squared Max Price (₹)
Minimum	1100	1270	1200	1350	1200	1350
First quart	100	80	0	0	0	0
Median (Q	80	0	0	0	0	0
Third qua	0	0	0	0	0	0
Maximum	20	200	150	200	150	200

Figure 5: Screenshot showing the calculation of Minimum, First quartile ,Median, Third quartile and Maximum. (Note : calculated from the jaggery market dataset)

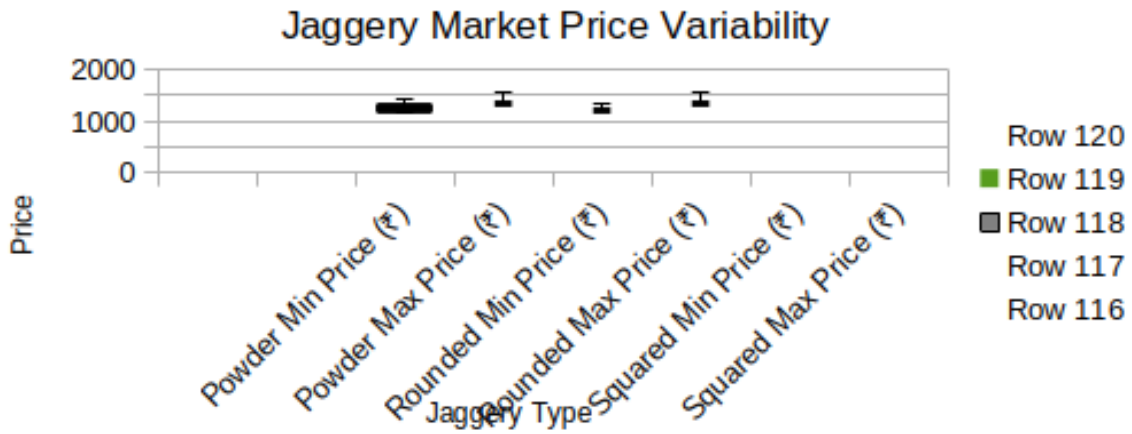

Figure 6: Box plot of Jaggery Market dataset for different types of jaggery. (Note : calculated from the jaggery market dataset)

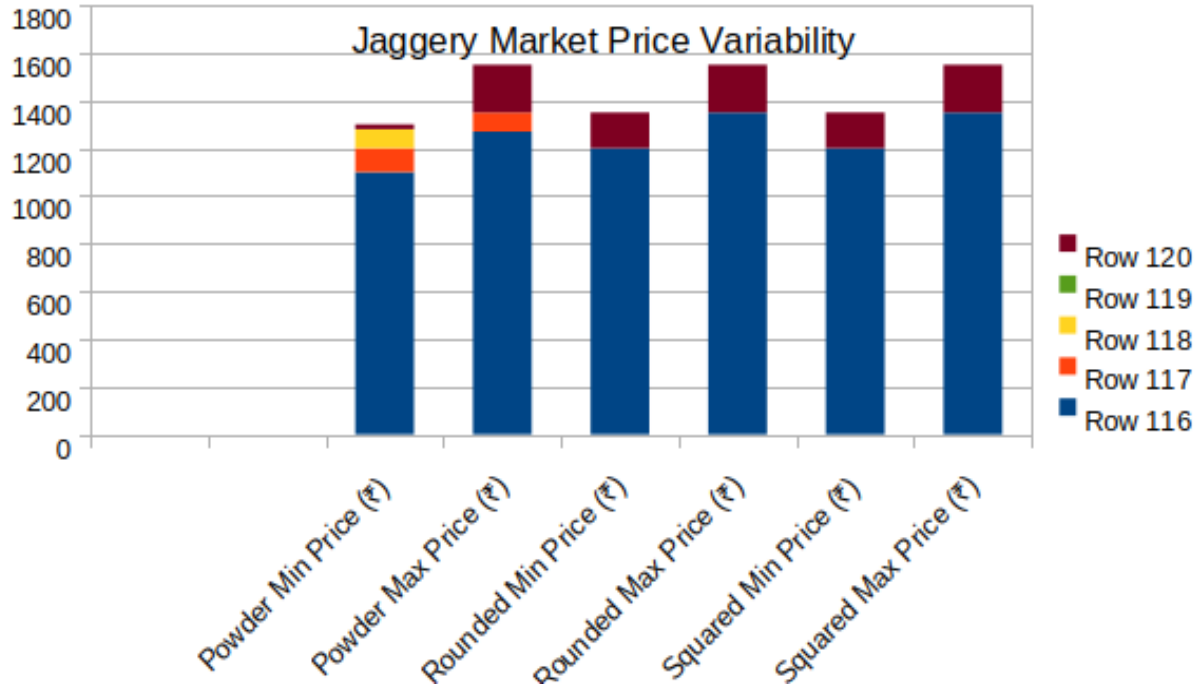

Figure 7: Staked column chart with Minimum, Maximum, First quartile, Third quartile and Median. (Note : calculated from the jaggery Market dataset)

Consistency in Powder Jaggery Prices:

- Box Plot: Powder jaggery shows a relatively narrow interquartile range (IQR), indicating a stable price range. This suggests a consistent demand and minimal price fluctuation throughout the year.
- Stacked Column Chart: Monthly prices for powder jaggery are steady, with minimal variation across months. Even during peak demand seasons, its price remains close to the median, reflecting its role as a staple product with steady demand.

Observation: Powder jaggery appears to be the least affected by seasonal changes or market demand spikes. This product is likely aimed at a customer base that values consistency, making it a dependable item in the market.

Price Volatility in Rounded Jaggery:

- Box Plot: Rounded jaggery displays a broader IQR compared to other types, indicating greater price variability. The lack of outliers suggests that all price fluctuations are within the expected range, driven by typical demand patterns.
- Stacked Column Chart: Rounded jaggery prices rise notably during festival seasons (e.g., October), reflecting its higher demand during these times. In non-festival months, prices drop back to a more typical range, reinforcing the seasonal nature of its demand.

Observation: Rounded jaggery experiences significant price fluctuations, particularly around festival months. This suggests it's a premium product with a demand closely tied to cultural or seasonal events. Planning production increases for rounded jaggery ahead of festival seasons could help capitalize on higher demand and profitability.

Moderate Stability in Squared Jaggery Prices:

- Box Plot: Squared jaggery has an IQR slightly wider than powder jaggery but narrower than rounded jaggery, indicating moderate stability in its price.
- Stacked Column Chart: Monthly prices for squared jaggery show mild increases during peak demand months (such as October) but not as dramatically as rounded jaggery. After the festive season, its price gradually returns to a steady range.

Observation: Squared jaggery has a demand profile that's somewhat seasonal, but not as volatile as rounded jaggery. It could serve as a mid-range product, appealing to customers who want a slightly higher quality than powder jaggery but do not require the premium appeal of rounded jaggery.

Monthly and Seasonal Trends:

- Stacked Column Chart: All types of jaggery reach their highest prices in October, indicating a strong surge in demand due to festival seasons. Prices then stabilize in the following months, with powder jaggery returning quickly to its regular price range, while rounded and squared jaggery gradually decrease.

Observation: The seasonal demand during festivals impacts all jaggery types, but it has the most pronounced effect on rounded jaggery. The pattern suggests that the jaggery market follows a predictable cycle, with demand peaks aligning with festivals. Manufacturers can leverage this trend by adjusting production volumes and pricing strategies in anticipation of these peak periods.

3.6. Monthly Trend of Jaggery Market Prices (Line Chart)

The Monthly Trend of Jaggery Market line chart shows a comprehensive analysis of price trends for three distinct types of jaggery—Powder, Rounded, and Squared—from June to May. This analysis includes both minimum and maximum prices for each type, indicated by six different lines on the chart:

Powder Jaggery: Minimum Price (blue) and Maximum Price (red)

- Rounded Jaggery: Minimum Price (yellow) and Maximum Price (green)
- Squared Jaggery: Minimum Price (dark blue) and Maximum Price (light blue)

The y-axis represents the price in ₹, ranging from 0 to 1800, while the x-axis spans the months from June to May. This segmentation allows for a detailed view of seasonal fluctuations, consumer preferences, and demand cycles for each type of jaggery.

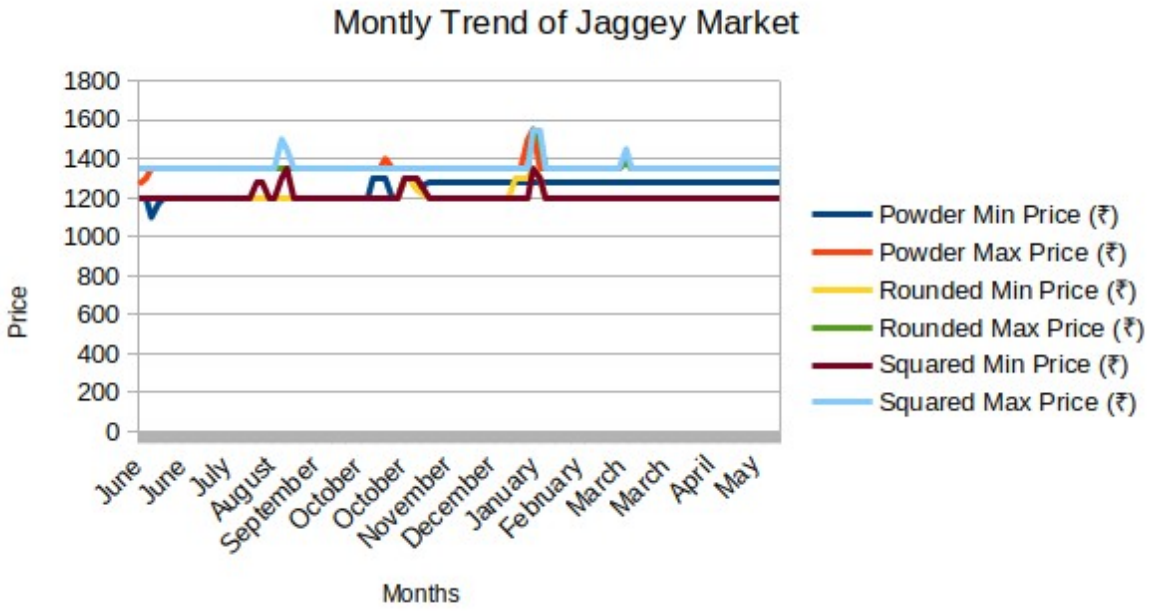

Figure 8: Line chart showing price trends of jaggery market for different types of jaggery. (Note : calculated from the jaggery market dataset)

1. Key Observations from Price Trends
    1. Powder Jaggery Price Trends:
        - Peak in October and January: Powder Jaggery prices experience two prominent peaks, one in October and another in January, aligning with the festive seasons of Diwali and Pongal. These are traditionally high-demand months when consumers purchase jaggery for festival preparations.
        - Higher Maximum Price Range: The maximum price for Powder Jaggery reaches close to ₹1600 in these peak months, reflecting increased demand and potentially limited supply during the festive periods.
        - Stabilization in Low-Demand Months: From April to June, the minimum and maximum prices for Powder Jaggery stabilize, hovering around ₹1200-₹1300, indicating a decrease in demand post-festive season.
    2. Rounded Jaggery Price Trends:
        - Higher Variability: Compared to Powder Jaggery, Rounded Jaggery shows slightly more variability, especially in peak months. This could be attributed to consumer preferences for different shapes of jaggery during festivals, possibly influenced by traditional uses and presentation.
        - Peak Periods in October and January: Like Powder Jaggery, Rounded Jaggery also experiences price peaks in October and January. However, its price fluctuations are somewhat broader, with maximum prices reaching around ₹1700, indicating a higher premium on Rounded Jaggery during festivals.
        - Stable Prices in Off-Season: From April to June, prices stabilize, similar to Powder Jaggery, reflecting reduced demand.

3. Squared Jaggery Price Trends:

    - Distinct Pattern with Smaller Peaks: Squared Jaggery has smaller price peaks in comparison to the other types. The maximum price for Squared Jaggery increases modestly in October and January, peaking at around ₹1500.
    - Moderate Demand Sensitivity: The lesser variation in Squared Jaggery prices suggests it may have a more stable, year-round demand that is less impacted by festive peaks. This could indicate that Squared Jaggery is used more for general consumption rather than seasonal or festival-specific uses.
    - Stable Prices from April to June: Similar to other types, Squared Jaggery prices also stabilize in the April-June period.

3. Comparative Analysis Across Jaggery Types

- Festival Demand Impact: All three types of jaggery—Powder, Rounded, and Squared—show price peaks in October and January due to increased demand during Diwali and Pongal. However, Rounded Jaggery exhibits the highest price peaks, suggesting it may be preferred during festive seasons.
- Variability in Prices: Rounded Jaggery prices are more volatile, indicating sensitivity to consumer demand during certain months. In contrast, Powder Jaggery shows slightly less variability, and Squared Jaggery is the most stable, suggesting it is less influenced by seasonal demand spikes.
- Price Stabilization in Low-Demand Periods: From April to June, all jaggery types show reduced price variability and overall lower prices, reflecting decreased demand in these months. This suggests that consumers may not purchase jaggery in significant quantities during this period, possibly due to the absence of festivals or seasonal consumption patterns.

3.7. Monthly Trend of Jaggery Production (Line chart)

The Monthly Trend of Jaggery Production graph reveals cyclical fluctuations in production, primarily driven by seasonal factors and variations in sugarcane quality. The peak in October suggests that favorable weather and high-quality sugarcane availability create ideal production conditions. This may also coincide with increased market demand, providing an incentive to maximize output. Conversely, the significant decline in April highlights a period where conditions become less favorable, possibly due to a seasonal reduction in sugarcane quality, increased temperatures, or operational constraints.

This analysis highlights the critical role of aligning production with seasonal cycles and market demands. For Ponnar Sankar, this means strategically planning for high-output months to capitalize on favorable conditions, while implementing efficiency measures to mitigate lower production periods.

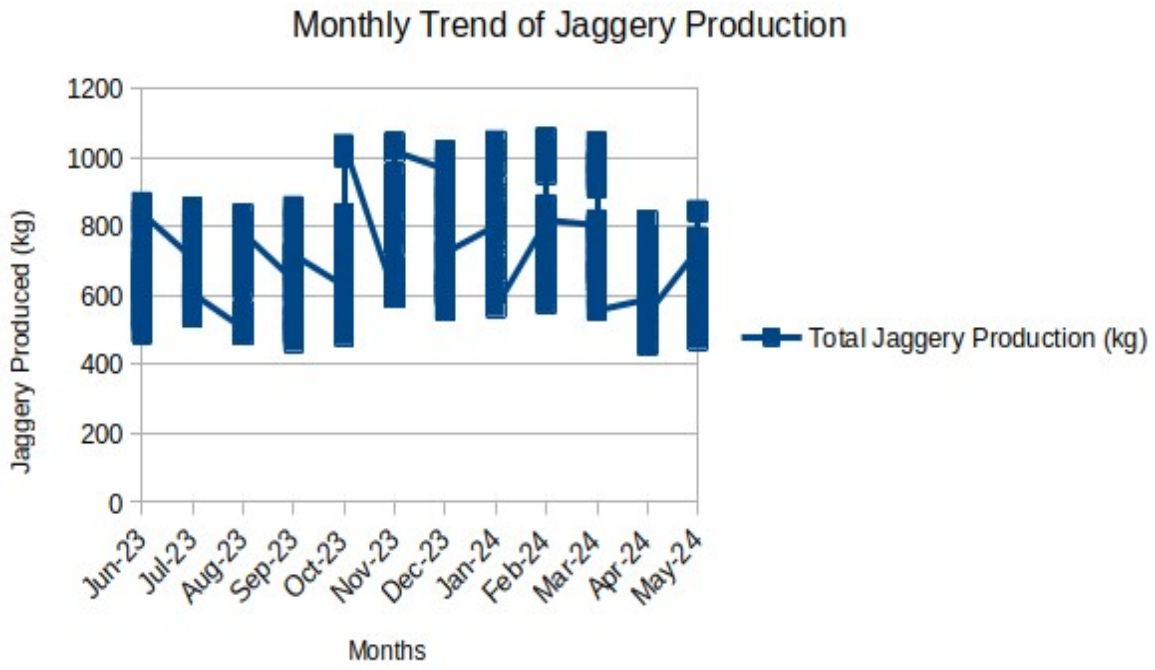

Figure 9: Line chart showing monthly trend of jaggery production of PONNAR SANKAR.
(Note : calculated from the jaggery produciton dataset)

3.8. Profit Trend Over Time (Line chart)

The Profit Trend Over Time line graph offers a clear visualization of profitability from June 2023 to May 2024, capturing monthly fluctuations in gross profit (in ₹). It highlights periods of both gains and losses, giving insights into the dynamics of production costs, demand, and seasonality that influence profitability. I calculated daily and monthly profits by factoring in production costs, labor expenses, and market price. This profitability analysis was vital for assessing financial health over time, as it pinpointed the most profitable periods and highlighted times of reduced profit margins. Visualizing this information allowed for an actionable overview of trends, enabling us to recommend operational adjustments, such as ramping up production before peak demand periods.

Key Observations:

- June 2023: Profit begins at -₹5000, indicating a loss.
- July and August 2023: Profits remain negative, stabilizing around -₹2500.
- September 2023: Profitability reaches a break-even point of ₹0.
- October 2023: Profits rise sharply to ₹12,500, marking the peak.
- November 2023: Profits decrease to ₹5000.

- December 2023: A further decline to ₹2500.
- January and February 2024: Profits remain stable at ₹5000 each.
- March 2024: Profits rise slightly to ₹7500.
- April 2024: A steep drop in profits to -₹5000.
- May 2024: Profits reach the lowest point at -₹7500.

Graph Features:

- X-Axis: Months
- Y-Axis: Gross Profit (₹)

The graph's profit trends highlight considerable seasonal variability, with profit peaks and troughs that reflect shifts in demand, cost structure, and market factors. Notably, the negative profits in June, July, August, April, and May signal low-demand periods or heightened production costs, while October's sharp profit increase suggests ideal production conditions or high market demand.

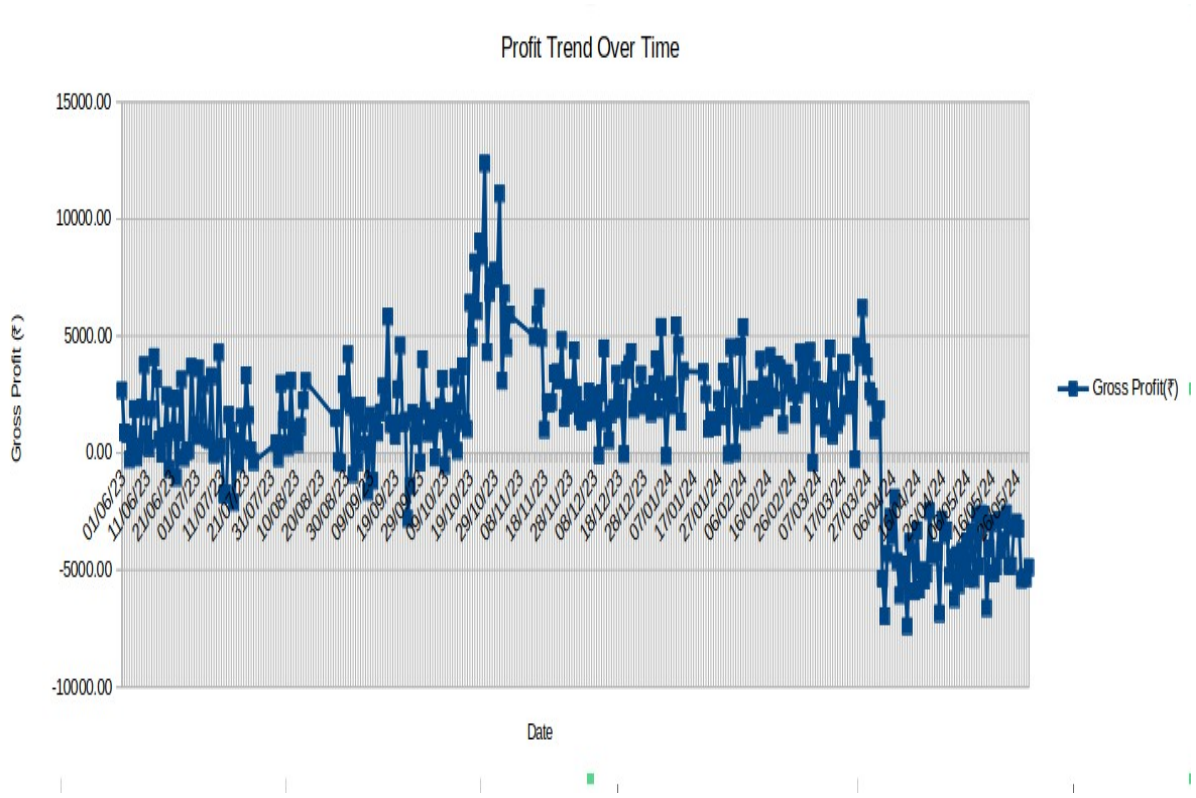

Figure 10: Line chart showing profit trend of PONNAR SANKAR.
(Note : calculated from the jaggery produciton dataset)

3.9. Monthly Trend of Sugarcane Price (Line chart)

The "Monthly Trend of Sugarcane Price" graph reveals fluctuations in the price per ton of sugarcane from June 2023 to May 2024. Starting around ₹3700 per ton in June 2023, prices rose steadily, reaching approximately ₹4400 per ton in October. Following this peak, a slight decline occurred in November, with prices dipping to about ₹4000 per ton, before sharply increasing to around ₹4700 per ton. From December 2023 to February 2024, prices stabilized close to ₹4000 per ton. Minor variations resumed from March to May, with prices fluctuating between ₹3800 and ₹4200 per ton, concluding the year with higher prices than at the start.

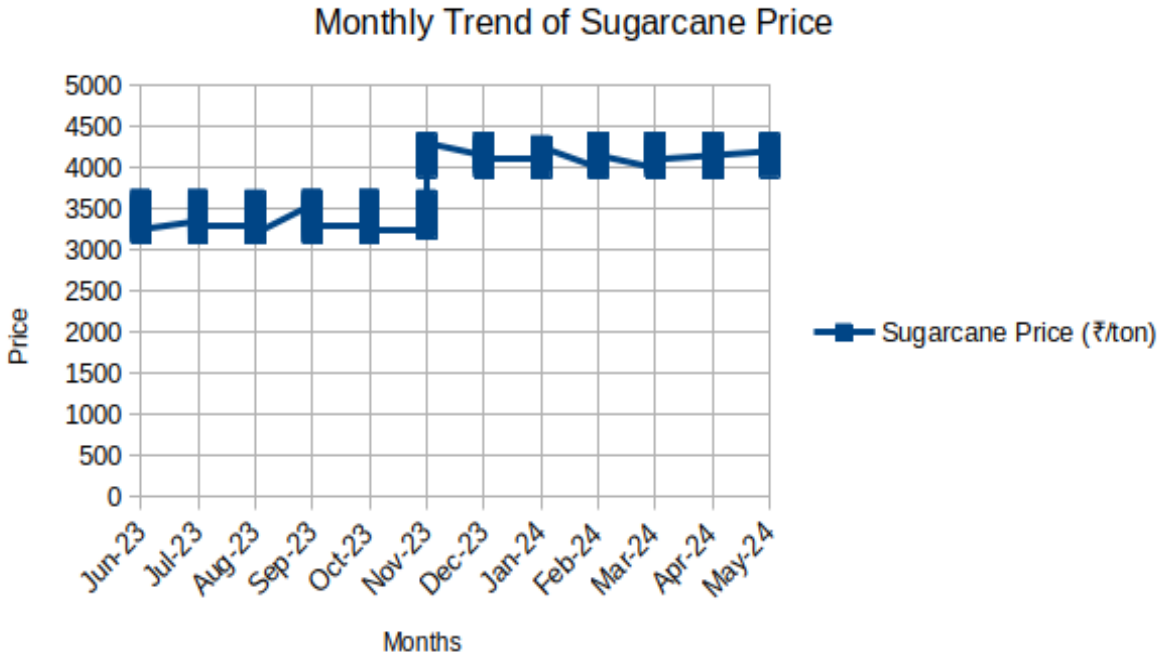

Figure 11: Line chart showing monthly price trend of sugarcane bought by PONNAR SANKAR. (Note : calculated from the jaggery produciton dataset)

These findings underscore the seasonal and market-driven variability in sugarcane prices, driven largely by changes in supply and demand. The initial price from June to October suggests a period of high cultivation. The initial price increase from November suggests a period of reduced cultivation, which tightened supply and increased prices. The peak in November aligns with heightened demand during the festivel season, exacerbating the impact of limited sugarcane availability. The stabilization from December to May reflects a balanced supply and demand, likely due to steady harvests. Minor fluctuations in the last quarter indicate regular market adjustments

3.10. Relationship Between Jaggery Yeild and Profit (Scatter Plot)

To understand the relationship between jaggery yeild (per ton) (in kilograms) and gross profit (per ton) (in ₹), I examined a scatter plot, which revealed the nature and strength of the relationship.

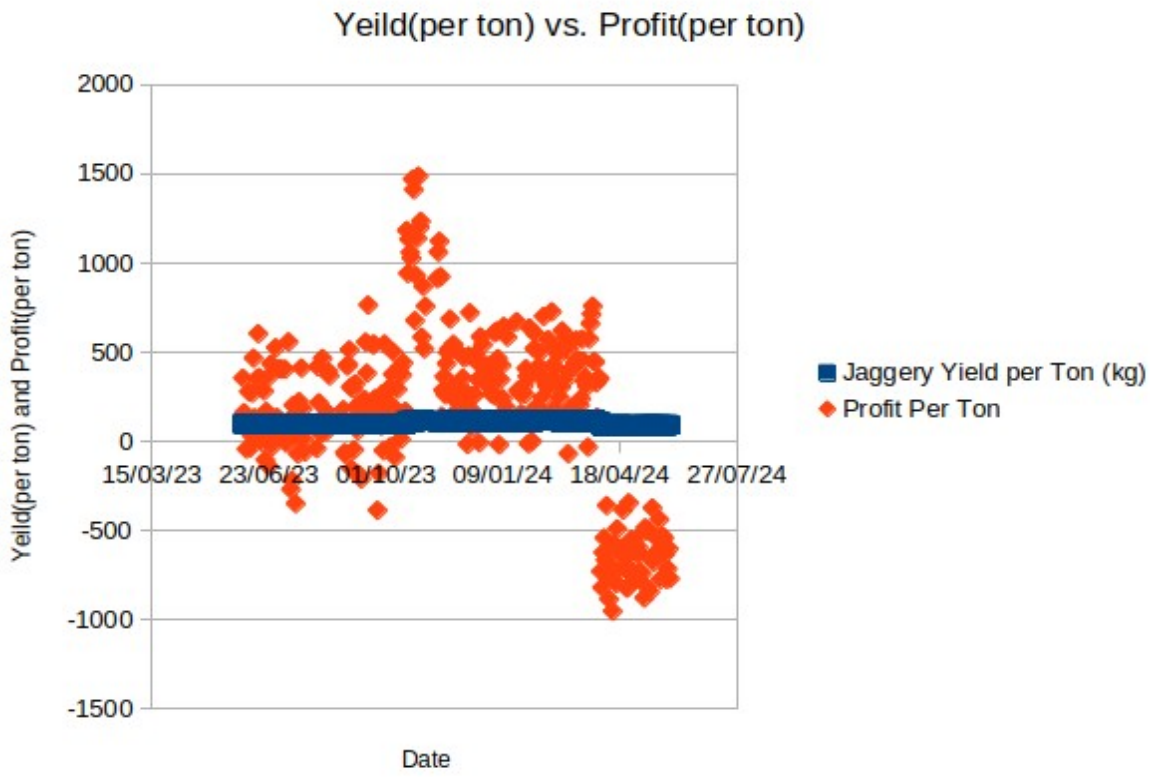

Figure 12: Scatter Plot showing the relationship between Jaggery Yield and Profit of PONNAR SANKAR. (Note : calculated from the jaggery produciton dataset)

The scatter plot titled "Yield (per ton) vs. Profit (per ton)" reveals a significant positive correlation between jaggery yield per ton and profit per ton. The calculated correlation coefficient value is 0.7029, indicating a strong positive relationship between these variables. This suggests that as the jaggery yield increases, the profit per ton generally increases as well. For instance, at a yield of around 120 kg per ton, the profit can be approximately ₹1000 per ton, while at a yield of around 90 kg per ton, the profit can drop to approximately ₹-1000 per ton.

While the correlation coefficient of 0.7029 indicates a strong positive correlation, it also highlights that yield is a significant factor influencing profit, but not the sole determinant. Other factors such as market prices, production costs, and economic conditions also play crucial roles in determining profitability.

4 Interpretaiton of Results and Recommendation

The analysis of Ponnar Sankar's jaggery manufacturing operations reveals critical insights into its core challenges and opportunities. By focusing on inconsistent jaggery yield, unstable market pricing, and unpredictable market demand, the data-driven findings provide actionable strategies for improving operational efficiency, aligning production with demand, and stabilizing profitability. Additionally, general recommendations address broader operational improvements and diversification opportunities.

1. Addressing Inconsistent Jaggery Yield

The Monthly Average Jaggery Yield chart highlights yield variability, with peaks in October (120 kg/ton) and declines in April (90 kg/ton). A correlation coefficient of 0.7029 between jaggery yield and profit underscores the direct impact of yield on financial performance.

To ensure consistent yield and address operational inefficiencies:

- Quality Control: Implement robust sugarcane quality checks and train farmers on best cultivation practices.
- Process Optimization: Upgrade equipment to ensure efficient extraction and minimize wastage during production.
- Seasonal Adjustments: Align staffing and resource deployment to match seasonal variations, with proactive measures during low-yield months like April.

By stabilizing jaggery yield, the company can enhance production consistency and better meet market demands.

2. Managing Unstable Market Pricing

The Jaggery Market Price Variability (Box Plot) and Monthly Trend of Jaggery Market Prices (Line Chart) reveal that jaggery prices are merchant-driven, with Powder Jaggery achieving the highest prices in October (₹1350-₹1400). Rounded and Squared Jaggery prices are slightly lower but follow similar seasonal trends.

While Ponnar Sankar cannot directly control prices, it can adopt strategies such as:

- Quality Assurance: Strengthening relationships with merchants by maintaining consistent product quality.
- Market Alignment: Planning production for peak months to capitalize on high-demand periods.
- Diversification of Sales Channels: Introducing direct-to-consumer (B2C) channels such as online platforms to supplement wholesale market sales.

Understanding pricing trends empowers Ponnar Sankar to operate strategically in a volatile market environment.

3. Mitigating Unpredictable Market Demand

The Monthly Profit Analysis (Column Chart) and Scatter Plot of Production vs. Profit highlight seasonal profit variability, with peaks in October (₹12,500) and March and troughs in months like June and April. These fluctuations reflect changing market demand and production cost dynamics.

To better align production with demand, the company should:

- Demand Forecasting: Use historical trends to anticipate high-demand periods and optimize production schedules.
- Diversification of Product Offerings: Explore producing spiced jaggery or organic jaggery to attract diverse customer segments.
- Direct Sales Opportunities: Sell jaggery directly to customers through online platforms like Amazon, Flipkart, or a dedicated company website to capture higher profit margins.

General Recommendations

Beyond data-driven insights, Ponnar Sankar can adopt broader strategies to modernize operations and explore new revenue streams:

1. Upgrade Equipment: Replace outdated machinery with automated systems to reduce labor dependency and improve production efficiency. Modern equipment ensures consistency in jaggery quality, reduces manual errors, and lowers production time.
2. Enhance Cleanliness: Maintain a clean and hygienic manufacturing environment to build trust among merchants and potential direct customers. A neat facility also makes it feasible to allow direct customer visits, adding credibility to the company's brand.
3. Diversity Product Range: Introduce innovative jaggery products such as spiced jaggery, flavored jaggery powder, or organic jaggery. Such diversification meets varied customer preferences and creates opportunities to charge premium prices.
4. Direct-to-Customer Sales:
    - Establish an online presence by selling on platforms like Amazon and Flipkart.
    - Develop a user-friendly website offering jaggery products with delivery options.
    - Expand into local retail stores or partner with organic food outlets to widen customer reach.
5. Explore New Products: Leverage existing resources to launch complementary products such as sugarcane juice, which is in high demand during summer months. This diversifying increases profitability and optimizes raw material utilization.
6. Sustainability Practices: Invest in eco-friendly production methods, such as reducing water and energy usage. Highlight these practices in marketing efforts to attract environmentally conscious consumers.

7. Customer Engagement: Develop programs to educate consumers about the health benefits of jaggery, fostering loyalty and driving demand. Consider holding factory tours to showcase the production process and reinforce transparency.

By adopting these strategies, PONNAR SANKAR can:

- Enhance operational efficiency through modernized equipment and streamlined production processes.
- Build stronger customer relationships by diversifying product offerings and sales channels.
- Increase profitability by capitalizing on high-demand periods and managing costs effectively.
- Establish a sustainable growth framework, ensuring resilience in the face of market fluctuations and demand unpredictability.

This holistic approach aligns the company's operational goals with market dynamics, paving the way for consistent growth and enhanced competitive positioning in the jaggery market.