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To evaluate the inventory management of paddy and maize seeds in the seed processing units of Medchal district, Telangana

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Abstract

Inventory management in seed processing units plays a decisive role in ensuring quality, timeliness, and compliance with regulatory standards. The present study, titled *"Processing and Inventory Management of Paddy and Maize Seeds: A Case Study Approach"*, was carried out at SGM Seed Processing Unit, Medchal, Telangana, a custom processor handling paddy and maize under ISTA and TSSOCA certification norms. The study evaluated operational efficiency, inventory accuracy, and fulfillment systems across multiple Rabi and Kharif cycles between November 2021 and June 2025. Using a mixed-method case study design, data were collected through structured interviews, on-site observations, surveys, and operational registers, supplemented by secondary sources. Inventory management performance was analyzed using eight key evaluation metrics: processing loss rate, viability retention, inventory accuracy, storage loss rate, fill rate, backorder rate, forecast accuracy, and dead stock ratio. Results revealed that SGM maintained high inventory accuracy (95–96%), kept storage losses around 2% (paddy 2.1%, maize 1.9%), and achieved fill rates above 94%. However, challenges included reconciliation mismatches during bulk-to-pack transitions, occasional dead stock accumulation, and forecast variability during peak Kharif demand. The study recommends stronger ERP integration, predictive analytics for demand forecasting, and supplier evaluation mechanisms to further enhance inventory efficiency.

Keywords: Seed processing, inventory management, paddy, maize, fill rate, forecast accuracy, dead stock ratio

1. Introduction

Inventory management is central to the performance of seed enterprises, particularly in regions like Telangana, where paddy and maize dominate production and trade. Unlike industrial products, seeds are biological and perishable, making them highly sensitive to storage and handling conditions. Poor inventory management can result in losses of viability, stock misreporting, delayed delivery, and dead stock accumulation, directly impacting productivity and profitability. The Indian seed industry, valued at USD 5.2 billion (ISF, 2023), is one of the largest globally, supported by strong certification systems under ICAR, ISTA, and TSSOCA. In this landscape, custom processors like SGM Seed Processing Unit play a crucial role by ensuring compliance, while also managing intake, processing, and inventory functions for multiple seed companies.

Paddy and maize together account for ~52% of India's cereal production, and in Telangana, they form the backbone of both food and feed systems. Medchal district, where SGM is located, has emerged as a seed processing hub, benefiting from organized clusters of farmers, aggregators, and farmer-producer organizations (FPOs). This study evaluates how effectively SGM manages its inventory functions, with a focus on accuracy, reconciliation, fill rates, backorder management, forecasting, and dead stock reduction. By analyzing operational data across four years, the research identifies best practices and areas requiring improvement.

2. Materials and Methods

The study was conducted at SGM Seed Processing Unit, Medchal, Telangana, between November 2021 and June 2025, covering seven crop cycles (Rabi and Kharif). The plant was chosen as a case study owing to its established infrastructure, reputation for handling both paddy and maize, and adherence to ISTA and TSSOCA certification standards. A purposive sampling method was adopted to gather insights from stakeholders directly involved in seed processing and inventory operations, including operational staff (seed intake, processing, packing, logistics), managers (inventory, procurement, and finance), and client representatives (procurement managers from partner seed firms). Primary data were collected through structured observations of workflow processes during intake, processing, storage, and dispatch; semi-structured interviews with 20 operational staff and 5 managers, along with structured questionnaires to cover stock reconciliation, ERP usage, and fulfillment practices to capture experiential insights; and questionnaires focusing on ERP usage, stock reconciliation, and fulfillment practices. In addition, secondary data were obtained from intake/output registers, ERP system entries, daily processing logs, stock ledgers, certification records from TSSOCA and ISTA, operational manuals, financial reports, and relevant seed policy and market documents. An evaluation framework consisting of eight inventory management metrics was applied, covering both efficiency and system-level dimensions: processing loss rate to assess handling efficiency, viability retention to capture the biological quality of seeds in storage, inventory accuracy for system reliability, storage loss rate for preservation, fill rate and backorder rate for fulfilment efficiency, and forecast accuracy and dead stock ratio to evaluate demand planning and inventory turnover.

Table 1: Evaluation Metrics and Benchmark Thresholds

Metric	Formula	Benchmark	SGM Avg. Paddy (2021–25)	SGM Avg. Maize (2022–25)
Processing Loss Rate	(Seeds lost ÷ Intake) × 100	≤5%	4.3%	3.6%
Processing Efficiency	100 – Loss Rate	≥95%	95.7%	96.2%
Viability Retention	(Post-storage ÷ Initial germination) × 100	≥85%	88%	89%
Inventory Accuracy	(System ÷ Physical count) × 100	≥95%	95%	96%
Storage Loss Rate	(Loss ÷ Stored quantity) × 100	≤8%	2.1%	1.9%
Fill Rate	(Orders fulfilled ÷ Orders received) × 100	≥90%	94%	95%
Backorder Rate	(Unfulfilled ÷ Orders received) × 100	≤5%	4%	3%
Forecast Accuracy	(1 – (Forecast – Actual) / Actual) × 100	≥85%	93.6%	93.7%
Dead Stock Ratio	(Unsold ÷ Inventory) × 100	≤5%	4.6%	4.1%

Source: SGM Records (2021–2025)

3. Results and Discussion

3.1 Inventory Accuracy and Reconciliation

The inventory accuracy achieved by SGM Seed Processing Unit was consistently high, averaging 95–96 per cent. This was attributed to the use of ERP-based inventory tracking systems that captured intake, dispatch, and processing in real time. The company also implemented monthly reconciliation exercises where physical stock counts were matched with system records. While these measures kept deviations minimal, occasional errors occurred during transitions from bulk storage to packaging, which caused temporary mismatches. Automating these transitions with barcode systems and digital lot tracking could further reduce reconciliation delays.

3.2 Storage Losses

Storage losses were found to be minimal, averaging just 2 per cent against the permissible threshold of 8 per cent (paddy) and 6 per cent (maize). The company achieved this through climate-controlled storage facilities operating at 12–14 °C and 50–55 per cent relative humidity. Regular fumigation, moisture checks, and strict adherence to FIFO (First-In, First-Out) principles reduced pest and fungal attacks. These measures ensured that seed viability was preserved even during extended holding periods, providing a competitive edge in meeting client delivery schedules.

3.3 Fulfillment Systems – Fill and Backorder Rates

Order fulfillment was efficient, with fill rates consistently above 94 per cent. Scheduling of client orders in advance allowed the unit to manage peak workloads effectively. Despite this, backorders averaging 3-4 per cent did occur, mainly due to unexpected order surges during Kharif planting seasons. The findings suggest that while operational systems were robust, there remains scope for integrating predictive demand models with procurement and processing schedules to anticipate such spikes.

Table 2: Fill Rate and Backorder Rate (2021-2025)

Season/Year	Crop	Fill Rate (%)	Backorder Rate (%)
Rabi 2021-22	Paddy	93.8	4.2
Kharif 2022	Maize	95.1	3.0
Rabi 2022-23	Paddy	94.5	3.9
Kharif 2023	Maize	94.8	3.2
Rabi 2023-24	Paddy	94.1	4.1
Kharif 2024	Maize	95.3	2.8
Rabi 2024-25	Paddy	94.7	3.6

Source: Computed from SGM operational data

Key Observations

- Fill rates remained consistently above the 90% benchmark, indicating efficient scheduling and resource allocation.
- Backorders, while minimal, reflected occasional mismatches between forecasted and actual demand, particularly in Kharif seasons.
- Maize showed slightly better fulfillment stability than paddy, highlighting the greater predictability of maize demand patterns.

3.4 Forecasting and Dead Stock Trends

Forecast accuracy was strong, averaging around 93-94 per cent. This demonstrated the company’s ability to align production with client demand. Nevertheless, deviations were observed during Kharif seasons where demand fluctuated sharply. Dead stock ratios were contained below 5 per cent, but paddy showed a marginally higher rate (4.6%) compared to maize (4.1%). This reflects the relative unpredictability of farmer demand for paddy seed, which is sensitive to water availability and government procurement policies. Addressing this requires investment in dynamic forecasting models and closer coordination with distribution networks.

Table 3: Inventory Accuracy and Dead Stock Trends

Year/Season	Inventory Accuracy (%)	Dead Stock Ratio (%)
2021-22 Rabi	95.1	4.7
2022 Kharif	96.2	4.3
2022-23 Rabi	95.3	4.5
2023 Kharif	95.8	4.2
2023-24 Rabi	95.0	4.6
2024 Kharif	96.1	4.1
2024-25 Rabi	95.5	4.4

Source: Computed from SGM operational data

Key Observations

- Inventory accuracy was consistently high across all seasons, reaffirming system robustness.
- Dead stock ratios stayed within permissible limits but were slightly higher for paddy, showing demand variability challenges.
- Improved forecasting tools and flexible inventory allocation could mitigate dead stock risks in the future.

4. Conclusion

The study highlights that efficient seed processing and systematic inventory management are crucial for maintaining quality, compliance, and client satisfaction, with SGM Seed Processing Unit consistently exceeding benchmarks in utilization levels, viability retention, and inventory accuracy. Nonetheless, challenges such as forecasting variability, dead stock buildup, and supplier quality inconsistencies persist, requiring targeted improvements. To address these gaps, the study recommends strengthening ERP integration with end-to-end lot tracking, adopting predictive demand forecasting models to manage seasonal volatility, collaborating with certified Farmer Producer Organizations (FPOs) for reliable and scalable procurement, standardizing intake quality testing through laboratory protocols, and implementing supplier performance scorecards to enhance accountability. Collectively, these measures would further improve inventory management efficiency while providing replicable best practices for reinforcing India's seed supply chain.

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