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Suta-based Measurement System for Industrial Grading and Bagging of Makhana Pops: A Strategic Tool for Quality, Pricing, and Market Positioning

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Thurri

Murra

Ulva/Olva

Medium 1

Medium 2

Medium 3

Rasgulla

Rajbhog

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Abstract

Makhana (*Euryale ferox*) is a humble agricultural commodity that has become a global hit as ***"Plant Pops,"*** and the makhana industry of Bihar is gaining national and international recognition. The makhana value chain remains informal particularly in grading and packaging, despite its domestic market being worth ₹5,000 crore (2023) and its exports increasing. The Indian traditional measurement system is central to the makhana value chain, which is effectively utilized for grading and bagging of popped makhana seeds or makhana pops (*lawa*), determining their quality and pricing. The close relationship between size-based grading and income realization is supported by field research conducted in seven significant Bihar markets. The strategic value of the *Suta-based* measurement method, which classifies popped makhana seeds (*lawa*) by diameter, immediately affects the price (from ₹ 200/kg for <3 Suta pops to over ₹ 1,500/kg for >6.5 *Suta*). On the other hand, the Bora-based packaging system distorts prices due to its reliance on uncalibrated volumes. Enhancing transparency, increasing farmer earnings, and establishing Bihar as a global leader in premium makhana would require institutional reforms, training initiatives, and digital grading systems.

Keywords: Makhana (Euryale ferox), Suta-based grading system, Bihar agriculture, value chain standardization Makhana pops, Export readiness, Traditional bagging

Introduction

Makhana (*Euryale ferox*), an aquatic crop native to the eastern Indo-Gangetic plains, particularly in Bihar, India, has transitioned from a traditional delicacy to a contemporary superfood, driven by growing demand in export-focused and health-conscious markets. Known for its high protein, low fat, and antioxidant qualities, makhana has gained popularity under the plant-based snack category, creating new value chain opportunities for both growers and retailers. Over 2.5 lakh farmers and thousands of processors depend on the makhana value chain, which is primarily concentrated in the Kosi and Mithilanchal regions of Bihar, as a vital source of income.

The increased demand for plant-based and gluten-free snacks is expected to propel India's domestic makhana market, which was valued at around ₹ 5,000 crore (~USD 600 million) in 2023, to ₹ 11,000 crore (~USD 1.3 billion) by 2028, with a compound annual growth rate (CAGR) of 17.6%. Moreover, Indian makhana exports have been steadily increasing, reaching 25,130 MT in 2024 from 6,700 MT in 2020 (39% CAGR) with estimated value over Rs. ₹2500 crore; the USA, UAE, and Europe are among the top destinations. Bihar now has a rare opportunity to solidify its standing as a major center for the production and processing of high-quality makhana worldwide.

The Bihar makhana industry remains semi-structured, despite the international interest, particularly in post-harvest processing, grading, and marketing procedures. The conventional *Suta* (or *Soot*) based measurement system is one of this value chain's most distinctive yet underutilized elements. This system grades popped makhana seeds, also known as lawa, according to their diameter, with one *Suta* being roughly 3.175 mm. The accurate categorization of product quality made possible by this domestic indicator has a direct impact on consumer preferences and market pricing. The economic importance of standardization is demonstrated by the fact that lower grades (<3 *Suta*) command less than ₹ 200/

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kg, while high-grade pops (6.5+ *Suta*) can fetch prices over ₹ 1500 kg.

The common *Bora* (bagging) technique, which is based on volumetric rather than weight-based selling, leads to irregularities throughout the packaging and trading of makhana pop. This disadvantages new or small-scale merchants in particular, as they often lack the necessary knowledge to calibrate bags precisely. As a result, there is less competition in both the home and export markets, leading to price volatility and information asymmetry. Formalizing and expanding the *Suta*-based grading and *Bora*-based packaging processes is imperative to improve traceability, quality assurance, and farmer income as the demand for export-grade makhana soars. This policy brief examines the strategic potential of the Suta grading system as a cost-effective and scalable tool for value chain standardisation, promoting equity in trade, and enhancing export readiness.

Data and Methodology

A qualitative, field-based method was used to investigate grading, pricing, and marketing methods at Bihar's main makhana pop markets through Focus Group Discussions (FGDs) with processors and traders. Eight central market locations were used for the study: Harda and Pawai market (Katihar), Lalganj and Tulsiahipatti market (Saharsa), Pipra and Triveniganj (Supaul), Jhanjharpur Mandi (Madhubani), and Barabazar (Darbhanga). There was one FGD with traders and one with processors in each market, totalling sixteen FGDs. To guarantee at least three years of experience in the makhana sector, eight to ten participants representing small, medium, and large-scale players were chosen using purposive sampling for each group. A semi-structured checklist, including grading schemes, *Suta* usage, pricing schemes, buyer-seller relationships, and difficulties with quality standardization, guided the discussions.

Thematic and descriptive analysis was the main technique used to examine the information gathered from Focus Group Discussions (FGDs). In order to capture the breadth and complexity of stakeholder perspectives, the analysis placed a strong emphasis on narrative summaries, frequency-based patterns, and direct participant quotations. Field notes and observations made during the FGDs were used to triangulate insights in order to ensure credibility.

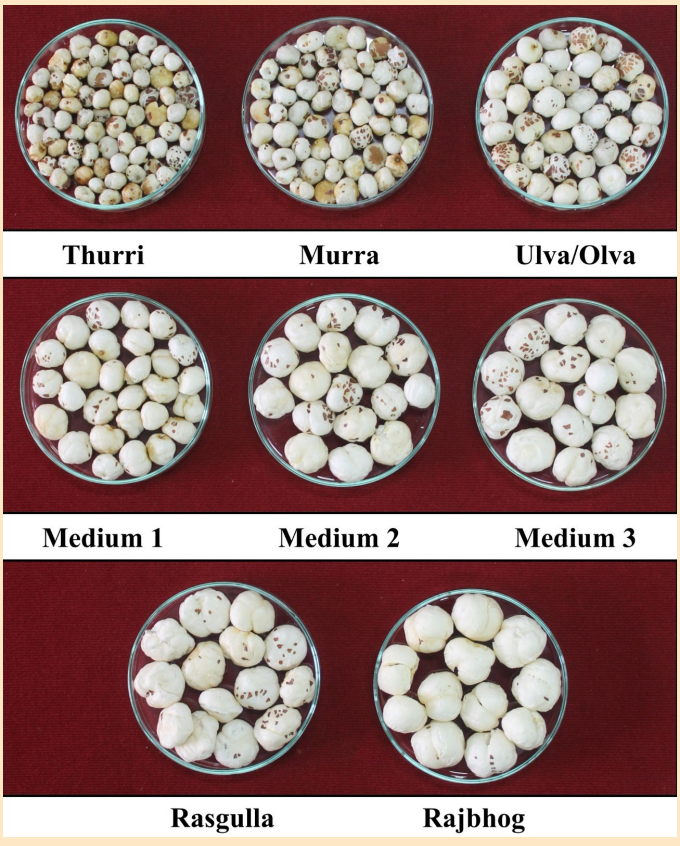
Results and Discussions

The significance of the conventional *Suta*-based grading method in establishing the market value of popped makhana seeds in Bihar is demonstrated in Table 1. There is a clear and substantial positive relationship between the market price of makhana pops and their size. *Thurri* (<3 *Suta* or <9.5 mm) available for just ₹ 200/kg and are typically used for flavoring and powdering. The market value rises with the size of the pops: *Rasgulla* (6–6.5 *Suta*) sells for ₹ 1250/kg, *Ulwa* or *Olwa* (4–4.5 *Suta*) receives ₹ 680/kg, and *Murra* (3–4 *Suta*) earns up to ₹ 400/kg. Rajbhog (>6.5 *Suta* or >20.7 mm), the highest premium grade, can sell for up to ₹ 1,575/kg. The price difference between the lowest and highest grades is almost eight times this.

Along the makhana value chain, this kind of differentiation has a significant impact on income generation and value realization. Medium-sized categories (5–6 *Suta*) frequently used for raw export or roasting, already fetch prices of ₹ 970 - ₹ 1,100/kg. A simple half-*Suta* hike can result in an increase of ₹ 100 to ₹ 150/kg, even within this mid-range. This level of detail enables accurate pricing and provides incentives for producers and processors who prioritise quality. A transparent yardstick for trade discussions is also provided by the regular application of the *Suta*-based approach, which lessens the need for arbitrary evaluations (Figure 1).

The extensive usage of the conventional *Bora* system for bulk sales, especially in local and wholesale mandis, continues to be a hindrance to the makhana pop industry. Makhana pops of all sizes are blended and sold using the *Bora* technique based on volume rather than weight or grade (Table 2). The bags are of fixed dimensions, often 27 × 44 or 28 × 46 inches. This system promotes market opacity and lacks standardization. Price ambiguity results from the inconsistent pop sizes in each bag; merchants usually average prices down to reflect lesser-

Figure 1: Grades of popped makhana seeds as per the "Suta" or "Soot"-based grading system in Bihar.



quality content. Smallholder farmers and recent market entrants are disproportionately impacted because they lack the expertise to calibrate their bags or negotiate advantageous conditions properly. On the other hand, experienced traders frequently reduce these risks by using visual judgment and established networks, which maintains the unfairness in the marketing system.

The absence of quality assurance and traceability in the *Bora* system is another issue that hinders its integration with official retail or export markets. Popped makhana and other healthy snacks are gaining popularity worldwide, particularly in North America, Europe, and Southeast Asia. However, entering these markets requires constant quality, unambiguous labelling, and compliance with food safety regulations—all of which are easier to achieve with a standardised, grade-based system. Sorted, graded makhana pops are transported in larger (30 × 50 inch) bags, which is a step in the right direction toward contemporary marketing techniques. The processors and exporters are using these bags more frequently to preserve consistency and stop quality deterioration during transportation. However, a lack of quality control infrastructure, regulatory requirements, and farmer awareness has limited their adoption.

Policy Issues and Strategic Implications

1. **Quality Assurance and standardization:**
   - Uniform grading enhances consumer trust and eases regulatory compliance in both domestic and export markets.
   - Large and premium-grade makhana pops (≥6.0 Suta) exhibit superior appearance, texture, and flavour, resulting in significantly higher market prices.
   - Institutionalizing the *Suta* system can standardize quality assessment akin to global grading norms in commodities like rice or coffee.

2. **Pricing and Profit Margins:**
   - Size-based pricing enables differentiated and targeted marketing (e.g., *Rajbhog* grade for luxury segments).
   - Accurate segregation ensures that high-value grades are not undervalued in bulk transactions.
   - Traders utilizing the *Suta* grading system can negotiate prices effectively and confidently through planned sales, enhancing profit margins.

3. **Market Segmentation and Product Positioning:**
   - Small sizes (<4.5 Suta) are suitable for industrial processing and flavouring.
   - Medium grades (4.5 – 6.0 *Suta*) suit roasted snack markets, especially in urban centres.
   - Large grades (6.0+ *Suta*) are suitable for export, gifting, and retail branding – key for accessing premium markets.

Table 1: *Suta*-based grading system of popped makhana seeds and price trend in Bihar for 2024 – 2025.

Suta Grade	Approximate Diameter (mm)	Description or Local Name	Preferable Use	Wholesale Price (₹ kg^{-1})
< 3 *Suta*	< 9.5	*Thurri* (Lowest Size)	Powder or Flavouring	200.00
3 – 4 *Suta*	9.6 – 12.7	*Murra* (Small Size)	Flavouring	400.00
4 – 4.5 *Suta*	12.8 – 14.3	*Ulwa*/*Olwa*	Flavouring	680.00
4.5 – 5 *Suta*	14.4 – 15.8	Medium Size (Category 1)	Flavouring or Roasting	750.00
5 – 5.5 *Suta*	15.9 – 17.4	Medium Size (Category 2)	Roasting	970.00
5.5 – 6.0 *Suta*	17.5 – 19.0	Medium Size (Category 2)	Export (Raw)	1100.00
6 – 6.5 *Suta*	19.1 – 20.7	*Rasgulla* (Large Size)	Export (Raw)	1250.00
6.5+ *Suta*	> 20.7	*Rajbhog* (Premium Size)	Export (Raw)	1575.00

Table 2: *Bora*-system of measurement for ungraded makhana pops marketing.

Purpose	Bag Size (Width × Length)	Remarks
Traditional Mixed-size Sale (*Bora*-system)	27 × 44 inch	Used for ungraded makhana pops sold based on volume and not on weight.
Traditional Mixed-size Sale (*Bora*-system)	28 × 46 inch	Alternative size in the conventional system.
Graded Makhana Transport	30 × 50 inch	Used specifically for transporting sorted/graded makhana pops.

4. **Inventory and Risk Management:**
    - *Suta*-based grading aids traders in mitigating the risks across fluctuating demand cycles (e.g., festive vs off-season).
    - Inventory planning becomes more efficient when linked with predictive demand by grade.

5. **Export Readiness:**
    - Export markets (e.g., USA, Japan) demand uniform, visually appealing, larger-sized makhana.
    - Proper grading enhances traceability and facilitates compliance with phytosanitary and food safety regulations.

6. **Value Addition and Branding:**
    - *Suta*-based grading facilitates brand identity formation (e.g., "*Rajbhog* Select").
    - Traders can create differentiated product lines through roasting, seasoning, and packaging innovations based on the grade of makhana pops.

Future Policy Needs

1. **Create Certification and Labeling Norms:** Develop a national grading certification system for makhana, including labelling norms indicating *Suta* grade. About five size grades of i) below 10 mm, ii) 10 – 12 mm, iii) 12 – 15 mm, iv) 15 – 18 mm, and v) more than 18 mm may suffice for the purpose.

2. **Promote standardized Grading:** Support training programs and infrastructure for *Suta*-based grading to enhance transparency and value realization. The grading system may be developed according to an international standard.

3. **Incentivize Export-Grade Processing Units:** Provide subsidies or credit support for value-added units handling 5.5+ *Suta* makhana pops, targeting premium and export segments.

4. **Develop a Digital Grading and Trading Platform:** Integrate digital tools (AI-based size detection) with marketing platforms to support remote grading, traceability, and price discovery.

5. **Farmer-Trader Awareness Programs:** Launch campaigns to raise awareness of the benefits of grading and pricing mechanisms among farmers and new entrants.

Conclusion

The Suta-based measurement system offers a technically sound, regionally grounded approach to grading makhana pops by diameter, ensuring consistency in quality, fair pricing, and transparency. However, under the Bora-based makhana pops packaging system, the plastic bags are loosely packed, differing in volume and compaction. Due to its subjectivity, the *Bora* system frequently results in pricing conflicts, disadvantages smallholders, and restricts processors' capacity to satisfy premium market needs. Formalization of the *Suta* system becomes crucial as the health-conscious consumer and export growth propel India's makhana market to reach ₹ 11,000 crore by 2028. Market efficiency will be improved by institutionalizing this approach through accredited grading facilities, training for farmers and traders, and improvements to rural infrastructure. The value chain can be further enhanced by integrating the Suta system with export certificates, market support regulations, and e-market platforms. A crucial structural change for equitable, open, and globally competitive makhana trade is advocated for the transition and standardization of *Suta* grading and *Bora* packaging to international standards.

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