

5. Establishment of Millets Processing Unit

Abstract:

This chapter delves into the dynamic landscape of small millet processing, addressing the escalating demand for healthful foods in India. Entrepreneurs, motivated by health-conscious consumer choices, are increasingly drawn to the small millet-processing sector. The abstract provides a comprehensive overview, spanning traditional millet processing to the machinery required for establishing processing units. Technological advancements in millet processing machines are explored, guiding new entrants in equipment selection based on their operational scale. The narrative unfolds against the backdrop of a nation prioritizing holistic well-being, where small millets emerge as nutritional powerhouses. The demand transcends national borders, resonating globally. The chapter navigates through the complexities of millet processing, contrasting traditional labor-intensive methods with contemporary centrifugal force-based machines. Processing is vital for husked millets, enhancing their edibility through cleaning, grading, and husk removal. The decline in consumption patterns due to manual processing challenges is addressed, emphasizing the transformative role of modern machines. The journey extends to millet processing requirements at various levels, from village communities to large-scale enterprises. Key considerations before purchasing millet processing machines are outlined, urging entrepreneurs to conduct market surveys, learn from successful ventures, and prioritize machine performance. The abstract concludes by positioning this chapter as a guide for individuals entering the small millet processing domain, offering insights into the industry's nuances and potential within the healthful foods market.

Keywords:

Entrepreneurs, powerhouses, labor-intensive, large-scale enterprises, millet processing.

5.1 Introduction:

The pulse of India's agricultural heartbeat resonates with a rhythmic transformation, heralded by a paradigmatic shift towards health-conscious consumer choices. Amidst this evolution, a remarkable surge in the demand for healthful foods has given rise to the reinvigoration of small millets—an ancient grain family that is gaining newfound attention in contemporary dietary preferences.

This chapter embarks on an insightful journey into the heart of this metamorphosis, centering its narrative on the escalating market for small millet foods and the entrepreneurial interest kindled by this trend. As health and nutrition awareness permeates through diverse strata of society, small millets are emerging as a beacon of nutritional excellence. Entrepreneurs, attuned to this evolving landscape, are increasingly drawn towards the small millet-processing sector, recognizing both the nutritional richness and economic viability of these grains. The narrative unfolds against the backdrop of a nation seeking holistic well-being, where consumers are not merely making food choices but embracing a lifestyle centered around nourishment and vitality. Intriguingly, the demand for millets is not

confined within national borders; it reverberates globally. This chapter contends with the multifaceted dynamics of this growing market, probing into the intricacies of millet processing, which has evolved from a traditional, labor-intensive practice to a sophisticated and efficient domain, thanks to technological innovations in millet-processing machinery. The traditional narrative of women manually hulling small millets using pestle and mortar or wooden/stone grinders, woven with elements of drudgery and time-intensive labor, is juxtaposed against the contemporary tableau of centrifugal force-based millet processing machines. These technological marvels not only promise efficiency but also bear the promise of rejuvenating the consumption of small millets, which had dwindled in production regions due to the burdensome traditional processing methods. In this evolving narrative, the introduction sets the stage for a comprehensive exploration of the why and how behind millet processing. It delineates the imperative role of processing in rendering husked millets suitable for human consumption, laying bare the essential steps of cleaning, grading, and husk removal. The dichotomy between traditional methods and modern machinery underscores the need for a technological leap in the small millet-processing sector.

It aspires to guide entrepreneurs, enthusiasts, and researchers through the intricate landscape of millet processing, unraveling not just the complexities but also the immense potential that lies within the folds of this ancient yet resurgent grain family. The market for healthful foods is increasing rapidly in India, as there is increasing health and nutrition awareness across the different sections of the society. As part of this growing market for healthful foods, the market for small millet foods is also on the rise. To capture this business opportunity, the reason increasing interest among the entrepreneurs to enter into the small millet-processing sector in the recent past.

5.2 Millet Processing Machine:

The demand for millets, both domestically in India and on the global stage, has soared, fueled by a surge in health consciousness among consumers who seek the pinnacle of quality in millet grains (shah et al., 2023). The linchpin of meeting this demand lies in the relentless pursuit of advancements and upgrades in millet-processing machinery. Understanding the intricacies of millet grains becomes paramount in this context. In India, a rich tapestry of nine distinct millet varieties unfurls, each contributing its unique flavor, texture, and nutritional profile to the culinary spectrum. The classification into two main categories, naked and husked millets, delineates the diverse landscape of this ancient grain family.

Naked grains, such as Sorghum (Jowar), Pearl Millet (Bajra), and Finger Millet (Ragi), stand distinguished by their lack of husk. In contrast, husked grains, encompassing Foxtail Millet, Little Millet, Barnyard Millet, Kodo Millet, Brown top Millet, and Proso Millet, carry an additional husk layer. The demand for millet grains of the highest quality propels us into the realm of millet-processing machinery. The traditional narrative of painstaking manual processing, often performed by women using pestle and mortar or wooden/stone grinders, is giving way to a new era. This era is defined by the efficiency, precision, and scale achievable through advanced millet-processing machines. As individuals across the globe embrace health-conscious lifestyles, the spotlight on millets intensifies.

It is the millet-processing machines that serve as the linchpin, ensuring that the journey from the fields to the consumer's plate is not just efficient but also preserves the integrity of these nutritional powerhouses. This chapter navigates through the dynamic landscape of millet processing, shedding light on the machinery that not only addresses the rising demand but also plays a pivotal role in sustaining the health-centric choices of a discerning consumer base.

5.2.1 Why Processing is Essential for Husked Millets:

- **Enhancing Edibility:** Processing husked millets is a fundamental step to enhance their edibility for human consumption. This comprehensive process involves cleaning, grading, and meticulous removal of husks, as the indigestible nature of husks poses a challenge to human digestive systems.
- **Traditional Manual Practices:** Historically, the hulling of small millets was entrusted to the skilled hands of women in production regions. Armed with pestle and mortar or wooden/stone grinders, these traditional methods were deeply embedded in local practices due to the absence of adequate processing infrastructure.
- **Limited Local Processing Infrastructure:** The absence or scarcity of local processing infrastructure in villages compelled reliance on manual methods. The traditional techniques persisted due to the lack of advanced machinery, creating a scenario where processing remained a labor-intensive task primarily conducted by women.
- **Drudgery and Time-Intensive Nature:** The traditional manual hulling process, while culturally significant, imposed a heavy burden of drudgery and consumed substantial time. The intricate and laborious task undertaken by women in production regions contributed to the challenging nature of husking, impacting both physical well-being and daily schedules.
- **Decline in Consumption Patterns:** The cumulative effect of manual husking's drudgery and the absence of processing infrastructure resulted in a notable decline in the consumption of small millets within production regions. The demanding nature of the traditional process acted as a deterrent, leading to a shift away from small millets as a dietary staple.
- **Revitalizing Consumption through Innovation:** This chapter delves into the transformative role of modern millet-processing machines in alleviating the challenges posed by traditional methods. By streamlining the processing workflow, these innovations not only ensure the removal of husks but also contribute to revitalizing the consumption of small millets, marking a pivotal shift in the trajectory of millet processing practices.

5.2.2 Methods of Processing Millets:

In the intricate realm of millet processing, the challenge lies in the steadfast bond between the husk and the grains, demanding the application of force for separation (Covington, 2021). Two pivotal forces come into play: shear force and impact force. The traditional method of manual hand pounding, though laborious, is a testament to the resilient spirit of communities, resorted to only on special occasions, resulting in millets deemed tastier than their market counterparts, according to the insights shared by tribal women. Amidst the challenges of manual processing, a technological metamorphosis unfolds with the

introduction of millet processing machines. These machines operate on the principle of centrifugal force, revolutionizing the husk removal process. As the husked grains make contact with the cast iron within the machine, the outer covering succumbs to the impact force, breaking away seamlessly. This mechanized approach not only streamlines the arduous task of husk removal but also enhances the overall efficiency of millet processing.

The testament provided by tribal women underscores the intrinsic connection between traditional methods and the sensory experience of the final product. As we traverse the landscapes of rural millet processing, understanding the amalgamation of forces that contribute to the dehusking process becomes essential (Fuller et al., 2010). It is this delicate interplay of shear force, impact force, and human expertise that shapes the narrative of millet processing in rural areas. Having navigated the basics of millet processing, the journey now beckons towards the machinery that propels this transformation. This chapter unfurls the intricate details of setting up a millet processing unit, exploring not only the technical aspects of machinery but also delving into the strategic layout and design considerations that underpin the establishment of these essential hubs in the heart of rural millet-producing regions.

5.2.3 Millet Processing Machinery required for setting up a small-scale Unit:

To understand millet processing, I had an opportunity to visit the Primary Processing Unit at the Indian Institute of Millets Research, Hyderabad. To set up a unit we require machines for cleaning, grading, dehulling, and finally the quality product. Let us know about these machines.

- **Grader-cum-Aspirator:** The grader is used for separating the inert materials like big stones, sticks, sand, grass, etc. from the grains (Gettens and Stout, 2012). Sieves of different sizes separate these. Care should be taken to select the right sieve size and the operator should see that the holes of the sieve are not clogged. Generally, a triple deck grader with three sieves is used. The top sieve helps in separating the big sticks, stones, and grasses, the middle one separates the good quality grains, and the bottom separates the fine and coarse sand particles. The aspirator has a small fan that sends the dust and light particles to the rear end.
- **Destoner-cum-Aspirator:** The grains coming from the grader are put into destoner for removing the small stones and mud balls, which are identical to the size of the grains. Destoner works based upon gravitational principles. There are two sieves in this machine. The millet grains after falling on the destoner bed, the lighter material moves to the front and the heavy materials towards the back. The air adjustment slot is to be adjusted as per requirement. It is better to have a Variable Frequency Drive, which lessens the mechanical and electrical stress on the machine. This reduces the wear and tear of the machine.
- **Dehuller-cum-Aspirator:** After proper cleaning and grading, the millet grains are put into dehuller for husk removal. There are two types of dehuller, one is the Centrifugal and the other is the Abrasive dehuller.
- **Centrifugal Dehuller:** It has an impeller that is responsible for the removal of husk from the millet grains. When the grains are put into the hopper, it enters the impeller, where it is thrown with a great centrifugal force onto the hard casing of the impeller

(Chen et al., 2023). Due to heavy impact force, the husk gets separated. The lighter husk is collected at the back and the dehulled grains are collected at the front. The efficiency of the machine is measured based on the hulling recovery and the retention of bran on the grains.

- **Abrasive Dehuller:** They are classified into two types, one is the Emery abrasive, and the other is the rubber roller type. In Emery type, two grinding stones are used. One stone is stationary and the other rotates at a constant speed.

5.2.4 Choosing Set of Equipment Based On the Planned Scale of Operation:

This section will help the new entrant to assess his/her requirement of machines and other requirements for setting up Small Millet Processing Unit (SMPU) (Dixit et al., 2016). It will also give him/her information on the equipment available in the market with contact details of manufacturers.

Table 5.1: Requirement of equipment for SMPU at different levels

Description of requirement	Village/ community scale	Small scale enterprise	Medium scale enterprise
1.Capacity	50kg/hr	100 kg/hr	500-1000 kg/hr
2. Manpower	2 persons	2 to 10 persons depending on the volume of operations	15 to 30 persons depending on the volume of operations
3.Infrastructure	200 sq. ft. floor area	1200 sq. ft. floor area Godown to stock 2 to 4 tonnes of materials	5000 to 10000 sq. ft. floor area Godown to stock 10-20 tonnes of materials Pick-up vehicle Open yard for drying, sorting and cleaning grains A small off ice room
4. Equipment	Decided based on locally grown small millet crops	Decided based on actual small millet crops to be processed	Decided based on actual small millet crops to be processed

Description of requirement	Village/ community scale	Small scale enterprise	Medium scale enterprise
4.1 Suggested basic equipment	Destoner-1 Grader-1 with aspirator Huller-1	Destoner-1 to 2 Grader-1 to 2 Huller-1 to 2	Destoner-4 to 8 Grader-4 to 8 Huller-2 to 4 Pulveriser-1 Semolina making machine-1 Elevators
4.2 Additional equipment		Pulveriser-1	Polisher-1
4.3 Investment required (approximately)	Rs.1.5 lakhs	Rs.2.5 to 3.5 lakhs	Rs.10 to 30 lakhs

5.2.5 Manufacturers of Millet Processing Machine:

- Perfura Technologies (India) Pvt. Ltd
- AVM Engineering Industries
- Victor Agro Sales
- Agromech Engineers
- KMS Industries
- Borne Technologies Private Ltd

5.2.6 Millet Processing Machine Requirements and Infrastructure at a different level:

A. Village/Community Level:

- **Space Requirement:** A modest 200 square feet floor area sets the stage for millet processing at the village/community level.
- **Essential Machinery:** A cost-effective solution comprises a Destoner-cum-Grader with Aspirator and a Table top Dehuller, boasting a capacity of 50kg/hr. (Selvi et al., 2021). This project, costing approximately 2 lakhs, is a testament to efficiency, designed for seamless operation by two individuals and adaptable to a single-phase power supply.

B. Small Scale Level:

- **Space Requirement:** As ambitions grow, a minimum of 1200 square feet floor area becomes the canvas for small-scale millet processing endeavors.

- **Essential Machinery:** The arsenal expands to include a Destoner, Grader, and 2 Dehullers, each contributing to a capacity of 100 kg/hour. With an estimated cost ranging between 4-5 lakhs, this setup lays the foundation for increased production and efficiency.

C. Medium Scale Level:

- **Capacity and Infrastructure:** Stepping into the medium-scale domain, the operation envisions a capacity of 500-1000 kg/hour and demands a more substantial space of 5000 to 10,000 square feet.
- **Machinery Ensemble:** The machinery ensemble includes 4 to 8 Destoners and Graders, coupled with 2 to 4 Dehullers. For value addition, the introduction of a Pulveriser, Semolina Machine, and Flakes Making Machine is advocated.
- **Cost Implications:** This venture entails a more significant investment ranging from 20-30 lakhs, reflecting the scale and potential for value addition in this enterprise.

D. Large Scale Level:

- **Epicenter in Nashik:** For those aiming for large-scale millet enterprises, the thriving hub of Nashik beckons. Here, the scale reaches new heights with a potential investment ranging from 60-70 lakhs, indicative of the expansive operations and advanced infrastructure.

5.2.7 Points to Consider Before Purchasing Millet Processing Machine:

A. Market Potential Analysis:

In-Depth Survey: Conduct a comprehensive survey and thorough research to gauge the market potential before embarking on a millet processing project. Understand the dynamics of demand, competition, and consumer preferences to inform a strategic and informed approach.

B. Learn from Successful Enterprises:

Field Visits to Enterprises: Embark on field visits to successful millet processing enterprises. Scrutinize their journey, learning from their triumphs and challenges during the initial stages. This firsthand knowledge is invaluable in navigating potential pitfalls and optimizing strategies.

C. Performance Check of Machines:

In-Depth Machine Evaluation: Prioritize a meticulous examination of millet processing machines. Assess their performance, durability, and efficiency. Engage with manufacturers, seek referrals, and perhaps even witness the machines in action before making a purchase decision.

D. Entrepreneurial Training:

Training for New Entrepreneurs: Acknowledge the learning curve and encourage new entrepreneurs to undergo specialized training programs. Equip them with the essential skills and insights required for efficient millet processing operations. This proactive approach can significantly enhance the chances of success.

E. Precision in Sieve Size and Grain Dimensions:

Technical Understanding: Develop a profound understanding of sieve sizes relevant to millet grains. Grasp the nuanced relationship between sieve dimensions and the varied sizes of millet grains. This technical expertise ensures precise processing, avoiding inefficiencies or quality compromises.

F. Evaluate Financial Viability:

Cost-Benefit Analysis: Conduct a thorough cost-benefit analysis encompassing not only the machine procurement costs but also operational, maintenance, and ancillary expenses. Ensuring financial viability is essential for the sustained success of the millet processing venture.

G. Compliance with Regulatory Standards:

Adherence to Regulations: Familiarize yourself with and adhere to regulatory standards and certifications applicable to millet processing. Compliance ensures the production of high-quality, safe products and fosters consumer trust.

H. Supply Chain Considerations:

Strategic Supply Chain Planning: Strategically plan the supply chain from raw material sourcing to distribution. Establish reliable suppliers, optimize logistics, and ensure a seamless flow from production to market to avoid bottlenecks and disruptions.

I. Environmental Sustainability:

Sustainable Practices: Incorporate environmentally sustainable practices in millet processing operations. Consider eco-friendly packaging, waste management, and energy-efficient processes to align with contemporary consumer expectations and global sustainability trends.

J. Customer Feedback Mechanism:

Establish Feedback Mechanism: Implement a robust mechanism for gathering customer feedback. This iterative process allows for continuous improvement in product quality, processing efficiency, and overall customer satisfaction.

5.3 Future Perspectives:

- **Technological Advancements:** The future holds promising prospects for continued technological advancements in millet-processing machinery. Innovations such as AI-driven sorting, robotic processing, and sustainable energy solutions are anticipated, fostering greater efficiency and sustainability in the processing chain.
- **Global Market Expansion:** The burgeoning demand for healthful foods transcends geographical boundaries. Small millets, with their nutritional richness, are poised to capture a more significant share of the global market. Entrepreneurs and enterprises may explore export opportunities, contributing to the economic growth of regions engaged in millet cultivation.
- **Diversification of Millet-Based Products:** Beyond grains, the diversification of millet-based products is a compelling avenue. Entrepreneurs may explore value addition through the creation of millet-based snacks, flours, beverages, and ready-to-eat meals, aligning with diverse consumer preferences.
- **Community-Centric Processing Hubs:** The establishment of community-centric millet processing hubs may witness a surge. These hubs, equipped with shared processing facilities, can empower local communities, especially women, and contribute to rural development, fostering a sustainable and inclusive millet ecosystem.
- **Research and Development Initiatives:** Investment in research and development initiatives is pivotal. Collaborations between research institutions, government bodies, and private enterprises can drive innovation in millet varieties, processing techniques, and nutritional enhancements, ensuring the continued relevance of small millets in evolving dietary trends.
- **Consumer Education and Awareness:** A key aspect of the future involves intensifying efforts in consumer education and awareness. Communicating the nutritional benefits, ecological sustainability, and cultural significance of small millets can stimulate increased consumer demand, further propelling the growth of the industry.
- **Policy Support and Incentives:** Government policies and incentives that promote millet cultivation and processing can be instrumental. Supportive measures, such as subsidies, streamlined certification processes, and market linkages, can incentivize farmers and entrepreneurs to actively participate in the small millet value chain.

5.4 Conclusion:

In conclusion, the exploration of small millet processing unveils a transformative narrative woven with threads of tradition, innovation, and entrepreneurial zeal. As health-conscious consumer choices reshape the dietary landscape in India and beyond, small millets emerge not only as ancient grains but as modern solutions to nutritional excellence.

The trajectory from laborious manual processing to the efficiency of advanced millet-processing machines signifies a paradigm shift, breathing new life into the consumption of these nutritional powerhouses. The imperative role of processing in rendering husked millets suitable for human consumption underscores the need for technological advancements. Centrifugal force-based machines, in contrast to traditional manual methods, stand as symbols of progress, promising not only efficiency but also the revival of small millet consumption that had waned in production regions. The chapter's blueprint for

establishing millet processing units, its insights into machinery requirements, and the considerations for prospective entrepreneurs form a roadmap for those venturing into this domain. The multifaceted nature of millet processing, encapsulating cultural, societal, and economic dimensions, unfolds as a tale of resilience and adaptability.

5.5 References:

1. Chen, Z., Wassgren, C., Tamrakar, A., and Ambrose, R. K. (2023). Validation of a DEM Model for Predicting Grain Damage in an Industrial-Scale Handling System. *Smart Agricultural Technology*, 100274.
2. Covington, C. (2021). *Vibrational Nutrition: Understanding the Energetic Signature of Foods*. Simon and Schuster.
3. Dixit, A. K., Rawat, I., Sharma, S., Mann, S., and Kumar, R. (2016). Entrepreneurship through EDP and Licensing of Post-Harvest Technology: An Impact Assessment. *Indian Journal of Economics and Development*, 12(4), 679-686.
4. Fuller, D. Q., Allaby, R. G., and Stevens, C. (2010). Domestication as innovation: the entanglement of techniques, technology and chance in the domestication of cereal crops. *World archaeology*, 42(1), 13-28.
5. Gettens, R. J., and Stout, G. L. (2012). *Painting materials: a short encyclopedia*. Courier Corporation.
6. Selvi, D. T., Hepziba, S. J., and Kanjana, S. (2021). Livelihood improvement of under privileged farming community of Theni, Madurai and Dindigul districts of southern Tamil Nadu through minor millet seed production. *Indian Journal of Extension Education*, 57(3), 41-46.
7. Shah, P., Dhir, A., Joshi, R., and Tripathy, N. (2023). Opportunities and challenges in food entrepreneurship: In-depth qualitative investigation of millet entrepreneurs. *Journal of Business Research*, 155, 113372.