

Job Role MILLET PRODUCT PROCESSOR

QUALIFICATION PACK: Ref. Id. FIC/Q1011

SECTOR: Food Processing

NSQF Level: 3

Grade: 9



विद्यया ऽ मृतमश्नुते



एन सी ई आर टी
NCERT

PSS Central Institute of Vocational Education, Bhopal

(A constituent Module of National Council of Educational Research and Training, Ministry of Education, Government of India)

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FOREWORD

India has a rich tradition of cultivating and consuming millets, which are now being recognized worldwide as “nutri-cereals” for their nutritional value and resilience to climate change. In line with the Government of India’s efforts to revive and promote millets, the vocational course on Millet Product Processor (Qualification Pack: Ref. Id. FIC/Q1011) has been developed for students of grade 9 under the Food Processing sector.

This Module has been designed to equip learners with the knowledge and practical skills required to process, prepare, and package millet-based products. The curriculum aligns with NSQF Level 3, focusing on hands-on training, entrepreneurial orientation, and employability skills. Through this, students will not only understand the importance of millets in nutrition and food security but also gain competencies for future career opportunities in the growing food processing industry.

We hope that this Module will inspire young learners to take pride in India’s millet heritage, develop innovative millet-based products, and contribute to building a healthier nation. Teachers, trainers, and students are encouraged to make full use of this resource to promote both skill development and sustainable food practices.

**New Delhi
September 2025**

**Dinesh Prasad Saklani
Director
National Council of Educational Research and Training**

ABOUT THE MODULE

The Grade 9 Millet Product Processor Module is a part of the vocational education curriculum under the NSQF (National Skills Qualifications Framework). This Module serves as a comprehensive resource for learners, educators, and practitioners involved in the processing and promotion of millets. It is structured into five key Modules, each focusing on a critical aspect of millet-based food processing and safety, with a balance of theoretical understanding and hands-on application.

Module 1, Introduction to Millets and Their Importance, sets the stage by exploring the significance of millets in relation to nature, farmers, and consumers. It provides an overview of the various types of millets and highlights their health benefits, making a compelling case for their inclusion in daily diets.

Module 2, Prepare for Processing, delves into the pre-production phase. It guides learners through planning for processing, procuring raw materials, ensuring hygienic storage of ingredients, and maintaining cleanliness and functionality of the work area and equipment — all essential for safe and efficient food production.

Module 3, Primary Processing of Millets, introduces learners to the first stage of millet transformation. It includes practical sessions on cleaning, grading, dehushing, and identifying different primary processed millet products, thereby equipping students with foundational processing skills.

Module 4, Secondary Processing of Millets, takes learning a step further into value addition. This Module covers the preparation of various millet-based products, introduces product categories, and teaches the fundamentals of packaging and labelling — critical for product presentation and marketing.

Module 5, Food Safety and Hygiene, emphasizes the importance of cleanliness and regulatory compliance in food processing. It covers personal and workplace hygiene, food safety protocols, and the necessary documentation to meet food safety standards.

Altogether, this Module aims to build technical competency, promote safe food handling practices, and empower learners to contribute meaningfully to the growing millet-based food sector. It combines scientific knowledge with skill-based learning, making it ideal for vocational education, school curriculum, and small-scale food enterprise training.

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(ii)

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PSSCIVE Team

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Module 1 Introduction to Millets and Their Importance

About the Module

This module introduces students to millets, their types, nutritional value, and significance in agriculture and human health. It highlights the environmental sustainability of millet cultivation, their resilience to climate change, and their role in ensuring food and nutritional security. Students will explore how millets support rural livelihoods and contribute to the economy. The module emphasizes the government's initiatives to promote millets and their growing demand in global markets. By understanding the importance of millets, learners will be able to appreciate their value as superfoods and their potential to address malnutrition and lifestyle-related health problems.

Learning Outcomes

- Explain the importance of millets in human nutrition and health.
- Identify different types of millets and their characteristics.
- Describe the environmental and economic benefits of millet cultivation.

Importance

Welcome, students! In this exciting Module, we'll dive into the world of millets – those tiny but mighty grains that are making a big comeback. You might have heard your grandparents talk about them, or seen them on the shelves in health food stores. But millets are much more than just a "health fad." They are a vital part of India's agricultural heritage, packed with nutrients, and incredibly important for sustainable farming. As future Millet Product Processors, understanding millets is the first step towards a fulfilling and impactful career.

This Module will equip you with the basic knowledge about different types of millets, their origins, nutritional value, and global significance. Get ready to discover the amazing potential of these ancient grains!

SESSION 1: SIGNIFICANCE OF MILLETS: NATURE, FARMER AND CONSUMER

Let's begin with a quick thought:

"Can a humble grain change the world?"

What if there was a food that cared for the Earth, supported our farmers, and made us healthier? That food exists—and it's called millet!

1. What are Millets?

Millets are a group of small-seeded grasses grown mainly in semi-arid regions. They have been a traditional staple in India for centuries. Unlike polished rice or refined wheat, millets are rich in nutrients, require less water to grow, and are climate-resilient crops.



Did You Know?

India is the largest producer of millets in the world!

These are often referred to as coarse grains, nutri-cereals, *Shree Anna* emphasizing their nutritional benefits.

Millets like: Ragi (Finger millet), Jowar (Sorghum), Bajra (Pearl millet), Kodo, Foxtail, Little, Barnyard millets etc., are a powerful solution for food and nutritional security, especially in arid and semi-arid regions where other crops struggle. With their natural ability to thrive in poor soils, withstand drought, and grow with minimal water and inputs, millets are champions of climate-resilient and sustainable agriculture. These grains are rich in calcium, iron, and dietary fibre, making them vital in fighting malnutrition—especially among women and children. Beyond health, millets empower smallholder farmers by offering low-risk cultivation and opportunities for value-added products and export. Global organizations like FAO and ICRISAT are helping revive millet farming through research, training, and support for farmers.

Let's explore how this simple grain impacts nature, the farmer, and you—the consumer!

Millets and Nature: A Gift to the Environment

Have you heard the terms “Climate Change” or “Global Warming”? These terms caution us to adopt a lifestyle that is aligned with nature and not to harass nature's wealth. Millets are considered nature's best friends, and the reasons are listed in the table below:

Feature	Why It Matters
Drought-tolerant	Need very little water to grow.
Low input farming	No need for chemical fertilizers or pesticides.
Grows on poor soils	Can grow even where wheat and rice fail.
Short growing period	Ready for harvest in 60–90 days.
Less carbon footprint	Contributes to climate-smart farming.
Can Withstand	High heat and low rainfall

Think About It:

Which crop do you think saves more water—rice or millets?
Rice = ~4,000 litres/kg

Millets = ~250–500 litres/kg

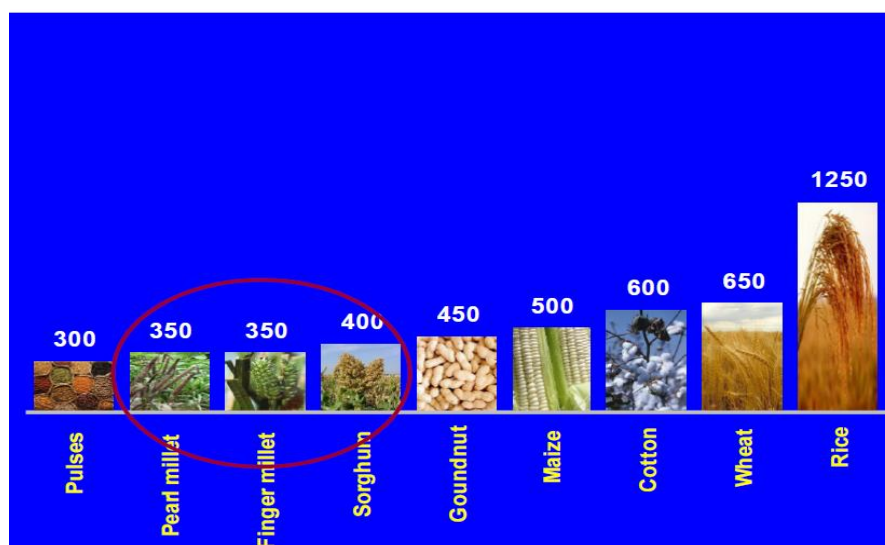


Fig. 1.1: Rainfall requirement (mm) to grow crops

Source: IIMR, Hyderabad, India.

Millets and Farmers: Food Security and Freedom

Millets have a short growing season and can thrive in harsh climates, making them ideal for resource-poor regions. They require minimal water and inputs, making them climate-resilient and environmentally friendly. Traditional farming involves mixed cropping, helping improve soil health and reduce pests. Modern techniques like improved seed varieties, precision farming, and pest management are boosting millet yields.

Understanding millet cultivation from soil preparation to harvest is key to promoting sustainable agriculture.

Risk-free farming: Even in bad weather, they often give some yield.

Local food systems: Farmers can consume and sell them locally.

Affordable to grow: No high-cost seeds or chemical sprays needed.

Revives traditional farming: Millets connect farmers to ancestral wisdom.

SESSION 2: OVERVIEW OF TYPES OF MILLETS

Major Millets: These are the most commonly cultivated and consumed millets.

Sorghum (Jowar): Widely grown in Maharashtra, Karnataka, and Rajasthan. It's used to make jowar roti (bhakri), porridge. Jowar is known for its drought tolerance and its ability to thrive in poor soils.

Pearl Millet (Bajra): Predominantly grown in Rajasthan, Uttar Pradesh, and Haryana. It's used to make roti, khichdi, and various snacks. Bajra is highly nutritious, rich in iron and fibre, and is particularly important for food security in arid regions.

Finger Millet (Ragi): Popular in Karnataka, Tamil Nadu, Chhattisgarh, Uttarakhand and Andhra Pradesh. It's used to make ragi flour, porridge, dosa, and malt beverages. Ragi is an excellent source of calcium and iron and is often recommended for infants and pregnant women.

Minor Millets: These millets are gaining popularity due to their exceptional nutritional profiles and health benefits.

Foxtail Millet (Kangni): Cultivated in Andhra Pradesh, Karnataka, and Tamil Nadu. It's used in upma, porridge, and kheer. Foxtail millet is rich in antioxidants and is known for its low glycemic index.

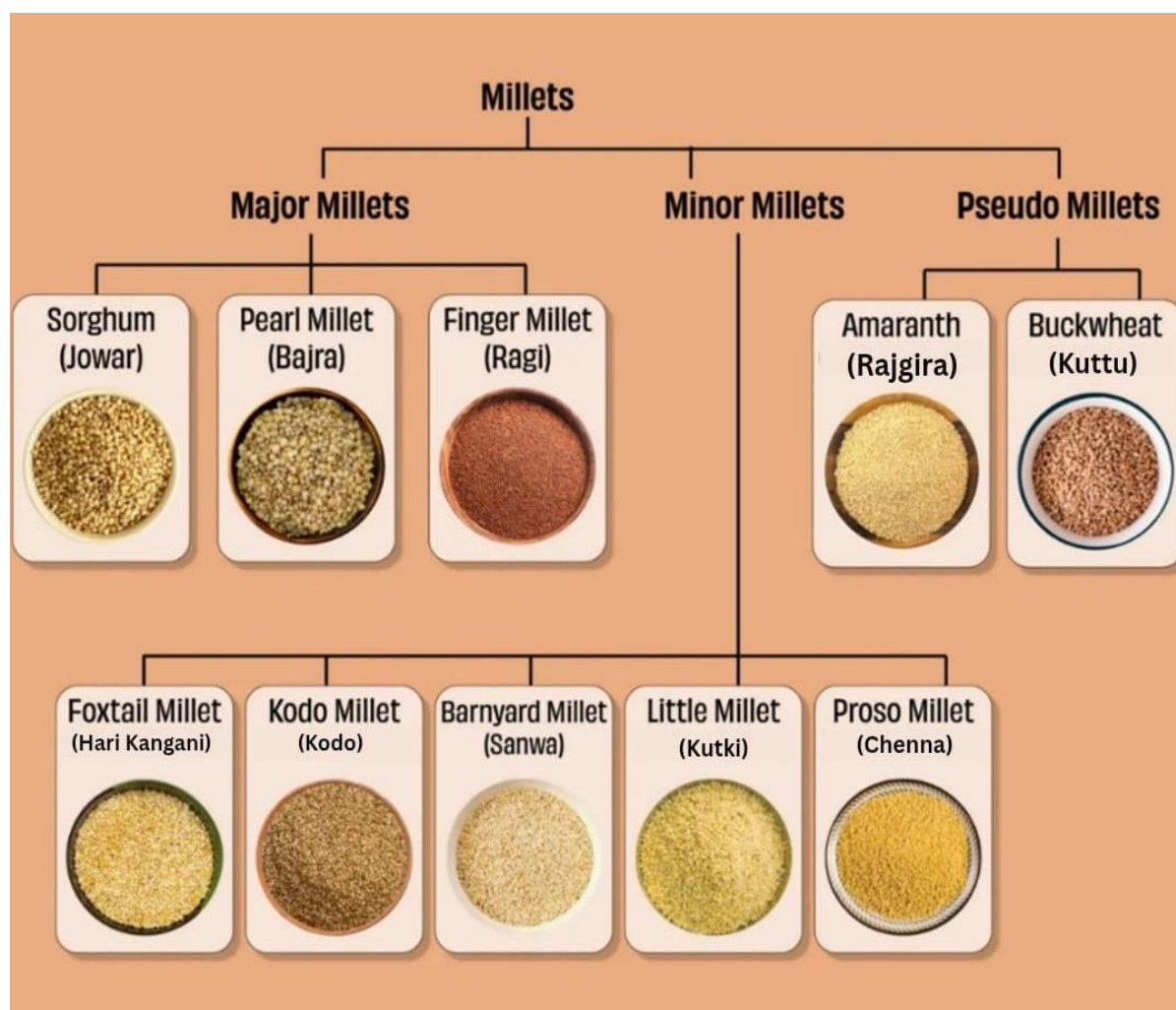


Fig. 1.2: Types of Millets

Proso Millet (Cheena): Grown in Uttar Pradesh, Rajasthan, and Madhya Pradesh. It's used in pulao, kheer and as rice. Proso millet is known for its neutral taste, easy cooking and nutritional content.

Kodo Millet (Kodon): Grown in Madhya Pradesh, Chhattisgarh, and Tamil Nadu. It's used in rice preparations, porridge, and snacks. Kodo millet is known for its medicinal properties and is often used in traditional medicine.

Little Millet (Kutki): Cultivated in Madhya Pradesh, Andhra Pradesh, and Maharashtra. It's used in rice dishes, upma, and laddoo. Little millet is rich in iron and is often recommended for people with anaemia.

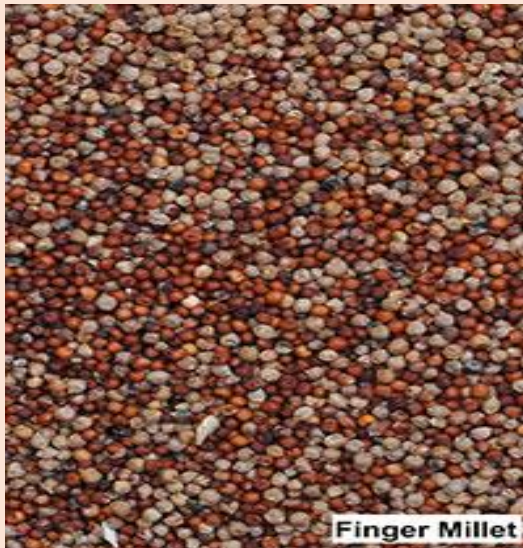
Barnyard Millet (Sanwa/Samvat): Grown in Uttarakhand, Madhya Pradesh, and Maharashtra. It's used in khichdi, kheer, and during fasting periods. Barnyard millet is a good source of iron and fibre and is often consumed during religious fasts.

Pseudo Millets (Shree Anna): *Amaranth (Ramdana/ Rajgira) and Buckwheat (Kuttu)*

MAJOR MILLETS

S. No.		Common Name
1.		✓ English: Pearl Millet ✓ Hindi, Bengali, Gujarati, Oriya, Punjabi: Bajra: ✓ Kannada : Sajje ✓ Marathi : Bajri: ✓ Tamil : Kambu ✓ Telugu : Sajja
2.		✓ English: Sorghum ✓ Hindi: Jowar, Jowari, ✓ Kannada : Jola ✓ Marathi : Jwari ✓ Tamil : Chola ✓ Telugu : Jonna sorghum ✓ Oriya : Juara ✓ Punjabi : Jowar ✓ Gujarati : Jowari,

3.



- ✓ English: Finger Millet
- ✓ Hindi: Ragi Nachni
- ✓ Kannada: Ragi, Mandua
- ✓ Marathi: Nagli, Nachni
- ✓ Tamil: Keppai, Ragi,
- ✓ Telugu: Ragi Chodi
- ✓ Oriya: Mandia
- ✓ Punjabi: Mandhuka,
- ✓ Bengali: Marwa
- ✓ Gujarati: Nagli, Bavto,

Minor Millets

4.



- ✓ English: Foxtail Millet
- ✓ Hindi: Kakun Kangni
- ✓ Kannada : Navane
- ✓ Marathi : Kang, Rala
- ✓ Tamil : Tenai
- ✓ Telugu : Korra
- ✓ Gujarati : Kang
- ✓ Oriya : Kanghu, Kangam
- ✓ Punjabi : Kangni

5.



- ✓ English: Proso Millet
- ✓ Hindi and Bengali: Cheena
- ✓ Gujarati: Cheno
- ✓ Kannada: Baragu
- ✓ Marathi: Vari
- ✓ Tamil: Pani varagu
- ✓ Telugu: Variga
- ✓ Oriya: China Bachari bagmu
- ✓ Punjabi: Cheena

6.		✓ English: Kodo Millet ✓ Hindi: Kodo ✓ Bengali : Kodo ✓ Gujarati : Kodra ✓ Kannada : Harka kodo ✓ Marathi : Kodra ✓ Oriya : Kodua ✓ Punjabi : Kodra ✓ Tamil : Varagu ✓ Telugu : Arikelu, Arika
7.		✓ English: Little Millet ✓ Hindi: Kutki, Sawan ✓ Kannada: Same, Save ✓ Marathi: Sava, Halvi, vari ✓ Tamil: Samai ✓ Bengali: Sama ✓ Gujarati: Gajro; Kuri ✓ Oriya: Suan ✓ Punjabi: Swank
8.		✓ English: Barnyard Millet ✓ Hindi: Jhangora, Sanwa ✓ Kannada: Oodalu barnyard ✓ Tamil: Kuthiraivolly ✓ Telugu: Udal, Kodisama ✓ Bengali: Shyama ✓ Oriya : Khira

Fig. 1.3: Millets and their Common names

Image Source: IIMR, Hyderabad, India

Structure of millet grains

The image illustrates the internal structure of a millet grain, technically known as a caryopsis. It highlights the various anatomical components essential to the nutritional and functional properties of millets. The outer layers include the pericarp and testa, which provide protection. Inside, the endosperm is divided into glassy and floury regions, serving as the main energy reserve, rich in starch. The aleurone layer surrounds the endosperm and is high in proteins and micronutrients. The germ or embryo comprises the scutellum, plumule, epiblast, and radicle, which are vital for germination and rich in essential nutrients. This structural understanding is crucial for processing and nutritional evaluation of millets.

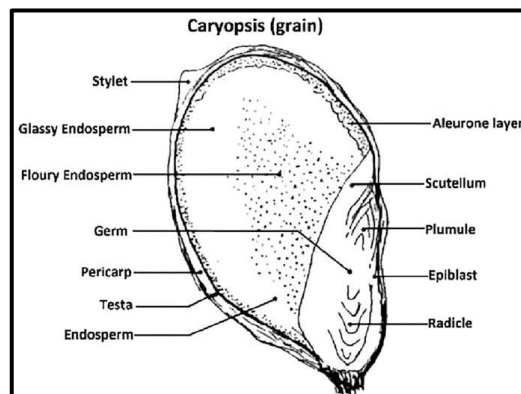


Fig. 1.4: Structure of Millet grains

Source: Dayakar Rao, B., Bhaskarachary, K., Arlene Christina, G. D., Sudha Devi, G., Vilas, A. T., and Tonapi, A. (2017). Nutritional and health benefits of millets. ICAR Indian Institute of Millets Research (IIMR) Rajendranagar, Hyderabad, 2, 38-57.

1.3 Place of Origin

Millets are among the oldest cultivated grains, with evidence of their consumption dating back thousands of years. Archaeological evidence suggests that millets were cultivated in China as early as 8000 BC and in Africa as early as 5000 BC. Most millets originated in Africa and Asia, including India.

In India, millets have been an integral part of agricultural practices and dietary habits since the Indus Valley Civilization. Remains of millets have been found in archaeological sites dating back to 5000 BC. Ancient texts, such as the Vedas, also mention the importance of millets in Indian culture. However, with the advent of the Green Revolution in the 1960s and 70s, the focus shifted to high-yielding varieties of rice and wheat, leading to a decline in millet cultivation. Nevertheless, with growing awareness of the nutritional and environmental benefits of the millets, there is a concerted effort to revive millet production and consumption.

1.4 Production and Consumption

Millets are currently grown in 131 countries, with sorghum and pearl millet accounting for over 90% of global production. (FAO 2022).

Majority of the millets are distributed in about in Africa (~48%) and in Asia (~50%) in the world.

India, USA, Nigeria, China, Ethiopia, Sudan, Niger, Burkina Faso, Chad, and Mali (Top 10 countries) produce 72.5% of the world's millet production while the top 3 countries produce 53.7% of the world's millet production. (FAO 2022).

India is the largest producer of millets in the world, with 19% of the global area and 20% of the global production and produces 11/18 millets cultivated in the world.

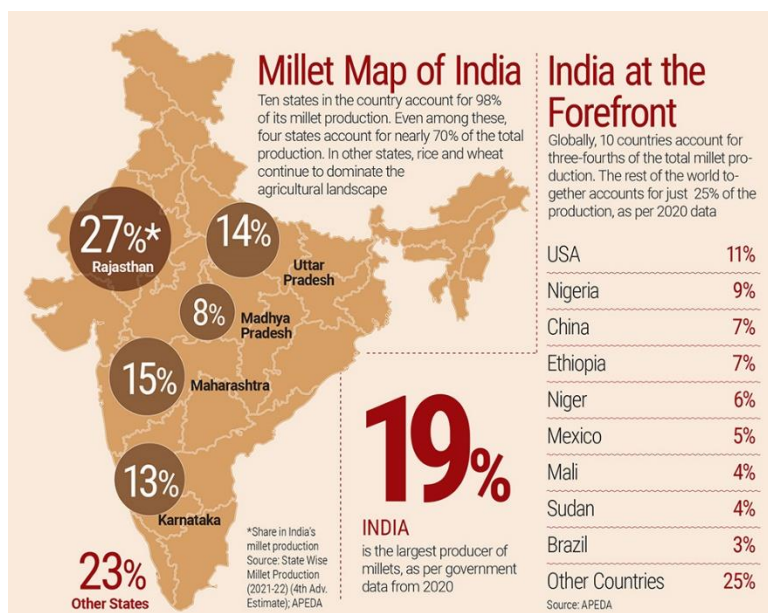


Fig. 1.5: Millets Production in India

(Source: <https://tinyurl.com/3hz3caf6>)

State-wise Millet Production in India: Rajasthan, Karnataka, Maharashtra, and Uttar Pradesh are key millets producing states in India.

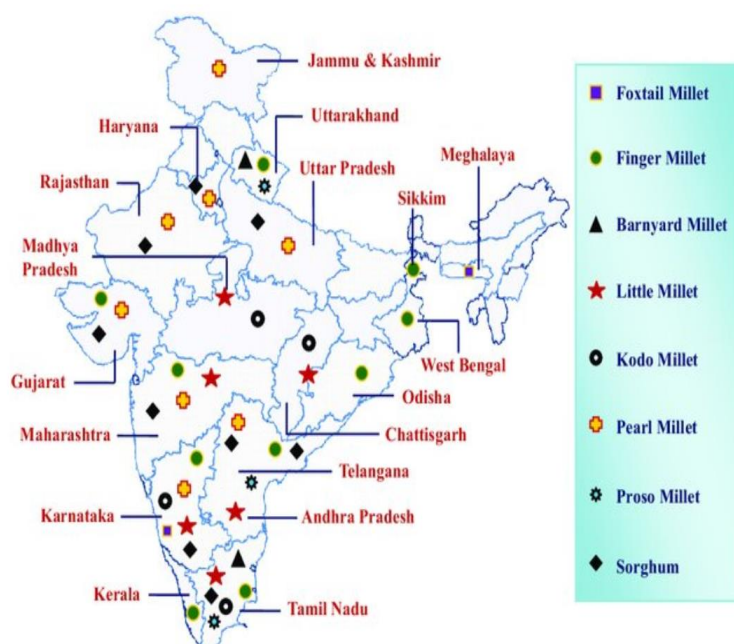


Fig. 1.6: State-wise Millet Production in India

Source: Pattanaik, S., and Priyadarshini, A. (2024). *Millets: Super Food for Nutrition Security and Livelihood Improvement. In Millets and Other Potential Crops* (pp. 11-22). CRC Press.

Activity 1: Field Visit – Exploring Millets on the Ground

Objective: To observe millet cultivation and interact with farmers.

Steps:

1. Visit a local millet farm.
2. Identify different millet crops.
3. Ask farmers about soil, water needs, and crop cycles.
4. Take photos and notes.

Worksheet: Post-Visit Reflection

- Which millets did you see?
- Describe one interesting thing you learned from a farmer.
- Make a report on your experience of the field visit.

1.5 Utilization of Millets

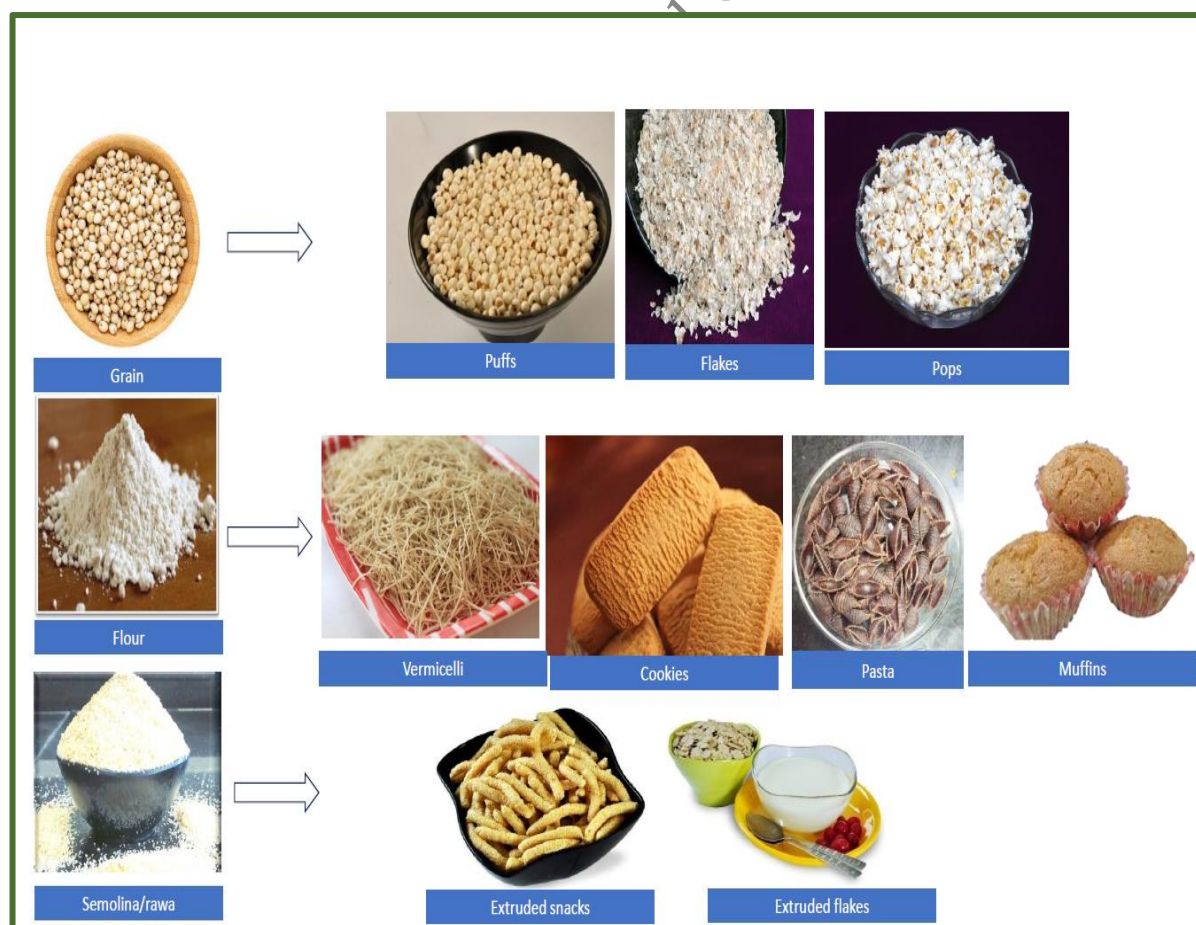


Fig. 1.7: Utilization of Millet in Food Industry
Source: IIMR, Hyderabad, India

Table 1.3: Utilization of Millet in Food Industry

Category	Examples
1. Primary Processed	De-husked millet grains, grits and flour
2. Secondary Processed	Roti (<i>bhakri</i> , <i>thalipeeth</i>), Ambali, Ragi Mudde, Millet dosa, Millet milk etc.
2.1 Ready-to-Cook	Noodles, Millet-based instant mixes, vermicelli, Wet Fermented Mixes (dosa, idli, dhokla), Millet-based pasta etc.
2.2 Ready to Eat	Millet breakfast cereals, extruded products, biscuits, cookies, crackers, muffins, bread Millet pancake, Millet-based snacks, Millet bars, Millet Pizza base, Millet weaning food, Millet Namkeen, Millet chakli etc.

Activity 2: Reviving Tradition: Millets and Culture

Millets have been part of traditional diets for generations. Ask your grandparents—what millets did they eat, and how were they prepared? You will uncover rich food traditions and local recipes that can still be relevant today!

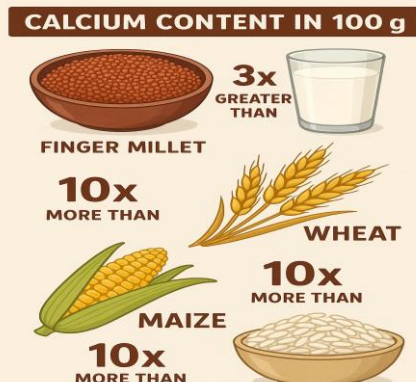
SESSION 3: MILLETS AND CONSUMERS: HEALTH IN EVERY BITE

Millets are not just ancient grains — they are smart, modern-day nutrition heroes. Packed with essential nutrients like protein, fibre, vitamins, minerals, and antioxidants, millets offer a wide range of health benefits for people of all age groups. Millets offer a range of health benefits for all age groups—including infants, lactating mothers, the elderly, and people recovering from illness. Millets are gluten free making it ideal for people having gluten intolerance or celiac disease.

Let us explore the reasons why millets are becoming more popular around the world:

Did You Know?

Ragi has 10x more calcium than wheat and 3x more calcium than a glass of milk! Great for bones and growing children.



Nutrients in Millets

Millets contain following nutrients:

- Carbohydrates for energy (300-350 kcal)
- Protein, which builds and repairs muscles (4-11 g protein)
- Fat (1-5%)
- Dietary fiber, which supports digestion and weight management (9-12 g/100 g)
- Minerals (1-4 g/100 g)

Did you know?

Finger millet (Ragi) has the highest calcium content.

Try This:

Check your home kitchen—do you have anything made from ragi, jowar or bajra?

Naturally Gluten-Free: Millets are naturally gluten-free. They are safe for people with gluten intolerance or celiac disease and serve as a great alternative to wheat and barley.

Powerful Antioxidants: Millets are also rich in powerful antioxidants. They contain plant compounds like antioxidants and phytochemicals that protect against cell damage and lower the risk of heart disease, cancer, and age-related problems.

Better Nutrient Absorption: Millets improve nutrient absorption. Processing methods like soaking, fermenting, and malting enhance nutrient bioavailability, making them easier for our bodies to take in.

Anti-nutrients: Millets also contain some anti-nutrients (like phytates and tannins) that can slightly reduce mineral absorption, these effects can be minimized through common cooking methods such as soaking, fermentation, malting, or cooking, which improve digestibility and nutrient absorption. Malted millets increase mineral bioavailability, making them ideal for infants and the elderly.

2.2 Millets and Disease Management

Millets have been proved to be beneficial for managing various disease conditions effectively.

◆ For Diabetes Management

Millets have a low glycemic index, meaning they release sugar slowly into the bloodstream. This helps manage blood sugar and improves insulin sensitivity.

◆ For a Healthy Heart

Millets help reduce bad cholesterol due to their high fibre content, support blood pressure control, and contain heart-friendly antioxidants and magnesium.

◆ For Weight Management

Because millets are high in fibre, they:

- Keep you full longer and prevents overeating.
- Help regulate body weight naturally

◆ For Better Digestion

The fibre in millets:

- Adds bulk to stools and therefore prevents constipation and reduces the risk of bowel and colon disorders.
- Supports overall gut health

◆ For Bone and Brain Health

Millets like Ragi are high in calcium and phosphorus — vital for bones and teeth.

Pearl millet contains compounds such as lecithin and cephalins that support brain function and reduce stress.

◆ For Immunity and Anti-inflammatory Support

Regular millet consumption boosts immunity and reduces inflammation markers like C-reactive protein.

Activity 3: Report on Nutritional Values

Instructions:

1. Each student picks a millet.
2. Research and create a 1-page report.
3. Include:
 - Name of Millet:
 - Nutrients Present:
 - Two Local /Traditional Dishes:
 - Two Packaged Products You Found (brands, if available):
 - What surprised you most about this millet?
 - Which millet would you add to your daily meal, and why?

Poster-Making Activity: Design a colourful poster titled: “Millets – The Grains of the Future!” Use illustrations and slogans.

Summary

Millets are a group of small-seeded grasses with a rich history and immense potential. They are drought-resistant, nutritious, and sustainable, making them a valuable crop for food security and healthy eating. In this Module, you learned about the different types of millets, their origins, global significance, nutritional value, and health benefits. You also explored real-life applications of millets in Indian settings, from traditional dishes to modern products. Understanding these concepts is essential for your future role as a Millet Product Processor. The resurgence of millets signifies a return to sustainable agricultural practices and a move towards a more nutritious and diverse diet.

PRACTICAL EXERCISE**Activity**

Q1. Collect market data on popular millet-based ready-to-eat or ready-to-cook products available online or in local stores. Prepare a chart comparing:

- Brand name
- Type of millet used
- Product form (e.g., flakes, dosa mix, cookies)
- Price per 100g
- Packaging type

Present your findings in a table and summarize which millet is most commonly used and why.

CHECK YOUR PROGRESS**A. Multiple Choice Questions (MCQs)**

1. What makes millets suitable for climate-resilient agriculture?
 - A. High water requirement
 - B. Nutritional value
 - C. Drought tolerance
 - D. Need for chemical fertilizers
2. Which of the following is a pseudo millet?
 - A. Proso millet
 - B. Kodo millet
 - C. Buckwheat
 - D. Little millet
3. Millets require approximately how many litres of water per kg compared to rice?
 - A. 4000 L
 - B. 3000 L
 - C. 1000 L
 - D. 6000 L
4. What is the glycemic index of millets like?
 - A. High
 - B. Low
 - C. Medium
 - D. Unpredictable
5. What is a common way to reduce anti-nutrients in millets?
 - A. Freezing
 - B. Grinding
 - C. Soaking and fermenting
 - D. Adding salt

B. Fill in the Blanks

1. Millets are often referred to as _____ grains or Shree Anna.
2. _____ is the richest millet in calcium.
3. _____ and _____ are examples of pseudo millets.
4. Millets are naturally free from _____, making them suitable for people with gluten intolerance.
5. Millets help reduce the risk of heart disease due to their high _____ content.

C. True or False

1. Buckwheat is a major millet.
2. India produces only 3 types of millets.
3. Millets require chemical fertilizers to grow.
4. Proso millet is also called Cheena in Hindi.
5. The FAO does not promote millet production.

D. Short Answer Type Questions

1. What are millets and why are they called “Shree Anna”?
2. List any two health benefits of consuming millets.
3. What are anti-nutrients, and how can their effect be reduced in millets?
4. Mention any two ways millets support Indian farmers.
5. What is the nutritional composition of millets (any three components)?

E. Long Answer Type Questions

1. Compare major and minor millets with examples and uses.
2. How do millets contribute to managing lifestyle diseases like diabetes and obesity?
3. Describe the structure and composition of millet grains.
4. Outline the different categories of millet processing in the food industry with examples.
5. Discuss the regional diversity of millet cultivation and usage across India.

Module 2 Prepare for Process Production

About the Module

This module focuses on the preparatory steps required before processing millets. Students will learn about cleaning, grading, drying, and storage methods essential for maintaining quality. It highlights the equipment and tools used in pre-processing and the importance of proper handling to avoid contamination. Emphasis is placed on safe workplace practices, personal hygiene, and correct storage techniques. The module also covers the importance of quality checks and the role of standard operating procedures in ensuring efficiency. By completing this module, students will be prepared to carry out millet processing in a safe, organized, and professional manner.

Learning Outcomes

- Demonstrate safe handling practices in preparing millets for processing.
- Identify and operate basic tools and equipment used in pre-processing.
- Apply cleaning, drying, and grading techniques to maintain millet quality.

Introduction

Welcome, students! Now that you know all about millets and their amazing benefits, it is time to roll up your sleeves and get ready for production. In this Module, you will learn how to plan, procure, store, and maintain everything needed to transform raw millets into high-quality food products. As future Millet Product Processors, mastering these preparation steps will ensure efficient, safe, and hygienic operations in any food production setting.

SESSION 1: PLAN FOR PRODUCTION

1.1 Work Requirement Analysis

What does “Planning for Production of Millet products” mean?

Before you produce a food product like millet upma mix or millet vermicelli, you must:

- Know what needs to be done?
- In what order?
- And who will do it?

This is called Work Requirement Analysis. In order to understand what needs to be done, you need to define the steps to be performed to make your products.

Activity 1: Define Your Product

1. Choose ONE millet-based product from below (or your own idea):
 - a. Instant Millet Upma Mix
 - b. Millet Vermicelli
 - c. Millet Ladoo Mix
 - d. Millet Energy Bar
 - e. Millet Pancake Mix

Write this in your notebook:

2. We plan to produce _____
3. Create a table in your notebook listing steps required to make your chosen product.

Define Steps in Production:

Let's take an example: Foxtail Millet Upma Mix (100kg/day)

Steps	Description
Product Formulation	Trials for the Foxtail Millets Upma recipe
Requirement of Area for Facility	Working Area as per Production Flow Cycle
Storage Facility	Clean and dry area for safe storage of raw materials and finished goods
Procurement of Raw Material	Identification of vendors to supply quality raw material regularly.
Equipment and Machinery	Procurement of required machinery as per the demand of the products. example: cleaner, grader, roaster, grinder, mixer, packaging and labelling machine etc.
Processing Techniques	Cleaning, grading, washing, soaking, drying, roasting, grinding, mixing packaging, labelling etc.
Licensing and Regulations	FSSAI, Lab Test Reports and local state regulations
Packaging and Labelling	Primarily as per FSSAI norms

1.2 Estimation of Resources: This involves figuring out the necessary staff, budget, and schedule for completing various tasks.

A. Estimating workforce: After outlining the steps in production, consider the following:

- How many people will be needed for each step?
- What skills should they have?
- How long will each step take?

Example: Millet Upma Mix

Step	Manpower Needed	Skills Required	Time
Cleaning	2	Basic sorting	1 hour
Grinding	1	Machine operation	30 mins
Mixing	1	Knowledge of recipe	30 mins
Packaging	1	Weighing, sealing	1 hour

Note: Same manpower can be used for performing other production activities also.

B. Estimating Raw Materials:

You must calculate:

- Raw millet needed (with 15-20% extra for wastage)
- Spices and ingredients
- Packaging material: size, type, number of pouches
- Labels and printing

Example Calculation:

If we aim to prepare 100 kg of the final mix, we should start with at least 100 kg of raw millets, along with an additional 20 kg of other raw materials. Since approximately 20% of the millet weight is typically lost during cleaning and grinding, the usable millet after processing will be around 80 kg.

PRACTICAL ACTIVITY

1. Pick a millet-based food item your group will plan to produce.
2. On a chart paper, draw a clear step-by-step flow diagram of your production process. Use boxes and arrows. You can also make ppt using computer. Include:
 - Each production step (in order)
 - Clear titles (e.g., Cleaning, Grading, Grinding...)
3. Annotate required manpower and raw/packaging material quantities at each step.
 - Number of people required
 - Skills needed
 - Quantity of materials (with units)
 - Packaging material required
4. Present your plan; classmates and instructor provide feedback.
 - Are all steps logical and complete?
 - Are the resource calculations realistic?
5. Incorporate feedback, refine your diagram and submit your final version to the teacher.

Worksheet Summary Page

1. Our group is making: _____
2. Total estimated quantity: _____
3. Production steps identified: _____
4. Number of people required: _____
5. Materials and packaging needed: _____

SESSION 2: PERFORM PROCUREMENT OF RAW MATERIALS

2.1 Sourcing Quality Ingredients

Imagine if your millet upma premix starts to smell bad just one week after production when it should remain good for at least three months. You investigate the issue and discover that it's due to poor-quality ingredients. This shows that sourcing good-quality raw materials is essential for the outcome of your final product and its shelf life. Getting quality ingredients from reliable vendors or suppliers leads to better taste, improved quality, and a longer shelf life.

Millet Quality Specifications

When buying millets, ask these questions:

Quality Parameter	Specification
Grain Size	Uniform grain size
Moisture Content	Less than 8 % to prevent fungal growth
Colour	Natural millet colour – no discolouration
Impurities	Free from stones, husk, and dust
Variety	Match with order (e.g., foxtail, barnyard millet)

For other ingredients, check for the quality specification as per the SOP.

Packaging Material Specifications

Always use Food-grade packaging that protects your product. Look for following attributes:

Attribute	Specification
Material	Food-safe plastic, paper, foil or any other biodegradable packaging material
Barrier	Should block moisture, light, oxygen and maintains the required structure of the product
Sealing Quality	Strong heat seals, no leakage, no spills
Size and Label Area	Enough space for all required details as per FSSAI
Sustainability	Recyclable, reusable, lesser carbon footprints, biodegradable etc.

2.2 Receiving as per Standard Operating Procedure (SOP)

SOP defines what needs to be done when ingredients arrive. When a supplier delivers millets or packaging, follow a checklist:

Step-by-Step SOP for Receiving Raw Material:

1. Receive with documents

- Delivery challan (bill),
- Quality certificate (if any)

2. Visual Inspection

- Look for colour, dust, insects and damaged bags

3. Sampling and Weighing

- Take random samples from different bags
- Weigh for quantity check

4. Record in Receiving Form

- Fill checklist
- Accept or reject delivery based on criteria

5. Store properly

- Accepted stock goes to storage room (dry, ventilated)

Sample Receiving Checklist

Item	Expected	Received	Pass/Fail
Millet variety	Foxtail millet	Foxtail millet	Pass
Moisture Level	<8%	Looks dry	Pass
Impurities	No visible dust/stones	Few husks	Needs to be rechecked
Quantity	50 kg	48.5 kg	Less than ordered
Certificate Attached	Yes	No	Not attached

PRACTICAL ACTIVITY**PROCUREMENT STEP-BY-STEP SIMULATION****1. Assign Roles:**

- 1 student: **Supplier**
- 3–4 students: **Receiving team**

2. Prepare 'Delivery Kit':

- A sack/bag of millet with labels
- Sample delivery challan and certificate

3. Inspection:

- Check for grain variety, moisture, and impurities
- Check packaging type and seal quality

4. Record in Receiving Form:

- Use printed form (see below)
- Tick items, write notes, and decide to accept/reject

5. Discuss and Solve Problems:

- What if millets have moisture?
- What if the bags are torn?

Sample Receiving Form Template

Parameter	Observation	Action
Grain type	_____	✓ / ✗
Impurities	_____	✓ / ✗
Moisture feel	_____	✓ / ✗
Packaging condition	_____	✓ / ✗
Document verified	Yes / No	✓ / ✗
Comments	_____	

Post-Activity Reflection Questions

- What mistakes were observed during procurement?
- What are the possible consequences of poor receiving practices?
- How can you train staff to follow SOP?

SESSION 3: STORE FOOD/FOOD INGREDIENTS HYGIENICALLY

3.1 Storage Principles

Even best-quality ingredients can spoil if not stored right. While storing food ingredients, ensure that you are storing food at right temperature, controlling moisture and humidity, keeping pests and rodents away considering the shelf life/expiry of the ingredients. To keep ingredients safe and fresh, we must understand their specific storage needs. Improper storage can lead to spoilage, infestation, contamination, health hazards, wastage and losses to businesses.

Millet Storage Rules

Aspect	What to Do
Temperature	Keep in a dry room
Humidity	Maintain below 40- 50% RH to prevent fungus growth
Ventilation	Allow airflow to reduce dampness
Containers	Use airtight bins or food-grade sacks
Elevation	Keep sacks on raised platforms with ventilation, not directly on the floor

Types of Other Raw Materials and Storage Guidelines

Category	Examples	Storage Needs
Dry Ingredients	Millet, grains, flour, semolina, etc.	Cool, dry room (below 25°C), airtight containers, low humidity (<50%)

Spices and Herbs	Mustard, curry leaves, turmeric, salt etc.	Airtight jars, away from sunlight, in dry conditions
Oils and Ghee	Edible oil, ghee etc.	Cool, shaded area; sealed caps to prevent oxidation
Sugars and Jaggery	Powdered sugar, jaggery blocks etc.	Moisture-proof bins, off the floor
Preservatives/Additives	Citric acid, natural colourants etc.	Labelled containers with tight lids; follow supplier instructions
Perishable Items	Fresh curry leaves, lemon etc.	Refrigerated zone (2°C to 5°C)
Packaging Material	Food-grade pouches, bags, bottles, labels	Clean, dust-free room, stored above ground, away from chemicals/moisture

Pest Management and Inspection

Practice	Purpose
Weekly inspections	Detect weevils, beetles, larvae early
Use of neem leaves/traps	Natural repellents
Clean floors and corners	Remove hiding/breeding spots
Use of wire mesh at windows	Keep rodents and insects out

Other Hygienic Practices:

- Follow First In, First Out (FIFO) and First Expiry First Out (FEFO): Think of this like milk in a fridge:
Use the oldest batch first, not the newest!
- Label all ingredients with:
 - Date of receipt
 - Batch code
 - Variety name
- Arrange stock in rows:
 - Older in front → Use first
 - Newer at back → Use later
- Ensure daily sweeping and mopping to remove dust and pest food spills.
- Protect all ingredients from insects/rodents through nets or traps

PRACTICAL ACTIVITY

Hygienic Storage

Step-by-Step Tasks for Student Groups

Activity Step

1. Clean and sanitise storage and receiving area

- Sweep, mop, sanitise bins and floors
- Remove old/damaged packaging

2. Mark Storage Zones

- Dry zone (e.g. grains, flour, spices)
- Cool zone (refrigerator if available)
- Quarantine zone (for suspicious or infested stock)

3. Demonstrate Proper Stacking

- Use pallets or racks to store sacks and jars off the floor
- Leave space between stacks

4. Label Each Item Properly

- Write ingredient name, date received, batch number
- FIFO tag (older/newer)

5. Mock Inspection: Moisture and Pest Check

- Open a few sacks or jars randomly
- Smell, look for bugs, clumping, discolouration

☐ Sample Storage Log Sheet

Date	Ingredient	Batch Code	Signs of Moisture?	Pest Activity?	Action Taken
07 May	Millet Flour	MF2025-01	No	No	Stored in Dry Zone
07 May	Jaggery Blocks	JG2025-02	Yes (sticky)	No	Quarantined
07 May	Curry Leaves	CL2025-03	No	Yes (small beetles)	Disposed

□ Tools and Materials Required

- Cleaning materials (broom, mop, sanitiser)
- Storage containers, jars, sacks
- Pallets or shelves
- Refrigerator (if available)
- Labelling materials: markers, stickers
- Log sheet printouts
- Magnifying glass (optional)

💬 Reflection Questions

- Why do some ingredients spoil faster than others?
- What could happen if storage areas are not labelled or inspected?
- How can small businesses avoid ingredient loss due to poor storage?

SESSION 4: CLEAN AND MAINTAIN WORK AREA, MACHINERY AND TOOLS

4.1 Preparing the Workspace

A Clean Layout Saves Time and Prevents Mistakes

A well-planned production area is just like a well-organized kitchen—it helps in:

- Efficient flow of materials from raw to finished product
- Cleanliness and food safety
- Reducing chances of accidents
- Easy operation and machine maintenance

Organise your production Module into these zones:

Zone	Function	Examples
Intake Zone	Raw materials received and inspected	Millets, spices, packaging materials
Processing	Washing, grinding, mixing, extruding	Planetary mixer, extruder, oven
Packaging	Weighing, sealing, labelling	Weighing scale, sealing machine
Dispatch	Final storage for ready products	Labelled cartons stored on racks

Checkpoints for Efficient Workflow

- Clear paths and work tables
- Access to water and power points
- Separate dry and wet workstations
- Colour-coded bins for waste disposal

4.2 Equipment and its Maintenance

Common Equipment and its Functions

Machine	Function
Dehuller	Removes husk from millets or pulses
Hammer Mill	Grinds grains into flour
Grinder	Pulverises dry spices and ingredients
Planetary Mixer	Mix ingredients uniformly
Cold Extruder	Shapes dough under low heat (e.g., noodles)
Hot Extruder	Cooks and shapes product (e.g., snack pellets)
Oven	Dries or bakes products (e.g., millet crackers)
Weighing Machine	Measures the exact quantity for packaging

Preventive Maintenance: Preventive maintenance is a strategy that involves scheduled inspections, servicing, and repairs of equipment and facilities. This helps prevent breakdowns and prolongs the lifespan of assets.

Task	Frequency
Clean filters and blades	Daily after use
Lubricate moving parts	Weekly
Check electrical connections	Monthly
Calibrate weighing scales	Monthly
Tighten belts and bolts	Weekly
Remove food residue from machines	After every shift

Troubleshooting Common Issues

Machine	Issue	Solution
Dehuller	Incomplete husk removal	Check settings and clean the drum
Mixer	Jerky movement	Check gears and lubricate
Extruder (hot)	Burnt smell	Clean barrel, reduce temperature
Oven	Uneven heating	Check air circulation and calibrate
Weighing Machine	Inaccurate readings	Replace the battery or recalibrate
Hammer Mill	Loud noise or clogging	Clean chute, inspect blades

CHECK YOUR PROGRESS

A. Multiple Choice Questions

1. What is the first step in planning for production?
A. Buying equipment
B. Hiring workers
C. Work Requirement Analysis
D. Cleaning raw materials
2. How much raw millet should you start with if aiming for 100 kg final mix?
A. 80 kg
B. 100 kg
C. 120 kg
D. 150 kg
3. Which of these is NOT a processing technique?
A. Grinding
B. Labelling
C. Cooking
D. Roasting
4. Which document is essential during receiving raw materials?
A. Insurance certificate
B. Delivery challan
C. Packaging license
D. Supplier agreement
5. Which machine is used to grind grains into flour?
A. Cold extruder
B. Hammer mill
C. Oven
D. Dehuller
6. FIFO and FEFO principles help in:
A. Managing workforce
B. Ensuring food safety
C. Buying new machines
D. Calculating profit

B. Fill in the Blanks

1. In production, approximately 20% of millet weight is lost during _____ and grinding.
2. All food packaging must be _____-grade.

3. Proper _____ can prevent pest infestation in storage areas.
4. Received materials must be recorded in the _____ form.
5. Labels should contain batch code, variety name, and date of _____.

C. True or False

1. Estimating raw materials includes calculation for packaging and labels.
2. Spices can be stored in moist conditions.
3. Proper sourcing of raw materials can improve the shelf life of the final product.
4. Storage rooms must have high humidity to maintain freshness.
5. Cleaning machines after every shift is part of preventive maintenance.

D. Short Answer Type Questions

1. What is Work Requirement Analysis, and why is it important?
2. Name four machines used in millet food processing.
3. List three quality parameters to check while receiving millets.
4. Mention two preventive maintenance activities for any processing machine.
5. What is the purpose of using food-grade packaging?

E. Long Answer Type Questions

1. Describe the step-by-step process for planning production of a millet-based product.
2. Explain the Standard Operating Procedure (SOP) for receiving raw materials in detail.
3. Illustrate how a production layout with designated zones improves efficiency and hygiene.
4. What is preventive maintenance? Why is it necessary in food processing operations?
5. A batch of packaged millet mix had spoilage complaints. How would you trace the problem from sourcing to storage?

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Module 3 Primary Processing of Millets

About the Module

This module trains students in the fundamental operations of primary millet processing. It includes dehusking, milling, and polishing processes that convert raw grains into edible forms. Students will understand how to use and maintain processing machinery and learn about quality control during each step. The module emphasizes the importance of minimizing wastage and maximizing yield through efficient practices. Learners will also explore challenges in processing small-sized millet grains and ways to overcome them. By mastering these skills, students will gain the confidence to carry out primary millet processing effectively and contribute to value addition in the food supply chain.

Learning Outcomes

- Perform dehusking, milling, and polishing of different millets.
- Operate and maintain primary processing machinery safely.
- Apply quality control measures to ensure high-quality millet products.

Have you ever seen grains being separated from their husk, or heard the sound of grains being ground using a traditional grinding stone? You might have noticed a family member carefully inspecting grains to remove unwanted materials such as stones, husk, or insects before cooking. Similarly, before millets can be used to prepare food items like *roti*, *idli*, or porridge, they must undergo several important initial steps. These steps are collectively known as primary processing.



Each step in primary processing has a specific purpose. In this lesson, you will learn about these steps as if you are performing them yourself!

SESSION 1: INTRODUCTION TO PRIMARY PROCESSING OF MILLETS

Primary Processing of millets is the first and most important step that prepares millets for further uses in food products. The unwanted material from millet grains is eliminated by using following five-Module operations:

1. Cleaning:

Cleaning removes dust, husk, straw, leaves, stones and other unwanted materials from the millet grains. Scalpers, screens and sieves are utilized for cleaning of the millets

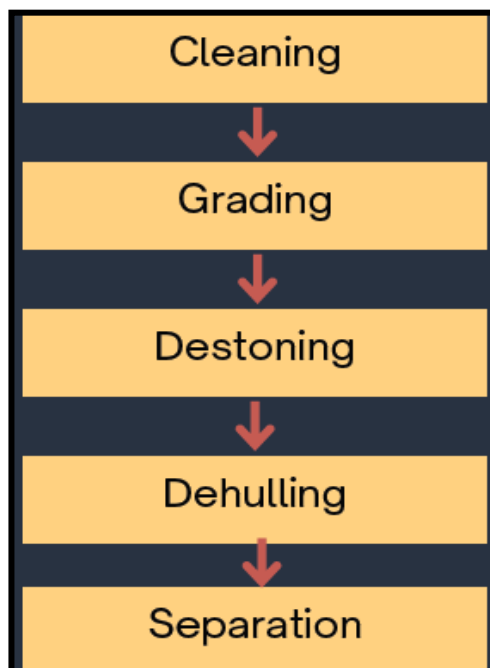


Fig.3.1: Module Operations in Primary Processing of Millets

Techniques Used:

- **Sieving:** Similar to using a kitchen sieve to remove large particles. You begin by pouring the millet into a large tray. With your fingers or a sieve, you shake it gently to remove dust.
- **Winnowing:** The lighter husk flies away as the heavier grains fall. In larger setups, machines such as aspirators, blowers, and magnetic separators are used to accomplish this task more efficiently.
- **Aspirators and Blowers:** Machines that blow away light debris.
- **Magnetic Separators:** Magnetic separators remove iron nails or metallic particles accidentally mixed with grains.
- **Specific Gravity Separators:** Separation of millets from other materials is done using specific gravity separators.

Think and Reflect:
What might happen if cleaning is skipped?

2. Grading: Sorting the Grains

Grading of millet grain is done to sort grains by size or density to group similar ones together. It ensures the uniform quality of the grain. It also eliminates the grains apart from the millets, such as rice, wheat, and pulses.

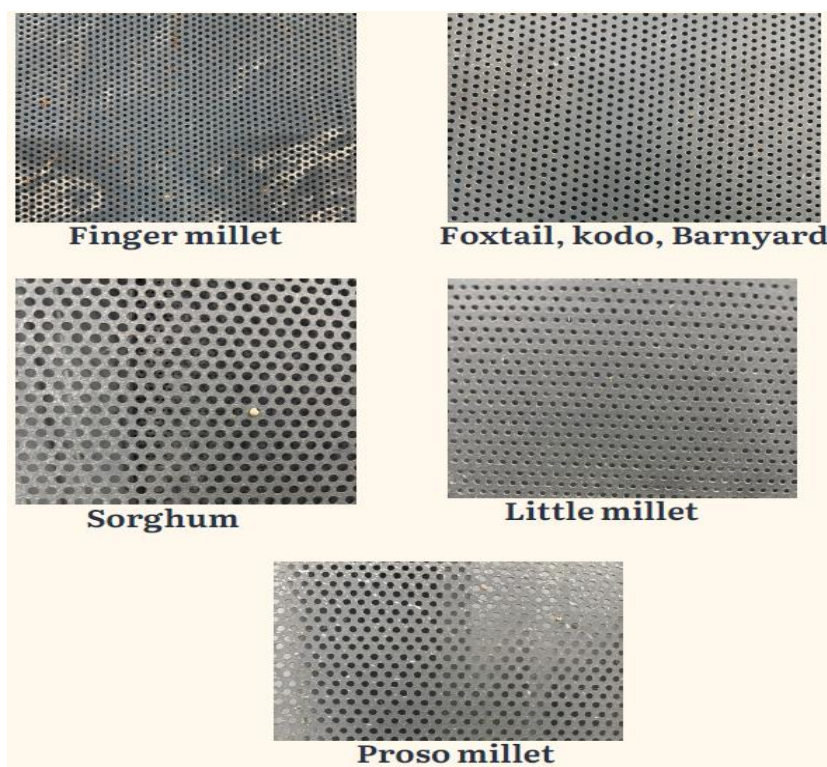


Fig.3.2: Grading Screens for Millets
(Source: IIMR, Hyderabad, India)

Same-size grains cook evenly and give a better texture to final products. You can do this using a sieve with different hole sizes or a grading screen. Grading screens or graders may vary from millet to millet based upon the size and shape of the millet grains.

Try This:

- Collect 3 types of millets. Observe and note down difference in their size and colour.
- How would grading help in this case?

3. Destoning: Removing Tiny Stones

Destoning, as the name suggests, is a process of separating stones from grains. Destoner is used to eliminate the stones in the grains. It gently vibrates and separates heavier stones from lighter grains.

Destoner Cum Grader



Fig.3.3: Destoner Cum Grader

4. Dehusking (Dehulling): Reaching the Edible Part

Dehusking, also known as dehulling, is the process of removing the outer husk from millets. Minor millets such as little millet and kodo millet have a tough, inedible outer layer called the husk, which is not suitable for human consumption. To make the grain edible, this outer husk must be carefully removed.

For this purpose, machines called dehuskers or dehullers are used. Once dehusking is complete, the grains appear cleaner, shinier, and softer. They are now ready to be used in preparing various food products.



Fig.3.4: Dehuller

The outer husk is hard and cannot be digested. Removing it allows access to the nutritious inner part of the grain, known as the kernel. The settings for dehulling—such as the impeller speed and grain flow rate—may differ depending on the type of millet. These adjustments are made based on factors like the size and hardness of the grain.



Fig.3.5: Millet Grains Before and After Dehulling

Source: <https://www.grain-processing-machine.com/Products/15T-Millet-Processing-Module.html>

5. Separation: Clearing the Mix

After the dehusking process, the output is a mixture of dehulled grains, unhulled grains, husks, and broken grains. To obtain clean, dehulled millet ready for further use, these components must be separated.

This is done using a machine called a separator. One common type is the gravity separator, which uses aspiration (air flow) to separate the lighter husk from the heavier grains based on their weight.



Fig.3.6: Continuous Primary Processing line at Indian Institute of Millets Research, Hyderabad, India

A typical millet processing Module consists of several distinct sections, each serving a specific function:

- **Raw Material Reception Area:**
 - A designated space for unloading and conducting initial inspections of raw millet.
 - Ideally located near storage and initial cleaning zones.
- **Storage Area:**
 - Facilities for holding raw millet before processing.
 - Should feature adequate ventilation and pest control mechanisms.
- **Cleaning and Pre-processing Area:**
 - Equipped with machinery to clean and remove impurities from the millet.
 - The layout should be optimized for efficient cleaning processes.
- **Processing Area:**
 - The core zone where dehulling, milling, sieving, and polishing take place.
 - Machinery arrangement should facilitate a smooth workflow with integrated dust control systems.

- **Quality Control and Testing Area:**
 - A dedicated space for performing quality checks and product testing.
 - Should be isolated from the main production area to prevent contamination.
- **Packaging Area:**
 - A section focused on packaging the finished products.
 - Ideally positioned near storage and dispatch areas for ease of operation.
- **Storage of Finished Products:**
 - Facilities for storing packaged millet products.
 - Regular temperature control and pest management practices should be in place.
- **Utility and Support Areas:**
 - Spaces designated for utilities (such as water and electricity), maintenance, and administrative functions.
 - Maintenance and operational support should be easily accessible.

Optional Steps: Based on Product Requirements

In addition to the five main primary processing steps, some optional processes may be carried out depending on the type of final product to be developed. These steps are not always necessary, but are used when a specific texture, appearance, or shelf life is desired.

Some of these optional steps include:

6. Soaking: Preparing for Milling

In some cases, before grinding, millets are soaked in water. Soaking allows the grains to absorb moisture, which makes them softer and easier to process. This step also helps in improving the digestibility and nutritional value of the grains.

7. Milling and Grinding: Transforming the Grain

Once the grains are dry, they are ready for milling or grinding. In this process, millets are broken down into different forms using a grinding machine or traditional stone grinders. The finer the grind, the quicker the grain cooks!

Millets can be processed into:

- **Grits** – Coarse and grainy texture
- **Semolina (Rava)** – Medium-coarse particles
- **Flour** – Fine and smooth powder

Each form is used in different recipes, such as porridge, rotis, or snacks.

8. Drying and Storage: Keeping It Safe

After milling, it is essential to dry the millets properly. This helps prevent the growth of fungus, mould, and other spoilage issues. Grains can be dried using an oven or a mechanical dryer.

Once dry, millets should be stored in clean, dry, airtight containers. This protects them from pests, moisture, and contamination. Use airtight containers and keep them in a cool, dry place to maintain freshness and extend shelf life.

SESSION 2: PRIMARY PROCESSED PRODUCTS OF MILLETS

Once millet grains are cleaned, dehusked, and separated, they are ready to be milled into forms like semolina, grits, and flour. These are used in making everyday foods like porridge, khichdi, upma, laddoos, cookies and pancakes.

1. Identifying Primary Processed Products of Millets

Primary processing transforms millet grains into versatile ingredients. The three common products are:

Product Name	Texture and Use	Local Name (Examples)
Grits	Coarse and grainy; used in porridge and khichdi	Daliya
Semolina	Medium-coarse; used in upma, halwa	Suji, Rava
Flour	Fine powder; used in rotis, pancakes and bakery items	Atta

2. Preparation of Semolina, Grits, and Composite Flour

After dehulling and separating the grains, they are milled into different sizes. Here is how you prepare each:

Steps for Preparation:

1. Dry the cleaned grains thoroughly in an oven before milling to reduce moisture content.
2. Use a disc mill or hammer mill to grind millet grains.
3. Pass the ground product through sieves of various mesh sizes:
 - **Large mesh:** Grits
 - **Medium mesh:** Semolina
 - **Fine mesh:** Flour

Making Mixed Millet or Composite Flour:

Composite flour is a blend of different millet flours and other flours like wheat, soya, or pulse flours. Additionally, as you are aware that millet is gluten-free therefore, its dough lacks elasticity, so blending with other flours improves structure and makes kneading of dough easy. Composite flour offers diversity in taste, texture, and nutrition.

Sample Recipe to make composite flour:

- 60% Millet flour
- 20% Wheat flour
- 20% Bengal gram flour (besan)

3. Evaluation of Physical Quality Parameters of Flour

As a Millet Processor, you must maintain the quality of the millet products. Flour serves as the base for further value-added products of the millets. Every time you make flour, you need to check the following parameters to maintain the quality and safety standards.

Parameter	What to Observe	Why It Matters
Colour	Should be natural (off-white or yellowish, depending on millet type)	Indicates freshness
Appearance	Free from lumps, pests, and discolouration	Sign of hygiene
Moisture Content	Should be $\leq 8\%$	High moisture spoils flour
Bulk Density	Check how tightly flour settles in a container	Useful for packaging/storage

4. Packaging, Labelling and Storage

Flour is delicate. If not packed and stored properly, it absorbs moisture or becomes infested with insects. Here's how to do it professionally:

Steps for Packaging and Labelling

- Choose packaging:
 - Zip-lock pouches or
 - Vacuum-sealed polybags or
 - Print and paste labels as per the FSSAI
- Storage
 - Keep in a dry and cool place
 - Use the FIFO (First In, First Out) method
 - Label storage containers/boxes clearly

Always follow FSSAI standards to ensure quality, hygiene, and safety

CHECK YOUR PROGRESS

A. Multiple Choice Questions

- What is the purpose of grading in millet processing?
 - Add flavour to the grain
 - Improve moisture content
 - Group grains by size or density
 - Polish the grains
- What process is used to remove the outer husk of minor millets?
 - Milling
 - Sieving
 - Dehusking
 - Fermentation

3. What technique is used to remove light husk from heavier grains during cleaning?
 - A. Grading
 - B. Winnowing
 - C. Grinding
 - D. Roasting
4. What is the ideal moisture content in millet flour for safe storage?
 - A. 12%
 - B. 5%
 - C. $\leq 8\%$
 - D. 15%
5. What is the function of a magnetic separator in cleaning?
 - A. Removes stones
 - B. Enhances texture
 - C. Removes metallic particles
 - D. Sorts grains by size
6. Which of the following packaging is best for long shelf life of flour?
 - A. Paper wrap
 - B. Open jars
 - C. Vacuum-sealed polybags
 - D. Cotton bags

B. Fill in the Blanks

1. The process of removing stones from millet grains is called _____.
2. _____ is the coarse product obtained from grinding millets and used in porridge or khichdi.
3. _____ separators are used to separate husk and grains based on weight.
4. The outer part of millet that is not suitable for consumption is known as _____.
5. The process of breaking down grains into finer forms is called _____.

C. True or False

1. Dehusking removes edible inner kernels from millet grains.
2. Milling helps in reducing the cooking time of millet-based foods.
3. The appearance of flour should be lumpy and discoloured.
4. Vacuum packaging helps extend the shelf life of millet flour.
5. Grits are finer than semolina.

D. Short Answer Type Questions

1. List any two-equipment used in the cleaning process of millets.
2. What are the three common forms of primary processed millet?
3. Define composite flour and mention one benefit.
4. Why is it necessary to dry millets after milling?
5. Mention any two techniques used in the grading of millets.

E. Long Answer Type Questions

1. Describe the five main steps involved in the primary processing of millets.
2. How is semolina, grits, and flour prepared from millet grains?
3. Discuss the quality parameters that must be checked in millet flour.
4. What are the roles of packaging, labelling, and storage in ensuring the quality of millet flour?
5. Explain the purpose of soaking millets and how it affects processing and nutrition.

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Module 4 Secondary Processing of Millets

About the Module

This module covers secondary processing methods that transform primary millet products into ready-to-eat or ready-to-cook food items. Students will learn about flour making, extrusion, baking, and preparation of millet-based snacks, breakfast cereals, and beverages. The module highlights innovative product development, packaging techniques, and shelf-life enhancement. It also introduces basic entrepreneurship concepts, encouraging students to think about millet-based business opportunities. Practical sessions will allow learners to develop hands-on skills in product preparation. By completing this module, students will be equipped with vocational skills that can support self-employment and contribute to promoting healthy, millet-based diets in the community.

Learning Outcomes

1. Prepare a variety of millet-based food products.
2. Apply secondary processing techniques such as extrusion and baking.
3. Demonstrate packaging and storage methods for processed millet products.

Once millets have been cleaned, graded, and milled into flour, semolina, or grits, they are ready for secondary processing. This involves converting these ingredients into consumable or ready-to-cook food items through cooking, mixing, fermenting, or baking.

In this Module, you will understand the concept of secondary processing of millets, categorize different types of value-added products, prepare selected millet-based items, and practice packaging and labelling according to basic food safety standards.

SESSION 1: SECONDARY PROCESSING OF MILLETS

Secondary processing refers to transforming primary-processed food items (cleaned, dried, or dehusked millets) into ready-to-cook or ready-to-eat products. It includes various steps such as grinding, fermenting, roasting, mixing, shaping, and packaging. This adds value, enhances shelf life, improves taste and texture, and increases consumer convenience.

Importance of Secondary Processing:

- Increases shelf life and marketability
- Enhances nutrition and digestibility
- Provides convenience to consumers
- Promotes entrepreneurship and income generation

TECHNIQUES EMPLOYED IN SECONDARY PROCESSING OF MILLETS

TRADITIONAL THERMAL TECHNIQUES

1. Steaming

- **Process:**

- Cleaned millets are soaked to increase moisture.
- They are steamed using traditional steamers or pressure steamers.
- After steaming, grains are flattened into flakes using a flaker or roller.
- Flakes are then dried in a dryer.

- **Benefits:**

- Enhances antioxidants and nutritional value.
- Improves digestibility, especially in sorghum.
- Makes the grain whiter and softer.

2. Roasting

- **Process:**

- Whole or ground millet is dry-heated in an iron pan or industrial roaster.
- Temperature is maintained between 120°C–180°C.
- Roasted grain is used for flours or snacks.

- **Benefits:**

- Adds nutty, roasted flavour and improves taste.
- Reduces anti-nutrients like phytates.
- Makes millets more digestible.

3. Cooking

- **Process:**

- Millets are boiled, pressure-cooked, or steamed in water until soft.
- Used in khichdi, porridge, or for making cooked grain salads.

- **Benefits:**

- Softens grains and releases beneficial nutrients.
- Enhances flavour and digestibility.

BIOLOGICAL TECHNIQUES**4. Germination (Malting)**

- **Process:**

- Millets are soaked in clean water for 6–8 hours.
- Drained and kept covered in a moist cloth or tray for 1–2 days.
- Sprouts are dried and used whole or milled into flour.



Fig.4.1: Malting of Millets

- **Benefits:**

- Increases protein digestibility.
- Reduces anti-nutrients like tannins and phytic acid.
- Improves phosphorus content and overall nutrition.

5. Fermentation

- **Process:**

- Millet grain is mixed with water and a starter (urad dal or previous batch).
- Left to ferment naturally for 8–12 hours at room temperature.
- Used for dosa, idli, dhokla, and other products.

- **Benefits:**

- Improves gut health and digestibility.
- Enhances flavour, aroma, and texture.
- Increases absorption of nutrients.

MECHANICAL AND FORMING TECHNIQUES

6. Extrusion

A. Cold Extrusion

- **Process:**

- Millet flour and other ingredients is mixed with water to form dough.
- Dough is shaped through dies using mechanical extruders (no heat).
- Common for murukku, pasta, or noodles.

- **Benefits:**

- Allows innovative shapes and snack formats.

B. Hot Extrusion

- **Process:**

- Composite flour containing millets and other ingredients are passed through an extruder under high temperature and pressure.
- Product expands upon exit, forming puffed snacks.

- **Benefits:**

- Improves texture and shelf life.
- Makes products crunchier and more appealing.

7. Baking

- **Process:**

- Millet flour is blended with other ingredients (oil, sugar/salt).
- Shaped into biscuits, cookies, or bars and baked in an oven.

- **Benefits:**

- Reduces moisture and extends shelf life.
- Improves flavour, texture, and crispness.

Secondary Processed Millet-Based Products:

Millet-based products are an integral part of traditional and modern Indian diets. They are classified into various categories based on their preparation

methods and consumption style. These products, rich in nutrients and flavours, are enjoyed across different regions of India, often influenced by regional cooking styles and the availability of millet varieties.

Ready-to-Cook (RTC) Millet-Based Products

Ready-to-Cook (RTC) products offer a convenient and nutritious alternative to conventional processed cereals. Common examples include porridges, multigrain flour mixes, vermicelli, pasta, noodles, and malt made from finger millet (ragi).

Finger millet is often ground into fine flour to prepare porridge, especially suited for infants and the elderly due to its high calcium and fibre content. These RTC products are particularly popular in Southern India, where ragi-based dishes like ragi *mudde* are staple foods.

Across rural India, millet flour mixes for making chapati or roti are increasingly gaining popularity due to their superior nutritional value. Traditional flatbreads such as *Thalipeeth*, Jowar Roti, and *jolada rotti* (sorghum roti) are widely consumed in Maharashtra and Karnataka.

In Gujarat, popular millet-based recipes include:

- *Bajra rotlo* (thick pearl millet flatbread)
- *Bajra khichdi*
- *Ragi muthiya*
- *Millet dhokla* and *millet handvo*

In Rajasthan, winter delicacies such as *bajre ki raab* and *bajre ka sogra* (pearl millet flatbread) are well-loved.

Odisha's traditional millet dishes include *Mandia roti*, *Mandia tampa*, and *Mandia kandul raav*.

From Uttarakhand, popular barnyard millet recipes include *Jhangora kheer*, *Chanchandu* (barnyard millet khichdi), and *Jhangora palayo*.



Mandia Kandul Raav



Mandia Jau



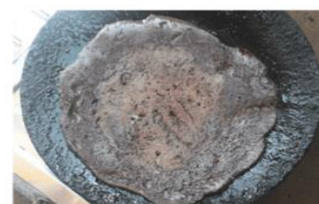
Mandia Anda



Mandia Sukua Raav



Mandia Pitha



Mandia Roti

Fig.4.2: Traditional Millets recipes of India

Ready-to-Eat (RTE) Millet-Based Products

Millet-based Ready-to-Eat (RTE) products cater to the needs of modern, health-conscious consumers looking for quick, wholesome snack options. These include:

- Traditional snacks like *chakli*
- Sweets such as *laddoos*
- Baked goods like cookies, cakes, rusks, and breads
- Contemporary items like millet energy bars, granola, breakfast cereals, muesli, and chips

Chakli, traditionally made from rice flour, is now increasingly prepared with millet flour (e.g., bajra or jowar) for added health benefits. It is especially popular in Gujarat and Maharashtra during festive occasions.

Millet-based energy bars and granola have gained traction in urban markets among fitness enthusiasts. In Northern India, particularly Rajasthan, *bajra laddoos* are winter favourites, prized for their warming properties and energy-boosting qualities.

Instant Mixes

Millet-based instant mixes are a convenient kitchen staple, especially in busy households. These mixes simplify the preparation of:

- *Upma*
- *Halwa*
- *Idli*
- *Dhokla*
- *Soups*
- *Pancakes*

Millet *upma* is a common breakfast item in South India, while *millet dhokla* and *millet idli*—originally made with rice and urad dal—are gaining popularity in Maharashtra and Gujarat. Substituting rice with millet not only enhances the nutritional profile but also lowers the glycaemic index, making them suitable for diabetics and health-conscious individuals.

Fermented Millet Products

Fermentation enhances the flavour, digestibility, and nutritional value of food. Traditional fermented millet products such as:

- *Idli*
- *Dosa*
- *Dhokla*

are made by fermenting millet flour with lentils or other grains. These foods are rich in fibre and probiotics, contributing to gut health.

Millet idli and *dosa* are popular in Southern India and Maharashtra, while *millet dhokla*—a steamed, tangy, and fluffy savoury cake—is a household favourite in Gujarat.

Ready-to-Drink (RTD) Millet-Based Beverages

Millet-based Ready-to-Drink (RTD) beverages are emerging as a healthful choice in the functional beverage market. Available in both powdered and liquid forms, they are quick to prepare and highly nutritious.

One of the most common RTD beverages is the *ragi drink* made from finger millet, widely consumed in Southern India as a refreshing, energy-boosting option. These beverages are now available in supermarkets and health stores, offering a natural and wholesome alternative to sugary drinks.

SESSION 2: PREPARING MILLET-BASED PRODUCTS

1. Preparation of Finger Millet (Ragi) Malt

- Choose well-cleaned, high-quality ragi with good germination potential.
- Wash the ragi grains thoroughly in clean water.
- Soak the washed grains in soft, clean water for 18-24 hours in a vessel of appropriate size.
- Change the soaking water 2-3 times during this period.
- After soaking, rinse the grains again to remove excess water.
- Spread the grains evenly on a clean gunny bag or thick cloth.
- Allow the grains to germinate for 36-48 hours, depending on temperature and humidity.
- Cover the grains with another cloth to encourage uniform germination.
- Sprinkle water occasionally to keep the grains moist during the germination period. A 2-day germination period is optimal for ragi. Longer germination may lead to excessive root and shoot growth, causing malting loss.
- After germination, dry the grains under the sun for 6-8 hours by spreading them thinly on a clean cloth or in the oven at 60 degrees.
- Once dried, gently rub the grains against a dry, clean cloth to remove the rootlets. Aspirate the rootlets, leaving only the malted ragi.



Fig.4.3: Finger Millet (Ragi) Malt

- Toast the malted grains in an iron pan at 65-70°C on a low flame.
- This enhances the digestibility of carbohydrates and proteins, and increases water-soluble vitamins, minerals, and other nutrients.
- Grind the toasted grains into a fine flour.
- Sieve the flour through an 80-100 mesh or muslin cloth.
- The resulting malted ragi is highly nutritious, rich in digestive enzymes, and can be used to prepare weaning foods, health foods, and medical foods.

CFTRI, Mysore, has developed a ragi malt-based weaning food formulation.

Proso Millet Khichdi:

A wholesome and tasty one-pot meal made using proso millet instead of rice, combined with moong dal and vegetables. It's a nutritious alternative to regular khichdi—light, comforting, and perfect for any meal!

Ingredients (Serves 2-3):

- $\frac{3}{4}$ cup proso millet
- $\frac{1}{4}$ cup split yellow moong dal
- Salt – to taste
- 2-3 green chillies (adjust to taste)
- 2 tbsp ghee
- 2 tsp mustard seeds
- 2 pinches asafoetida (hing)
- 1 tsp cumin seeds (jeera)
- $\frac{1}{2}$ tsp turmeric powder
- 2 tbsp sugar (optional)
- 1 carrot, peeled and diced
- 3 tbsp green peas (shelled)
- 1 onion, finely chopped
- $\frac{1}{2}$ capsicum, chopped
- 2 tomatoes, chopped
- Coriander leaves, chopped (for garnish)



Fig.4.4: Proso Millet Khichdi

Preparation Steps:

1. Rinse proso millet a few times until the water runs clear. Soak it in enough water for 1 hour, then drain.
2. Wash moong dal similarly and drain. Set aside.
3. Heat ghee in a pressure cooker. Add mustard seeds and let them pop. Add cumin seeds and a pinch of hing.
4. Add drained millet and moong dal to the cooker. Then stir in salt, turmeric, sugar (if using), onions, carrot, capsicum, peas, tomatoes, and chopped green chillies.

5. Pour in 5 cups of water, mix well, and close the lid. Cook for 5 whistles on medium heat.
6. Allow the pressure to release naturally. Open the lid and stir in chopped coriander leaves.
7. Enjoy hot with plain curd or raita.

Jowar Besan Chilla

A wholesome, high-fibre, and gluten-free savory pancake made from jowar and gram flour, served with a refreshing green chutney.

Ingredients

For the Chilla (Makes 5–6):

- Jowar (Sorghum) flour – 1½ cups
- Besan (Gram flour) – 1 cup
- Onion (medium), finely chopped – 1
- Green chillies, chopped – 2
- Ginger, chopped – 1 small piece
- Ajwain (Carom seeds) – 1½ tsp
- Turmeric powder – ¼ tsp
- Coriander leaves, chopped – 2 tbsp
- Salt – 1 tsp or as needed
- Oil – about 10 tsp (for cooking)
- Water – as needed to make thick batter



Fig.4.5: Jowar Besan Chilla

Method

1. In a mixing bowl, combine all dry ingredients for the chilla (except oil).
2. Slowly add water and stir to make a thick batter. Let the batter rest for 5–10 minutes.
3. Heat a frying pan and grease it with 1½ tsp of oil.
4. Pour a ladleful (about 1½ cups) of batter and spread it evenly.
5. Cover the pan and cook on medium heat until the bottom turns light brown.
6. Drizzle another 1½ tsp oil on top. Flip and cook the other side until golden brown.

Foxtail Millet Kheer

A creamy Indian dessert made by simmering foxtail millet in milk with saffron, jaggery, and nuts. Nutty, aromatic, and naturally sweet!

Ingredients (Serves 4):

- Foxtail millet – 1 cup
- Milk – 1.5 litres

- Sugar/Jaggery (grated or powdered) – 1 cup
- Saffron strands (optional) – 8 to 10
- Mixed nuts (cashews, almonds, pistachios) – ½ cup
- Ghee – 1 tbsp (optional, for roasting millet)
- Nuts – for garnish



Fig.4.6: Foxtail Millet Kheer

Preparation Steps:

1. Rinse foxtail millet thoroughly and strain out the water.
2. In a heated pan, add 1 tbsp ghee (optional), and roast the millet on a low flame for 2–3 minutes until golden and aromatic.
3. Remove from heat. If skipping ghee, dry roast instead.
4. In a heavy-bottomed pan, bring 1.5 litres of milk to a boil.
5. Once the milk boils, reduce the heat and add the roasted millet.
6. Cook on low flame for 20–25 minutes, stirring occasionally, until the millet becomes soft.
7. Lightly crush the saffron strands and add to the kheer.
8. Simmer for 10 more minutes on low flame to infuse the flavour and colour.
9. Stir in the grated or powdered jaggery.
10. Continue cooking on low flame for another 5–7 minutes, until the mixture thickens.
11. Add the chopped mixed nuts and stir well.
12. Turn off the heat and garnish with nuts.

SESSION 3: PACKAGING AND LABELLING OF MILLET PRODUCTS

Look at these millet cookies and share honestly which one would you buy from a shop? Why or why not?”



Fig.4.7: Package and Unpackaged Millets cookies

Importance of Packaging



Protection

Keeps product safe from moisture, air, insects, and spoilage.
Always use clean and sterilized food-grade packaging material



Shelf life

Airtight packaging improves shelf stability



Handling and Transport

Easier to stack, move, and store



Brand Identity

Attractive packaging can improve appeal and trust

Fig.4.8: Importance of Packaging

Type	Description	Examples
Primary Packaging	Direct contact with food	Pouches, glass jars, foil wrappers
Secondary Packaging	Outer layer for transport/display	Boxes, cartons, trays
Eco-friendly	Sustainable, reusable, or biodegradable	Cloth pouches, kraft paper, jute bags

3. Food Labelling Norms (FSSAI)

Every packaged food must include:

- Name of the product
- Ingredient list (in descending order by weight)
- Net weight
- Date of manufacture + Best Before
- Storage instructions
- Manufacturer details (Name + address)
- FSSAI License No.
- Veg/Non-veg logo
- Allergens
- Cost per gram

Activity: Pack and Label Your Millet Product**Materials Required:**

- Millet-based products
- Eco-friendly packaging options (cloth bags, zip pouches, kraft paper, empty jars)
- Label templates / blank stickers / markers
- Scissors, glue, tape

Steps:

- Choose a millet-based product you prepared
- Select a suitable eco-friendly packaging.
- Design a mock label including:
 - ✓ Brand/Product name (you choose)
 - ✓ Ingredient list
 - ✓ Mfg. and Best Before date
 - ✓ Storage Instructions
 - ✓ Your name as manufacturer
 - ✓ Vegetarian/Non-vegetarian symbol (use green dot/sticker)
 - ✓ Stick the label neatly and prepare the final packaged product.
-  Note: Click/display photos of students' products for class appreciation or a later exhibition.

** Reflection and Class Discussion**

- Show your packaged product and explain what makes it unique.
- How does good packaging influence buyers?
- Which information do you think is most important on a food label?
- What challenges did you face while packaging or labelling ?

Discuss:

- “If you were to sell this in your local market, what changes would you make to the packaging?”
- Emphasize how secondary processing + proper packaging increases value and marketability of millet products, especially helping farmers and micro-entrepreneurs.

Homework/Assignment

Design a unique packaging for a millet energy bar or instant mix product. Use any paper or recycled material at home and draw/create the label. Bring it for display in the next class.

PRACTICAL EXERCISE**Activity**

1. Interview a local food entrepreneur or millet product seller and ask about:
 - Their product range
 - Packaging practices
 - Labelling challenges
- Submit a one-page report with pictures or drawings

CHECK YOUR PROGRESS**A. MULTIPLE CHOICE QUESTIONS (MCQs)**

1. Which of the following is NOT a traditional thermal technique used in millet processing?
 - A. Steaming
 - B. Roasting
 - C. Germination
 - D. Cooking
2. What is the main benefit of roasting millets?
 - A. Increases moisture content
 - B. Enhances sweetness only
 - C. Decreases anti-nutrients and adds flavour
 - D. Softens grains for khichdi
3. Which millet-based product is categorized as a Ready-to-Drink (RTD) item?
 - A. Millet upma
 - B. Ragi malt beverage
 - C. Millet dosa
 - D. Millet khichdi
4. Which of the following is a fermented millet product?
 - A. Millet vermicelli
 - B. Millet dosa
 - C. Millet granola
 - D. Millet muesli
5. Secondary processing of millets helps in:
 - A. Reducing shelf life
 - B. Decreasing digestibility
 - C. Enhancing marketability and nutrition
 - D. Removing all nutrients

B. Fill in the Blanks

1. _____ processing converts cleaned and milled millets into ready-to-eat or ready-to-cook products.
2. Finger millet is commonly known as _____.
3. Fermentation enhances _____ health and digestibility.
4. In packaging, _____ packaging is in direct contact with the food.

C. True / False

1. Germination reduces tannins and phytic acid in millets.
2. Millet-based cookies are examples of fermented food.
3. Ragi malt is suitable for infants and the elderly.
4. Traditional packaging materials like jute are not considered eco-friendly.
5. Malting decreases the nutritional value of millets.

D. Short Answer Type Questions

1. Mention any two benefits of roasting millets.
2. List any three fermented millet-based foods.
3. Name any two Ready-to-Cook (RTC) millet products.
4. What are the FSSAI labelling requirements for packaged millet products?
5. Describe the process of malting finger millet briefly.

E. Long Answer Type Questions

1. Explain the importance and benefits of secondary processing of millets.
2. Compare and contrast Ready-to-Cook (RTC) and Ready-to-Eat (RTE) millet products with examples.
3. How does fermentation enhance the nutritional value of millet-based foods? Provide examples.
4. List and explain various types of millet-based instant mixes and their benefits for modern consumers.
5. Detail the method of preparing Proso Millet Khichdi and explain how it serves as a nutritious alternative to rice.

Module 5 Food Safety and Hygiene

About the Module

This module emphasizes the importance of food safety and hygiene in millet processing and product preparation. Students will learn about contamination risks, personal hygiene, workplace sanitation, and compliance with food safety standards. The module covers Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP), and proper waste disposal methods. It stresses the significance of clean equipment, pest control, and maintaining hygienic conditions during processing and storage. By mastering these practices, students will ensure consumer safety, build trust in millet-based products, and align with national and international food safety regulations, preparing them for professional roles in the food sector.

Learning Outcomes

- Apply hygiene and sanitation practices in millet processing.
- Identify sources of food contamination and methods of prevention.
- Follow HACCP and GMP standards in food processing.

SESSION 1: MAINTAINING PERSONAL AND WORKPLACE HYGIENE

Importance of Personal Hygiene in Food Handling

Think about this: Would you eat food made by someone with dirty hands or long nails?



Fig.5.1: Bad and Good Personal Hygiene Practices

Personal hygiene means how you care for your body and appearance. In food handling, this is very important to ensure the food is safe, clean, and keeps the consumer's trust. Here are some personal hygiene rules that every food handler must follow:

Hygiene Rule	Why It's Important
Wash hands properly	Removes germs and dirt
Keep nails trimmed	Long nails carry bacteria
Wear clean uniform including apron and mask	Avoids dirt and hair in food
No jewellery or watches	Can fall into food or carry germs
Use a head cap/hairnet	Prevents hair from falling in food
Report illness	Sick workers can spread disease



Fig.5.2: Personal Hygiene Rules for Food Handlers

1.2 Workplace Hygiene Protocols

A clean kitchen is a safe kitchen. Here's what must be done:

Cleaning vs. Sanitizing

Cleaning	Sanitizing
Removes visible dirt and food bits	Kills harmful microorganisms
Uses water and detergent	Uses approved chemical sanitizers
Step before sanitizing	Final step before using the equipment

Important areas to clean and sanitize:

- Kitchen counters and tables
- Tools and utensils
- Equipment like mixers, grinders
- Storage racks and containers

Use only food-safe, approved cleaning agents. Follow the correct dilution and contact time instructions.

◆ 1.3 Cross-Contamination: Know It and Stop It!

Cross-contamination happens when harmful substances transfer from one surface or food to another. This can make food unsafe to eat.

Types of Contamination

- **Physical:** Hair, plastic, metal, stones
- **Biological:** Bacteria, viruses, fungi
- **Chemical:** Cleaning chemicals, pesticides

Common Sources of Contamination

- Using the same knife for raw and cooked food
- Not washing hands after touching raw meat or vegetables
- Not cleaning utensils or boards properly

How to Prevent It

- Use colour-coded chopping boards
- Keep separate utensils for raw and cooked items
- Store cooked food above raw food in the fridge
- Wash and sanitize hands and surfaces frequently

Activity 1

Part 1: Personal Hygiene Demonstration

Objective: Learn and practice personal hygiene in a real food-handling setting.

- Wear complete kitchen gear: apron, gloves, head cap, mask
- Check nails, hands, and uniform using a hygiene checklist
- Practice WHO handwashing steps
- Conduct a roleplay:

One group becomes “Hygiene Inspectors” and checks others using the checklist!

Checklist Includes:

- Are hands clean?
- Are nails trimmed?
- Is the apron clean?
- Is the hair completely covered?

Part 2: Cleaning and Sanitizing Workstation

Objective: Understand and perform correct cleaning procedures.

Steps to Follow:

1. **Pre-clean:** Remove leftover food bits from the equipment and work area.
2. **Wash:** Use detergent and scrub the surfaces.
3. **Rinse:** Wash off soap with clean water.
4. **Sanitize:** Use a food-grade sanitizer.
5. **Dry:** Let it air-dry or use a clean cloth.

Clean the following: Chopping boards, Knives and bowls, Kitchen counters and Food preparation trays

Part 3: Cross-Contamination Risk Mapping

Objective: Identify and fix contamination risks in a food setup.

Steps:

1. Observe your food lab, school canteen or home kitchen critically.
2. Identify points where contamination may happen.
3. Take measures to prevent contamination. For example, separating raw and cooked foods in containers.

SESSION 2: FOLLOWING FOOD SAFETY PROTOCOLS DURING PROCESSING

◆ 2.1 Principles of Food Safety

What is Food Safety?

Food safety means keeping food free from harmful bacteria, chemicals, and foreign objects during its journey from raw material to final product. It protects the consumer from foodborne illnesses and ensures product quality.

HACCP

HACCP stands for Hazard Analysis and Critical Control Points. It is based on seven principles as shown in figure below.



Fig.5.3: Seven Principles of HACCP

It's a system that helps food processors to:

1. Identify possible hazards
2. Decide where they might occur (critical points)
3. Set control measures to prevent risks

Example: Flow for Millet Laddoo

Receiving grains → Cleaning → Roasting → Mixing → Shaping → Packaging

Check: Are ingredients safe?

Are your hands clean?

Are surfaces sanitized?

Good Manufacturing Practices (GMPs)

These are general rules every food business must follow:

GMP Aspect	Practice Example
Cleanliness	Wash hands, sanitize surfaces
Pest Control	Keep storage areas sealed and clean
Record-Keeping	Maintain logs for temperature, cleaning
Staff Hygiene	Uniforms, gloves, head caps

◆ 2.2 Types of Food Hazards

All food safety problems fall into one of these three hazard types:

Type	Examples	Risk to Health
Biological	Bacteria (E. coli, Salmonella), molds	Food poisoning, illness
Chemical	Pesticides, cleaners, excess additives	Poisoning, allergies
Physical	Glass shards, metal, stones, hair	Injury or choking

Always inspect ingredients, equipment, and your workstation before use.

◆ 2.3 Safe Handling During Processing**Storage Safety**

- Keep food at the right temperature (cold foods below 5°C, hot foods above 60°C)
- Follow FIFO: First In, First Out – use old stock first
- Check expiry dates before using

Cooking and Reheating

- Cook food to safe internal temperatures (e.g., grains above 74°C)
- Use a food thermometer where possible

During Processing, Always Wear:

- Clean apron and gloves
- Hairnet or cap
- Mask if handling uncovered food

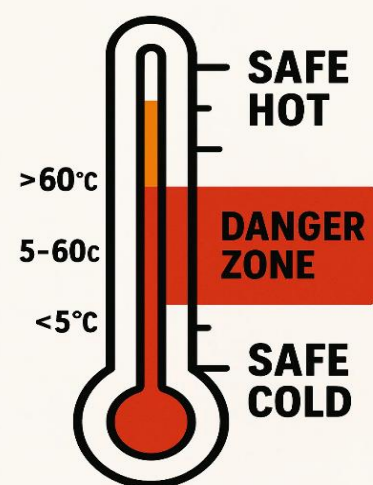


Fig.5.4: Danger Temperature Zone

Activity 2: Food Safety Risk Assessment

Task: Choose a millet-based food product and conduct a safety risk assessment.

Examples: Millet laddoo, Millet khichdi, Millet snack bar

What to Do:

1. Create a **flowchart** of your food process
2. At each step, ask:
 - What could go wrong (hazard)? Example (flour can absorb moisture)
 - How can I prevent it (control)? Storing flour appropriately in moisture-proof bags or containers.

Template for Mapping

Processing Step	Hazard Identified	Control Measure
Roasting millet	Undercooked grains (bio)	Roast till golden brown
Mixing with jaggery	Hair (physical)	Wear head cap

Activity 3: Safe Waste Handling and Disposal

Food waste can attract pests and create safety risks. It's important to handle it the right way.

Types of Waste

- **Biodegradable:** Food scraps, peels, shells
- **Non-biodegradable:** Plastic wrappers, packaging

Disposal Protocol

- Separate waste into colour-coded bins
- Label bins clearly
- Disposal of waste in designated areas

Group Task:

Work in teams to write a **Clean-Up SOP (Standard Operating Procedure)** for your classroom or food lab.

Your SOP must include:

- Safety gear to wear
- Tools used (broom, mop, bins)
- Steps to clean, sanitize, and dispose
- Final inspection checklist

Create a complete flowchart with hazard points and safety measures for a millet-based product.

Group Presentation: on "**Top 5 Safety Rules Every Kitchen Must Follow**"

Each team presents their golden rules for food safety with examples and visuals!

SESSION 3: UNDERSTANDING REGULATORY COMPLIANCE AND DOCUMENTATION

◆ 3.1 Overview of FSSAI

FSSAI stands for Food Safety and Standards Authority of India. It is the national body that ensures the food we eat is safe, hygienic, and properly labelled.

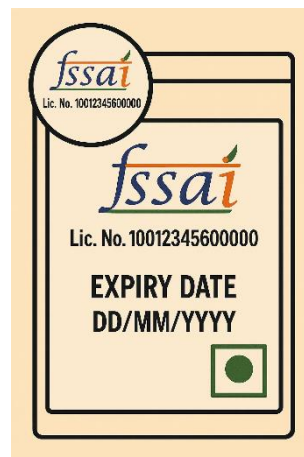
What Does FSSAI Do?

- Sets food safety rules and regulations
- Issues licenses and registrations to food businesses
- Checks if food businesses follow hygiene and quality standards

What Do You See on a Label?

- FSSAI Logo – a sign of licensed food
- License or Registration Number – trackable ID for traceability

Try This: Look at any packaged food at home. Can you find the FSSAI logo and number?



**Fig.5.5: FSSAI
LIC. No. Template**

3.2 Key Requirements for Food Businesses**Starting a Small Food Business?**

You must register your business with FSSAI.

Registration is needed if you...

- Sell packaged food or beverages
- Run a home-based or small-scale processing Module (like millet snacks)
- Operate a food stall, tiffin service, or bakery

License Condition under FSS Regulations, 2011:

- **Mandatory FSMS Plan:** Every food business operator (FBO) must have a documented *Food Safety Management System (FSMS)* plan.
- **Compliance with Schedule 4:** FBOs must follow FSSAI *Schedule 4* of the regulation.

Schedule 4 – Key Areas (Based on GHP and GMP):

Divided into 5 Parts, depending on the type of food business:

1. Part 1:

- Basic hygiene and sanitation
- For all FBOs, including *street food vendors*

2. Part 2:

- Hygiene practices for licensed operators in *manufacturing, processing, storage, packaging, distribution*

3. Part 3:

- Specific to *milk and milk products*

4. Part 4:

- Applies to *meat processing and slaughterhouses*

5. Part 5:

- For businesses applying for a *Catering License*

FBOs must create and follow an FSMS plan and meet hygiene standards under Schedule 4, tailored to their type of business. FSSAI has also introduced Food Safety Display Boards (FSDBs) for various food businesses. In addition to the existing mandatory requirement of displaying FSSAI License/ Registration Number, it is also mandatory for FBOs to display these Food Safety Display Boards at FBO premises.



Fig.5.6: Food Safety Display Boards

3.3 Basic Documentation Practices

Documentation helps track food batches, cleaning, storage conditions, and hygiene steps. This is important for **traceability, safety checks, and audits.**

Types of Records to Maintain

Document Type	Why It's Important
Procurement Record and Stock	Tracks ingredients availability and non-availability in stock
Batch Production Record	Tracks ingredients and steps used
Cleaning Log	Shows regular cleaning of workstations
Temperature Log	Confirms correct food storage/cooking temps

Think About It: If someone falls sick after eating your product, how would you trace where the problem happened? That's why logs matter!

Activity 1: Fill a Sample FSSAI Registration Form

Task:

Use a sample FSSAI registration form and fill it with mock details for a millet-based business.

Include:

- Business name and address
- Owner's name
- Food category (e.g., millet snacks)
- Type of business (small processor/vendor)

Activity 2: Hygiene Checklist and Cleaning Log

Task:

Create and maintain a daily hygiene and cleaning log for your class kitchen or workstation.

Your Checklist Should Include:

- Date
- Name of person responsible
- Activity done (e.g., sanitized knives)
- Verified by (teacher/peer)

CHECK YOUR PROGRESS

A. Multiple Choice Questions (MCQs)

1. Which of the following is a *chemical* type of contamination?
A. Hair
B. Bacteria
C. Pesticides
D. Stones
2. Which step comes immediately before sanitizing in the cleaning process?
A. Rinsing
B. Washing
C. Drying
D. Pre-cleaning
3. Which of the following is a Good Manufacturing Practice (GMP)?
A. Using colourful aprons
B. Reusing containers without cleaning
C. Keeping pest control in place
D. Tasting food with fingers

4. Which of these is NOT a recommended way to prevent cross-contamination?
 - A. Using colour-coded chopping boards
 - B. Storing raw food above cooked food
 - C. Washing hands regularly
 - D. Keeping separate utensils
5. Which of the following records helps track ingredient availability?
 - A. Cleaning Log
 - B. Procurement Record
 - C. Temperature Log
 - D. Batch Production Record

B. Fill in the Blanks

1. _____ hygiene refers to how a food handler cares for their body and appearance.
2. Cleaning removes visible dirt, while _____ kills harmful microorganisms.
3. _____ contamination includes bacteria, viruses, and fungi.
4. Food handlers must always wear a _____ to prevent hair from falling into food.
5. The full form of FSSAI is _____.

C. True or False

1. Long nails are allowed in food handling as long as they are clean.
2. Wearing jewellery while preparing food can lead to physical contamination.
3. Biological hazards include metal and plastic pieces.
4. The FSMS plan is optional for small home-based food businesses.
5. Food safety logs are not required for small-scale businesses.

D. Short Answer Type Questions

1. Define cross-contamination with one example.
2. What are the three main types of food hazards?
3. What is the importance of wearing proper kitchen gear while handling food?
4. What is HACCP and how does it help in food safety?
5. Why is record-keeping important in food processing?

E. Long Answer Type Questions

1. Describe the steps involved in cleaning and sanitizing a food workstation.

2. What are Good Manufacturing Practices (GMPs)? List four GMPs with examples.
3. Explain the importance and components of a Food Safety Management System (FSMS) plan.
4. Discuss the requirements for FSSAI registration for small food businesses.
5. What is the role of documentation in food safety audits and traceability?

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ANSWER KEY

Module	MCQ	Fill in the Blanks	True/False
Module 1	1. Drought tolerance 2. Buckwheat 3. 4000 L 4. Low 5. Soaking and fermenting	1. Nutri-cereals 2. Finger Millet (Ragi) 3. Amaranth, Buckwheat 4. Gluten 5. Fibre	1. False 2. False 3. False 4. True 5. False
Module 2	1. Work Requirement Analysis 2. 120 kg 3. Cooking 4. Delivery challan 5. Hammer mill 6. Ensuring food safety	1. Cleaning 2. Food 3. Ventilation 4. Receiving 5. Receipt	1. True 2. False 3. True 4. False 5. True
Module 3	1. Group grains by size or density 2. Dehusking 3. Winnowing 4. $\leq 8\%$ 5. Removes metallic particles 6. Vacuum-sealed polybags	1. Destoning 2. Grits 3. Gravity 4. Husk 5. Milling/Grinding	1. False 2. True 3. False 4. True 5. False
Module 4	1. Germination 2. Decreases anti-nutrients and adds flavour 3. Ragi malt beverage 4. Millet dosa 5. Enhancing marketability and nutrition	1. Secondary 2. Ragi 3. Gut 4. Primary	1. True 2. False 3. True 4. False 5. False
Module 5	1. Pesticides 2. Rinsing 3. Keeping pest control in place 4. Storing raw food above cooked food 5. Procurement Record	1. Personal 2. Sanitizing 3. Biological 4. Head cap/hairnet 5. Food Safety and Standards Authority of India	1. False 2. True 3. False 4. False 5. False