Ministry of Food Processing Industries
*Government of India*

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# Reading Manual for Ragi Flour

# Under PMFME Scheme



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# CONTENTS

# Abbreviations & Acronyms

| Sr:No. | Abbreviations &Acronyms | Full Forms |
|---|---|---|
| 1. | FAO | Food and Agriculture Organization |
| 2. | Kcal | kilocalorie |
| 3. | APEDA | Agricultural and Processed Food Products Export Development Authority |
| 4. | PET | Polyesters |
| 5. | PA | Polyamide |
| 6. | WVTR | Water Vapour transmission rate |
| 7. | FSSAI | Food Safety and Standards Authority of India |
| 8. | FBO | Food Business Operator |
| 9. | FLRS | Food Licensing and Registration System |
| 10. | PFA | Prevention of Food Adulteration |
| 11. | MoFPI | Ministry of Food Processing Industries |
| 12. | FPOs | Farmer Producer Organizations |
| 13. | SHGs | Self Help Groups |

# CHAPTER 1
# INTRODUCTION

## 1.1.Industrial Overview:

### Cereal Grains

Tiny, hard and edible dry seeds that grow on grass-like plants called cereals are cereal grains (or simply grains). In most nations, they are a staple food and have more food power worldwide than any other food category, by far. In human history, grains have played a major role, and grain agriculture is one of the key developments that fuelled civilization's growth. They are consumed by people, and they are also used for feeding and fattening animals. It is then possible to transform grains into many different food items.

Cereals are an essential component of the human diet and are an important source of starch and other dietary carbohydrates (dietary fiber) that play an important role in human consumption of energy and nutrients.

A whole grain consists of 3 main parts:

- Bran: The hard, outer layer of the grain. It contains fibre, minerals and antioxidants.
- Germ: The nutrient-rich core that contains carbs, fats, proteins, vitamins, minerals, antioxidants and various phytonutrients. The germ is the embryo of the plant, the part that gives rise to a new plant.
- Endosperm: The biggest part of the grain contains mostly carbs (in the form of starch) and protein.
- A refined grain has had the bran and germ removed, leaving just the endosperm.

### *1.1.1. Types of Cereal Grains*

The cereals most commonly cultivated are wheat, rice, rye, Oats, millet, barley, corn (maize), and sorghum.

| Image | Name | Description |
|---|---|---|
|  | **Rice (*Oryzasativa*) .** | Rice is an excellent source of calories because of its starch content. It comprises 75-80% of starch, 7% of protein, 0.4-0.8% of lipids and 12% of water. The protein of rice oats is of highly digestible nature and contains 4.1mg/100g of protein lysine higher than wheat. |
|  | **Barley**. | It is extremely nutritious and essential for malting. Usually used as an oat breakfast cereal, it is often used as animal feed. It is primarily grown on land that is unable to produce wheat. |
|  | **Sorghum** | Highly nutritious and used as a feed for livestock. |
|  | **Millet** | In China, Russia and Germany, millet porridge, mostly grown in Asia and Africa, is common. It may also be used as animal feed and bird feed for the manufacture of alcoholic beverages. |
|  | **Oats** | They are a staple cereal in Scotland and are exceptionally nutritious and used in more than half of the world as breakfast cereals. It is normal to reduce weight and lower blood sugar levels because of the high content of fiber. |

| | | |
|---|---|---|
|  | **Rye** | Cold climate cereal grain, used to produce beer, breads, whiskeys, vodka, and sometimes used as animal fodder. |
|  | **Maize** | Corn is a staple cereal used worldwide also as animal feed on continents such as South America and Africa. Cornflakes are a globally popular cereal, too. |
|  | **Wheat** | Wheat is one of the oldest domesticated grains and a major cereal crop. In modern times, wheat is used to manufacture bakery items for meals, breakfast cereals, and oats. It can be grown on a wide variety of soils, but in temperate climates it thrives. |

**1.2.Product Description:**

In the arid and semi-arid regions of Africa and Asia, Eleusinecoracana, or finger millet, is an annual herbaceous plant widely cultivated as a cereal crop. In Nepal, where 877 accessions were retained by the National Plant Genetic Resource Centre, Khumaltar, Nepal, it is commonly called kodo. It is a tetraploid species that originally evolved from its wild relative Eleusine Africana and is self-pollinating.Since time immemorial, finger

millet has been in food use, and a large number of traditional food preparations have been in practice in rural areas (predominantly tribal areas), especially in catchments of production. In India, finger millet, also known as ragi, is one of the major cereals that occupies the highest area among the small millets under cultivation.

In terms of protein (6-8 per cent) and fat (1-2 per cent), finger millet is comparable to rice and is superior to rice and wheat in terms of mineral and micronutrient content. For a wide section of society, it is a significant source of dietary carbohydrates. However, its use in the regular diet is currently generally limited to rural/tribal areas only.The key explanation is the inaccessibility of goods to the taste of the urban population. Using traditional as well as modern techniques to produce value-added and convenient food items, the processing of finger millet will be the possible solution to encourage and boost consumption, nutritional status and thus increase profitability and better livelihood for the tribal community.

| **Nutrients** | **Percentage** |
|---|---|
| Protein (%) | 7.3 |
| Fat (%) | 1.3 |
| Crude fiber (%) | 3.6 |
| Ash (%) | 3.0 |
| Starch (%) | 59.0 |
| Total dietary fiber (%) | 19.1 |
| Total phenol (mg/100 g) | 102[i] |

Finger millet (ragi) has the highest calcium amount, antioxidant and phytochemical properties, making it simple and slowly digestible. Therefore, it helps to regulate blood glucose levels very well in diabetic patients.The millet malt is traditionally used for infant feeding purposes and also since pretty old times to prepare drinks with milk of luke warm water with the addition of sugar. Finger millet is a very good source of natural iron and its ingestion leads to anemia recovery.Because of their high calcium and iron content, the Ragi based foods are highly appropriate for expectant mothers and elderly people. Consumption of finger millet naturally assists in calming the body. In cases of anxiety, depression and insomnia, it is helpful. It is good for migraines as well. For blood pressure problems, liver disorders, asthma and heart weakness, green ragi (finger millet) is recommended.

**1.3.Market Potential:**

In India, finger millet (ragi), kodo millet (kodo), foxtail millet (kangni), barnyard millet (sawan), proso millet (cheema) and small millet are the leading producers of small millet (kutki). Under them, the annual planting area is about 2.5 million hectares; and under finger millet, about 1.5 million hectares constitute around 40-50 percent of the world's crop area.The finger millet area has decreased over the last three decades, but with a major productivity increase (1,500 kg/ha), its annual production has remained at around 2.4 million tonnes. Tiny millets currently account for less than 1% of the food grains produced in the world (ICAR, 2010).Their cultivation dates back almost 5000 years, and they form an important component of traditional cropping systems in India and make a major contribution to the regional food and nutritional protection and diversity of the national food basket, and are important both for dryland crops and hill farming in their production areas.Tiny millet grains have a longer storage life and can be referred to as a backup for famine. The strength shown by them can prove beneficial for their adaptation to various eco-systems and make them possible crops for contingency plantings.

In India, finger millet is an essential small millet that is grown. In many hilly regions of the country, it is a staple food. It is cultivated for both grain and forage. Grains are abundant in minerals and are the richest source of calcium used in many preparations, such as desserts, puddings, cookies, etc. It is also a rich source of iron, protein, fiber and other minerals and is a food free of gluten (elastic texture).It is low in fat and mostly contains unsaturated fat. It is believed that finger millet is a strong laxative and prevents constipation due to its rich fiber content. For people suffering from diabetes, liver disease, high blood pressure, heart weakness and asthma, it is a healthy meal. His green straw is ideal for silage processing.Karnataka, Uttarakhand, Maharashtra, Tamil Nadu, Odisha, Andhra Pradesh and Gujarat are the most important finger millet growing states.

**1.4. Raw Material Description:**

One of the most nutritious cereals is known to be finger millet. Approximately 5-8% of protein, 1-2% of ether extractives, 65-75% of carbohydrates, 15-20% of dietary fiber and 2.5-3.5% of minerals are contained in finger millet. The finger millet has the largest amount of calcium (344 mg percent) and potassium of all cereals and millets (408mg percent). The

cereal is low in fat (1.3%) and mostly contains unsaturated fat.On average, 100 grams of finger millet has an energy content of around 336 KCal.

The millet, however, also includes phytates (0.48 percent), polyphenols, tannins (0.61 percent), inhibitory factors of trypsin, and dietary fiber, which were once known as "anti-nutrients" due to their activities of metal chelating and enzyme inhibition (Thompson 1993), but are now called neutraceuticals.Finger millet, being non-glutinous, is healthy for individuals suffering from gluten allergy and celiac disease. It's non-acidic and, thus, easy to absorb. Rich in amino acids, finger millet is (Tryptophan, Threonine, Valine, Isoleucine and Methionoine).

Finger millet (ragi) contains high amounts of protein, iron, calcium, phosphorus, fiber and vitamins. The amount of calcium is greater than that of all cereals, and the content of iodine is said to be highest among all food grains. Ragi, along with the inclusion of essential amino acids, vitamin A, vitamin B and phosphorus, has the highest quality protein.Green ragi is also recommended for lactating mothers in the absence of milk production conditions. Finger millet could help to keep hunger, degenerative diseases and premature aging at bay if eaten regularly.

### 1.5.Types of Raw Material:

Finger millet is a tropical and subtropical crop that can be grown at an altitude of up to 2100 m. It is a heat-loving plant and the minimum required temperature for its germination is 8-10° C. For proper production and good crop yield, an average temperature range of 26-29 °C is the best.

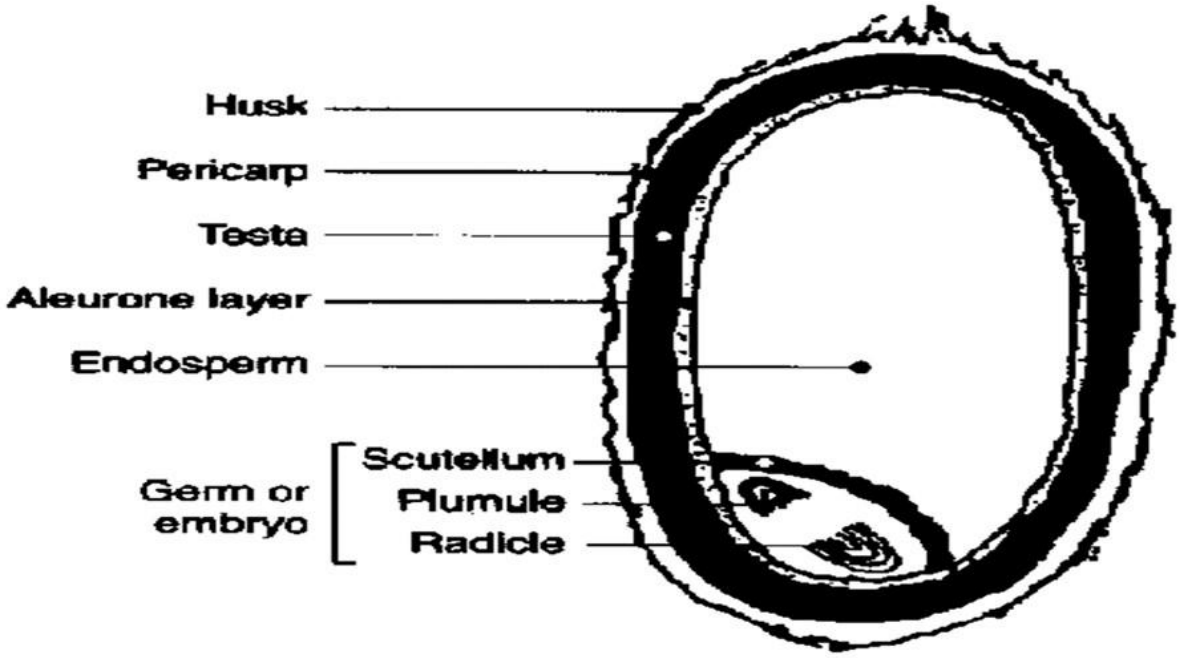
| Sl. No. | State | Varieties |
|---|---|---|
| 1 | Tamil Nadu | GPU 28, CO 13, TNAU 946 (CO 14), CO 9, CO 12, CO 15 |
| 2 | Andhra Pradesh | VR 847, PR 202, VR 708, VR 762, VR 900, VR 936 |
| 3 | Jharkhand | A 404, BM 2 |
| 4 | Orissa | OEB 10, OUAT 2, BM 9-1, OEB 526, OEB-532 |
| 5 | Uttarakhand | PRM-2, VL 315, VL 324, |

| | | |
|---|---|---|
| | | VL-352, VL 149, VL 146, VL-348, VL-376, PES 400 |
| 6 | Chattisgarh | Chhattisgarh-2, BR-7, GPU 28, PR 202, VR 708 and VL 149, VL 315, VL 324, VL 352, VL 376 |
| 7 | Maharashtra | Dapoli 1, PhuleNachani, KOPN 235, KoPLM 83 |
| 8 | Gujarat | GN 4, GN 5, GNN 6 |
| 9 | Bihar | RAU 8 |
| 10 | Karnataka | GPU 28, GPU-45, GPU-48, PR 202, MR 1, MR 6, Indaf 7, ML-365, GPU 67, GPU 66, KMR 204, KMR 301, KMR 340[ii] |

# CHAPTER 2
# PROCESS & MACHINERY REQUIREMENT

## 2.1.Raw Material Aspects:

To produce flour, finger millet can be milled as a first step in processing. However, due to the small size of the seeds and because the bran is very tightly attached to the endosperm, finger millet is hard to grind. In addition, during milling, the delicate seed may get crushed. The production of commercial mechanical finger millet milling systems is difficult.Finger millet is considered one of the most nutritious cereals. Finger millet contains about 5–8% protein, 1–2% ether extractives, 65–75% carbohydrates, 15–20% dietary fiber and 2.5–3.5% minerals. Of all the cereals and millets, finger millet has the highest amount of calcium (344mg %) and potassium (408mg %). The cereal has low fat content (1.3%) and contains mainly unsaturated fat. 100 grams of Finger millet has roughly on an average of 336 KCal of energy in them.




The primary product of finger millet, therefore, is whole grain flour. This has drawbacks, such as decreased flour storage time due to the high content of the oil. The industrial use of whole grain finger millet flour is, in addition, minimal. Prior to grinding, moistening the millet seeds helps mechanically extract the bran without causing damage to the rest of the crop.Other grains, such as finger millet and sorghum, can also be processed by the mini millet mill.

2.2 **Source of Raw Material**

Ragi is low in fat and mostly contains unsaturated fat. It is believed that finger millet is a strong laxative and prevents constipation due to its rich fiber content. For people suffering from diabetes, liver disease, high blood pressure, heart weakness and asthma, it is a healthy meal. His green straw is ideal for silage processing. Karnataka, Uttarakhand, Maharashtra, Tamil Nadu, Odisha, Andhra Pradesh and Gujarat are the most important finger millet growing states.

**2.2.Technologies:**

- **Hand operated flour mill:** Saddle stones

Milling is the method of ground cereal grains into flour. Traditionally, this would have been done by grinding the grain between two stones, a lower, stationary stone called the quern stone, and an upper, mobile stone called the hand stone.

Saddle stones are the oldest known flour milling machines. A saddle stone is a piece of hard stone that is cradle-shaped and carries the grain. The sandstone will have been either a cylindrical piece of stone (worn in both hands and traced like a rolling pin over the grain) or a disc held in one hand with a vertical handle on its back (rather like an upside-down mushroom). These hand stones were used to crush the grain and fairly coarse flour was made. Before being used, the grain was also malted in order to make grinding faster. These work in a manner similar to modern millstones and consist of two circular stones, a static bed stone overlying a revolving runner stone. The grain joins the quern through a hole at the middle of the runner stone and migrates when it is ground to the edge, emerging as a coarsely ground floor from between the stones. These rotating querns are hand-powered and are thus constrained by their operator's strength in size and milling capability. They could, however,

be much heavier than the hand stone used for saddle querns, so they could be used to make finer flour with the unmalted grain.

- **Mills and mill stones:**

As the agricultural Production of cereals was the need for more efficient methods of flour production. In such mills, even larger circular-shaped stones would be used and a finer flour would be produced than that produced by handheld instruments. To move the spinning motion of the runner stone, power sources have been used. Initially, cattle or slaves used to turn these big stones around. Over time, the source of power to transform the millstone became water or wind.

Electric motors are used in modern flour mills that use spinning millstones. millstones do not touch when in operation. There is a distance between the rotating runner stone and the static bed stone that is defined by the grain scale. In the middle of the runner stone, the grain is fed from a chute into a cavity, referred to as the eye. The grain is spread over the millstone surface by a complex series of groves known as furrows, which help to ventilate and cool the millstones as well. The millstones' grinding surfaces are known as land and are separated into areas called harps. Once ground the flour passes along narrow groves called cracking and is expelled from the edge of the millstones.

- **Roller mills:**

As the population multiplied and the needfor more and better flour and bread increased, a modern method of milling was devised. By moving the grain through a series of paired counter-rotating rollers with fluted surfaces, these mills work. To separate the bran from the starchy endosperm, the resulting crushed grain is sieved between each pair of rollers. It is super-fine white flour that is the finished result. To produce wholemeal flour from this type

of milling it is necessary to collect the bran that has been sieved off during the early stages of milling and add them back to the final product. To obtain brown flour a proportion only of the extracted material is added back.

**2.3.Manufacturing Process:**

- **Grain delivery**: The grain is supplied by covered trucks and hopper railcars to factories. The distance travelled by the grain varies tremendously. In several times, the 110-car unit train has covered hundreds of miles. In other situations, it is shipped in the same county from a nearby plant. After arriving at the mill, grain stocks will often have gone through a variety of accumulation processes (farmer, country elevator, terminal elevator, etc.).The number of conveyances carrying grain can vary based on the time of harvesting and delivery.
- **Grain standard:** Before barley grains are unloaded in a factory, the assessment is required with samples. The grain is tested for moisture, test weight, unsound seeds, and foreign material. The grains are categorized according to Indian Grain Standards and are also subject to the ISO trade standards. Product management chemists start experiments to identify grain and assess end-user values during unloading.
- **Cleaning:** After inspection, the grain is unloaded directly from the truck into the unloading container and transferred into large bins or silos through conveyors and bucket lifts. Grain storing is a science. It is necessary to maintain the correct moisture, heat, and air or mildew, sprout, or ferment Barley. The grain can also be fumigated to eradicate insect pests during transportation. During the process In terms of nutrient level and consistency, barely is stored.
- **Cleaning the barley grains:** It can take as many as six steps. The machines that clean the grain are collectively called the cleaning house.
  - ✓ **Magnetic separator** – The grain first passes by a magnet that removes ferrous metal particles. It will pass through other metal detectors after milling to ensure that no metal pieces are in the finished product. Magnets are also positioned throughout the milling process and at the last step prior to load-out.
  - ✓ **Separator** – Vibrating or rotating drum separators remove bits of wood, straw, and almost anything else too big or too small to be the desired grain.
  - ✓ **Aspirator** – Air currents act as a vacuum to remove dust and lighter impurities.

- ✓ **De-stoner** – Using gravity, the machine separates the heavy material from the light to remove stones that may be the same size as the desired grain.
- ✓ **Disc separator** – The grain passes through a separator that identifies the size of the kernels even more closely. It rejects anything longer, shorter, more round, more angular or in any way a different shape.
- ✓ **Scourer**– The scourer eliminates the outer husks, the soil in the kernel crease, and other minor impurities with vigorous scouring action. Currents of air are dragging up all the loose stuff.
- ✓ **Impact Entoleter**– The centrifugal force cuts down some unsound kernels or insect eggs and the aspiration rejects them from the flow of the mill. From the meet, the sound of the Barley flows into the grinding bins, large hoppers that regulate the feeding of the Barley to the actual milling process.
- ✓ **Colour Separator** – Newer mills may also utilize electronic color separators to simplify the cleaning process.

- **Grinding**: The grains of barley are now ready to be milled into flour.The modern milling process is a gradual reduction of the barley grains through the grinding and sifting process. This science of analysis, blending, grinding, sifting, and blending results in consistent end product. Barley kernels are weighed or fed from bins to roller mills, corrugated cylinders made of chilled steel. The rolls are paired and rotated inward to each other at varying speeds. Passing through the corrugated "first break" rolls, the separation of the bran, endosperm, and germ begins.

  There are about five roller mills or breaks in the system. Again, the aim is to remove the endosperm from the bran and the germ. To get as much pure endosperm as possible, each break roll must be set. The "break" rolls, each has successively finer corrugations, through the break rolls. The grist is sent back upstairs to drop through sifters after each trip. The system reworks the coarse stocks from the sifters and reduces the Barley particles to granular “middling” that are as free from bran as possible.
- **Sifters-** Through pneumatic tubes, the broken particles of Barley are elevated and then dropped into huge, vibrating, box-like sifters where they are shaken to separate the larger from the smaller particles by either a series of bolting cloths or screens.

  There may be as many as 27 frames inside the sifter, each covered with either a screen or nylon or stainless steel, with square holes that get narrower and smaller and the farther

down they go. It is probable that up to six different particle sizes come from a single sifter.

- **Blending:** From the fibre, the flour is separated and the process is repeated again.
- **Testing of the final product**: Lab checks are carried out after milling to ensure that the flour follows the specification and standards. Millers also conduct routine monitoring of indicator natural organisms. While dry flour does not provide an atmosphere that is conducive to microbial development, it is important to note that flour is not a ready-to-eat food and is a minimally processed agricultural ingredient. Flour is not meant for raw use. Baking, baking, boiling, and cooking heat processes are sufficient to kill any pathogens that may be found in flour and lower the possible risk of food borne disease.
- **Packaging of Product:** The packaging is carried out in a much simple process then milling, the Barley flour is fed to holding tank of the packaging machine, which simply seals one end of continuous packaging first, then it simply fills the packet as per required weight & seals the other end, generating the required packet.

### 2.4.Flow Chart:

| Steps | Machine Name | Description | Machine Image. |
|---|---|---|---|
| Grain Delivery | Unloading Bins | These are large bins designed for unloading of grains & similar product; they are equipped with large rod mess to prevent big impurities from entering system. |  |
| Grain Storage | Silos | These Equipments are class of storage Equipments which are specifically designed for dry grain raw material of small granule composition. Usually used to store grains but can also be used to store cement & aggregate. |  |

| | | | |
|---|---|---|---|
| Cleaning | Vibrating Pre-Cleaner | It's composed of a vibrating sieve, powered by an exciter which is in turn is powered by an appropriate motor; which is used to remove most of the dirt & large impurities from given grain. |  |
| Grinding | Heavy duty Pulveriser Mill | It basically a grinder class machine, which may employ any possible grinding arrangement to achieve, required grinding as per product to be grinded. |  |
| Sifters | Flour Sifter Machine | It's basically an industrial version of the sieve used to sieve out, large fibers, particles etc, to achieve required particle size in flour. |  |
| Finished Product Testing | Flour testing kit | This is the type of kit that measure moisture of flour before packaging of final product. |  |
| Packaging & Storage | Packet Filling & Packaging Machine | It's a simple packaging machine, designed to fill the given food grade plastic material's continuous pouch with required product after sealing one end & after filling sealing the other end also to generate packet of product. |  |

## 2.5.Additional Machine & Equipment:

| Machine | Description | Machine Image |
|---|---|---|
| **De-stoner** | It's a machine which is used to remove stones from the given grain, widely used in various grain mills in cleaning section. |  |
| **Disc Separator** | It's a separator class machine, generally used to remove foreign grains from required grain efficiently |  |
| **Magnetic Separator** | It's a type of separator which is used to magnetic impurities from given product using powerful electromagnets, used in wide range of industries for separation. |  |
| **Aspirator** | It's a more fine-tuned separator designed to remove finer impurities like remaining dirt, similar sized impurities, leaves etc |  |
| **Food Grade Conveyor** | These are conveyors with food grade belt to maintain food safety standards set by monitoring authorities. |  |

**2.6.General Failures & Remedies:**

| S. No. | General Failures | Remedies |
|---|---|---|
| 1. | Ball bearing failure of various machine | 1. Proper periodic lubrication of all bearings in various machines.<br>2. Regular replacement of all bearing to prevent critical failures. |
| 2. | Power Drive Overload | 1. Ensure proper weighing & metering specially in case of semi-automatic plant.<br>2. Install warning sensor in buffer region of loading capacity to ensure efficient operation. |
| 3. | Mechanical Key Failure | 1. Ensure that mechanical keys are replaced as per there pre-defined operational life.<br>2. Prevent Overloading. |
| 4. | Loss of Interface | 1. This problem is dominant in newly established automatic plant, one must learn to maintain rules in plant & ensure no employee goes near transmission lines, unless authorised.<br>2. Provide proper physical shielding for the connections. |
| 5. | Hulling | Grain has the whole hull intact.<br>Extra cleaning required for barley grains flour milling to sift out the impurities (dirt, chaff, etc.) |

## 2.7.Nutritional Information:Ragi(100 gram)

| Nutrient | Nutritional Value per 100g |
|---|---|
| Energy (calories) | 354 kcal |
| Protein (g) | 13g |
| Fat (g) | 3.4g |
| Carbohydrate (g) | 80g |
| Fiber (g) | 2.7g |
| Saturated Fat | 0.7g |
| Polyunsaturated Fat | 2g |
| Monounsaturated Fat | 0.7g |
| Potassium (mg) | 40mg |
| Sodium (mg) | 5mg |
| Sugars | 0.6g[iii] |

## 2.8.Export Potential & Sales Aspect:

To over 55 countries, Ragi is exported. For the year 2020-2021 (Apr-Oct), India exported USD 4.4 million worth of Ragi. Total export volumes for 2020-2021 (Apr-Oct) were around 14819770.In the year 2018, the total amount of Ragi exports worldwide was 13490370. The statistics show that the Indian exporters of Ragi have great potential to increase their participation in global trade and to boost their numbers. The main exporter of Ragi is Nepal. India exported 13490370 million metric tons of Ragi in YTD 2018, which indicates a decrease of -11.1 percent compared to YTD 2017.All around the world, Ragi is traded. The export analysis data provided shows that there are almost 55 countries and territories that are actively importing Ragi from India. The combined gross export value is USD 4.4 million.

Although figures on individual millet species are not very reliable, it is estimated that approximately 38,000 sq km of ragi are cultivated. Also, peanuts, cowpeas, pigeon peas or other plants are also intercropped. Ragi has an important protein portion, methionine amino acid, which makes it an important low-cost ingredient for millions of poor people who usually survive on starchy staples, such as plantain, polished rice, or maize, to meet the protein intake requirements.

# CHAPTER 3
# PACKAGING

### 3.1. Shelf Life of Product:

Flour infestation is a common problem that both traders and flour millers face. Maintaining the consistency of the grain and its flour is a difficult task. With due treatment & managed conditioned climate, flour can be stored without any signs of damage for up to 6 months. Finger millet (ragi) has very good shelf life that can extend up to few years. However, it is not known about the shelf of ragi flour after processing. The flour although lasts for 6 months without any alteration in the taste.

The moisture content of the Ragi flour

- Storage Conditions
- Storage –Temperature & Humidity
- Cross Contamination
- Unhygienic Conditions
- Cracks on the floors & walls
- Standing water near the stores
- Spillage & bird faeces in the stores/stairs & floors
- Presence of grains germs in the flour.

In order to improve the shelf life of the flour, the following additional precautions should be taken by millers -:

- Use clean & fumigated grains for milling
- Use scouring machines in the cleaning line
- Set cleaning machines with optimum efficiency to separate out all the impurities from the Ragigrains
- Clean the dead pockets of the cleaning line frequently, to get rid of non-moving grains at the elevator bottom & outlets, grains conveyor troughs, and tempered grain conveyors.
- Fumigate empty Grains bag.
- Before milling, use scourers to remove dirt in tempered grains
- Regularly clean the milling equipment like roller mills, feed hoppers, flour conveyors, gravity spouts, plan shifters purifiers, bran finishers, flour bins, flour elevators, flour packing hoppers, bran elevators line, etc.

- Fumigate packing materials before every use.
- Frequently fumigate bins & conveyors.
- Always keep the parking area & the flour storage area clean.
- Type of packaging materials used.

### 3.2.Ragi flour Packaging:

Packaging refers to the act of designing and producing the container or wrapper of a product. It is one of the most important parts of marketing.

There are many factors that need to consider while selecting a suitable type of pack for the product:

- The product contents.
- The application of the product.
- Content stability.
- Protection from any environmental factors
- Acceptability of the pack to the customer.
- Regulatory, legal, and quality issues.

***Characteristics of packaging material***

- The material selected must have the following characteristics:
- Must meet tamper-resistance requirements
- Must not reactive with the product
- They must protect the preparation from environmental conditions
- Must be non-toxic
- Must not impart odour/taste to the product
- Must be FDA approved.

Flour is packed directly in gunny bags, gunny poly-line bags for bulk sale, and for retail sale in laminated pouches or poly-bags.

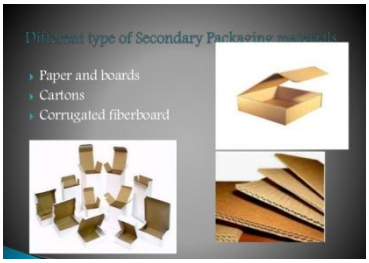
- **Hanging Bags-** Hanging bags in grocery stores and other shopping outlets are commonly used. They are a type of plastic bag that is also sealed with a back-middle seam on both ends as well. Hanging bags have a pre-cut hole that makes it easier for them to hang from hooks so that they can be seen in an attractive way.

- **Pillow bags -** A pillow bag is another typical type of package. The bags are named for their shape, which is like a cushion. They are found lying flat on grocery store shelves in the grocery store and were known to carry the items.
- **Gusseted Poly Bags-** Gusseted bags are often called flat-bottom bags because they feature a tucked in pleat that's been pressed flat. It allows the bag to expand for greater carrying capacity and to keep the shape of a box if necessary. These types of poly bags can be heat sealed, tied, stapled, or taped shut. They're the perfect poly bag for anyone looking to get more flour in a single bag.
- **Flexible Pouches-** Flexible pouches are a perfect way to carry most packaged items. They can be made with zipper-seal closures, which tend to keep the inside contents fresh for use. Flexible pouches offer amazing printing capabilities, so you can add your attractive product branding to the pouch itself. Many pouches stand up on their own, which helps you improve your shelf appearance.

### 3.3.Packaging:

- **Primary packaging:** Primary packaging is packaging which is in close association with the product itself and is often referred to as a consumer unit. The main purpose of the primary packaging is to contain, protect and/or conserve the final product, in particular against contamination.

- **Secondary packaging:** Secondary packaging is the outer packaging of the main packaging, which connects packages and further covers or marks the prescription component.




- **Tertiary packaging:**Tertiary packaging is used for the handling, transportation, and delivery of bulk products.

### 3.4.Material of Packaging:

In addition to cellulose and Aluminium foil, a very large amount of polymeric materials is used for packaging products. Paper boards and metal containers are also used for such purposes. While a range of packaging materials are available, the ultimate option of the packaging depends on the appropriate shelf life, the efficiency of the packaging machine, and the cost that is purely based on the market segment targeted by the manufacturer. The most common choice of packaging medium is plastic (usually flexible) as it offers the requisite safety and preservation, resistance to grease, physical strength, machinability, and printability.

Plastics that are lighter in weight are also the most preferred material for the packaging of flour. There are changing trends in the packaging of Flour. Plastic films and their laminates are increasingly used due to better properties and aluminium laminates due to price and better flex crack properties. Plastic packaging products that can be used are described below.

Polypropylene- Polypropylene films have better clarity than polyethylene and enjoy superior machinability due to stiffness. Lack of good salability has been a problem; however, PVDC and vinyl coating have been used to overcome this problem. Some varieties of PP have been specially developed for twist-wrap applications as they have the ability to lock in position after twisting.

Poly Vinyl Chloride (PVC)- PVC is a stiff and clear film having a low gas transmission rate. PVC can be used as small wraps, bags, and pouches. PVC when co-polymerized with polyvinylidene chloride is known as Saran. Since it is a costly material, it is only used as a coating to obtain barrier properties and heat salability. PVC film is also used for twist wraps, as it has twist retention properties and is excellent on high-speed machines.

Polyesters (PET) and Polyamide (PA) - Polyethylene terephthalate film has high tensile strength, gloss, and stiffness as well as puncture resistance. It has moderate WVTR but is a good barrier to volatiles and gases. To provide heat seal property, PET is normally laminated to other substrates. Nylons or polyamides are similar to PET but have high WVTR.

# CHAPTER 4
# FOOD SAFETY REGULATIONS AND STANDARDS OF BARLEY FLOUR

## 4.1.Introduction to FSSAI:

The Food Safety and Standards Authority of India (FSSAI) has been established under Food Safety and Standards, 2006 which consolidates various acts & orders that have hitherto handled food-related issues in various Departments. The FSSAI is responsible for setting standards for food so that there is one body to deal with and no confusion in the minds of consumers, traders, manufacturers, and investors. The Act aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command.

**Highlights of the Food Safety and Standard Act, 2006**-

Various central Acts like Prevention of Food Adulteration Act, 1954 , Fruit Products Order , 1955, Meat Food Products Order , 1973, Vegetable Oil Products (Control) Order, 1947,Edible Oils Packaging (Regulation)Order 1988, Solvent Extracted Oil, De- Oiled Meal and Edible Flour (Control) Order, 1967, Milk and Milk Products Order, 1992 etc will be repealed after commencement of FSS Act, 2006.

The Act also aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi- level, multi- departmental control to a single line of command. To this effect, the Act establishes an independent statutory Authority – the Food Safety and Standards Authority of India with head office at Delhi. Food Safety and Standards Authority of India (FSSAI) and the State Food Safety Authorities shall enforce various provisions of the Act.

**Establishment of the Authority-**

Ministry of Health & Family Welfare, Government of India is the Administrative Ministry for the implementation of FSSAI. The Chairperson and Chief Executive Officer of Food Safety and Standards Authority of India (FSSAI) have already been appointed by Government of India. The Chairperson is in the rank of Secretary to Government of India.

**4.2.FSSAI Registration & Licensing Process:**

According to Section 31(1) of Food Safety and Standards (FSS) Act, 2006,Every Food Business Operator (FBO) in the country is required to be licensed under the Food Safety & Standards Authority of India (FSSAI).

As per FSS (Licensing & Registration) Regulations, 2011, Licenses and Registrations are granted to FBOs in a 3 tier system

- Registration - for petty FBOs with annual turnover less than Rs 12 lakhs
- State license - for medium-scale food manufacturers, processor and transporters
- Central License - for large-scale food manufacturers, processor and transporters

**FSSAI registration is done online on the FSSAI website through Food Safety Compliance System (FoSCoS)**

- FoSCoS has replaced the Food Licensing and Registration System (FLRS).
- Petty food business operators are required to obtain FSSAI Registration Certificate
- "Petty Food Manufacturer" means any food manufacturer, whomanufactures or sells any article of food himself or a petty retailer, hawker, itinerant vendor or temporary stall holder (or) distributes foods including in any religious or social gathering except a caterer;

**or**

- Other food businesses including small scale or cottage or such other industries relating to food business or tiny food businesses with an annual turnover not exceeding Rs. 12lakhs and/or whose production capacity of food (other than milk and milk products and meat and meat products) does not exceed 100 kg/ltr per day

Any person or entity that does not classify as a petty food business operator is required to obtain an FSSAI license for operating a food business in India.

**FSSAI License - two types - State FSSAI License and central FSSAI License**

Based on the size and nature of the business, the licensing authority would change.

- Large food manufacturer/processors/transporters and importers of food products require central FSSAI license
- Medium-sized food manufacturers, processor and transporters requires state FSSAI license.
- License period: 1 to 5 years as requested by the FBO.
- A higher fee for obtaining FSSAI license for more years.

- If a FBO has obtained the license for one or two years, renewal may be done, no later than 30 days prior to the expiry date of the license.

**4.3.Food Safety & FSSAI Standards & Regulations:**

"2.4 CEREALS AND CEREAL PRODUCTS; 2.4.6 (20) Ragi shall be the dried mature grains of Eleusinecoracana L. Gaertn, which shall be free from added colouring matter, moulds, weevils, obnoxious substances, discolouration, poisonous seeds and all other impurities except to the extent indicated in the table in sub-clause (2) and shall also be free from rodent hair and excreta.

| Sl. No. | Characteristics | Requirement |
|---|---|---|
| 1. | Moisture, | 12.0 |
| 2. | Extraneous Matter | Not more than 1.0 percent. by mass of which not (Extraneous matter) more than 0.25 percent by mass shall be mineral matter and not more than 0.10 percent by mass shall be impurities of animal origin. |
| 3. | Other edible grains (per cent. by mass), Maximum | 2.0 |
| 4. | Damaged grains (per cent. by mass), Maximum | 2.0 |
| 5. | Immature and Shrivelled Grains (per cent. by mass), Maximum | 3.0 |
| 6. | Weevilled grains (per cent. by Count), Maximum | 2 |
| 7. | Uric acid (mg per kg), Maximum | 100 |

**Food Safety**

Part I - General Hygienic and Sanitary practices to be followed by Petty Food Business Operators applying for Registration

**Sanitary and hygienic requirements for food manufacturer/ processor/handler**

The place where food is manufactured, processed or handled shall comply with the following requirements:

1. The premises shall be located in a sanitary place and free from filthy surroundings and shall maintain overall hygienic environment. All new units shall set up away from environmentally polluted areas.

2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.

3. The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.

4. Floors, Ceilings and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.

5. The floor and skirted walls shall be washed as per requirement with an effective disinfectant the premises shall be kept free from all insects. No spraying shall be done during the conduct of business, but instead fly swats/ flaps should be used to kill spray flies getting into the premises. Windows, doors and other openings shall be fitted with net or screen, as appropriate to make the premise insect free The water used in the manufacturing shall be potable and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.

6. Continuous supply of potable water shall be ensured in the premises. In case of intermittent water supply, adequate storage arrangement for water used in food or washing shall be made.

7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.

8. No vessel, container or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the preparation, packing or storage of food. (Copper or brass vessels shall have proper lining).

9. All equipments shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.

10. All equipments shall be placed well away from the walls to allow proper inspection.

11. There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.

12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.

13. Persons suffering from infectious diseases shall not be permitted to work. Any cuts or wounds shall remain covered at all time and the person should not be allowed to come in direct contact with food.

14. All food handlers shall keep their finger nails trimmed, clean and wash their hands with soap, or detergent and water before commencing work and every time after using toilet. Scratching of body parts, hair shall be avoided during food handling processes.

15. All food handlers should avoid wearing, false nails or other items or loose jewellery that might fall into food and also avoid touching their face or hair.

16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.

17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.

18. The vehicles used to transport foods must be maintained in good repair and kept clean.

19. Foods while in transport in packaged form or in containers shall maintain the required temperature.

20. Insecticides / disinfectants shall be kept and stored separately and `away from food manufacturing / storing/ handling areas.

### 4.3.1. Labelling Standards(Regulation 2.5 of FSS)

Labelling requirements for packaged food products as laid down in the Part 2.4 of the Prevention of Food Adulteration (PFA) Rules, 1955, and the Standards of Weights and Measures (Packaged Commodities) Rules of 1977, require that the labels contain the following information:

1. Name, trade name or description
2. Name of ingredients used in the product in descending order of their composition by weight or volume
3. Name and complete address of manufacturer/packer, importer, country of origin of the imported food (if the food article is manufactured outside India, but packed in India)
4. Nutritional Information
5. Information Relating to Food Additives, Colours and Flavours
6. Instructions for Use
7. Veg or Non-Veg Symbol
8. Net weight, number or volume of contents
9. Distinctive batch, lot or code number
10. Month and year of manufacture and packaging
11. Month and year by which the product is best consumed
12. Maximum retail price

Provided that — (i) the nutritional information may not be necessary, in case of foods such as raw agricultural commodities, like, wheat, rice, cereals, flour, spice mixes, herbs, condiments, table salt, sugar, jaggery, or non –nutritive products, like, soluble tea, coffee, soluble coffee, coffee-chicory mixture, packaged drinking water, packaged mineral water, alcoholic beverages or flour and vegetables, processed and pre- packaged assorted vegetables, flours, vegetables and products that comprise of single ingredient, pickles, papad, or foods served for immediate consumption such as served in hospitals, hotels or by food services vendors or halwais, or food shipped in bulk which is not for sale in that form to consumers.

**Wherever applicable, the product label also must contains the following**

The purpose of irradiation and license number in case of irradiated food. Extraneous addition of colouring material.

Non-vegetarian food – any food which contains whole or part of any animal including birds, fresh water or marine animals, eggs or product of any animal origin as an ingredient, not

including milk or milk products – must have a symbol of a brown colour-filled circle inside a brown square outline prominently displayed on the package, contrasting against the background on the display label in close proximity to the name or brand name of the food.
Vegetarian food must have a similar symbol of green colour-filled circle inside a square with a green outline prominently displayed.
All declarations may be: Printed in English or Hindi on a label securely affixed to the package, or Made on an additional wrapper containing the imported package, or Printed on the package itself, or May be made on a card or tape affixed firmly to the package and bearing the required information prior to customs clearance.

Exporters should review the Chapter 2 of the "FSS (Packaging and Labelling) Regulation 2011" and the Compendium of Food Safety and Standards (Packaging and Labelling) Regulation before designing labels for products to be exported to India. FSSAI revised the labelling Regulation and a draft notification to that effect was published on April 11, 2018, inviting comments from WTO member countries and the comments received are under review and the publication date remains unknown.

According to the FSS Packaging and Labelling Regulation 2011, "pre-packaged" or "pre packed food" including multi-piece packages, should carry mandatory information on the label.

# CHAPTER 5

# OPPORTUNITIES FOR MICRO/UNORGANIZED ENTERPRISES

## 5.1. PM-FME Scheme:

Ministry of Food Processing Industries (MoFPI), in partnership with the States, has launched an all India centrally sponsored "PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)" for providing financial, technical and business support for up-gradation of existing micro food processing enterprises. The objectives of the scheme are :

I. Support for capital investment for up-gradation and formalization with registration for GST, FSSAI hygiene standards and Udyog Aadhar;
II. Capacity building through skill training, imparting technical knowledge on food safety, standards & hygiene and quality improvement;
III. Hand holding support for preparation of DPR, availing bank loan and up-gradation;
IV. Support to Farmer Producer Organizations (FPOs), Self Help Groups (SHGs), producers cooperatives for capital investment, common infrastructure and support branding and marketing.[iv]

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