Ministry of Food Processing Industries
Government of India

सत्यमेव जयते

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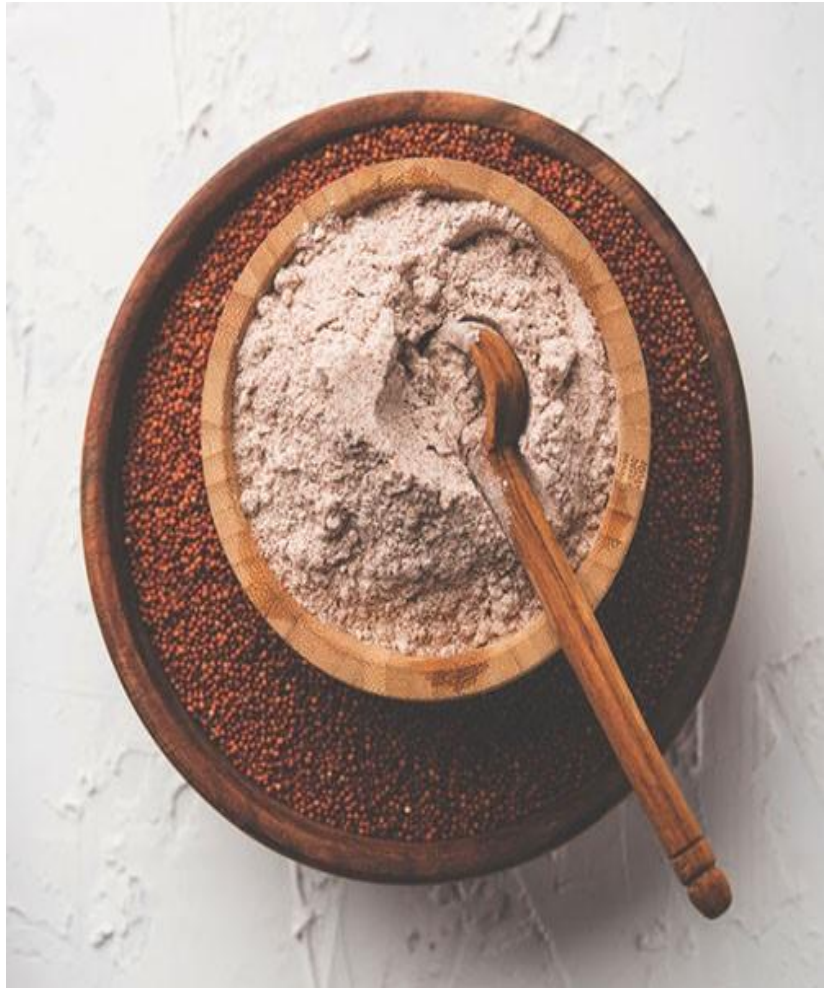
RAGI FLOUR

AATMANIRBHAR BHARAT

PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)

INTRODUCTION



Industrial Overview:

- Ragi flour is value-added meal products processed from millets.
- In the arid and semi-arid regions of Africa and Asia, finger millet, is an annual herbaceous plant widely cultivated as a cereal crop.
- Ragi flour is a significant source of dietary carbohydrates.
- Its use in the regular diet is currently generally limited to rural/tribal areas only.
- Using traditional as well as modern techniques to produce ragi flour, the processing of finger millet will be the possible solution to encourage and boost consumption.

INTRODUCTION

Product Description:

- Ragi flour is made out of ragi/finger millet grains. It is a powder food, finger millet powder.
- Ragi flour is rich in protein. Ragi flour is an ideal source of gluten free protein to vegetarians.
- Ragi flour is low in fats. Ragi flour is high in calcium, iron & other minerals.
- Ragi flour is made of purely graded, de-stoned ragi grains.
- Ragi flour is used to prepare baked items like (ragi biscuits, ragi cake etc.).
- Ragi flour also used to prepare ragi porridge, ragi halwa, ragi dosa, ragi mudde etc.

INTRODUCTION

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).
- 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.
- Karnataka, Uttarakhand, Maharashtra, Tamil Nadu, Odisha, Andhra Pradesh and Gujarat are the most important finger millet growing states.

INTRODUCTION

Raw Material Description:

- The main raw material is ragi/finger millet.
- Approximately 5-8% of protein, 1-2% of ether extractives, 65-75% of carbohydrates, 15-20% of dietary fibre 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 (408 mg 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.
- Finger millet is rich in amino acids (Tryptophan, Threonine, Valine, Isoleucine and Methionoine).
- Finger millet could help to keep hunger, degenerative diseases and premature aging at bay if eaten regularly.

INTRODUCTION

Types of Raw Material:

- Finger millet is a tropical and subtropical crop that can be grown at an altitude of up to 2100 m.
- Finger millet 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.

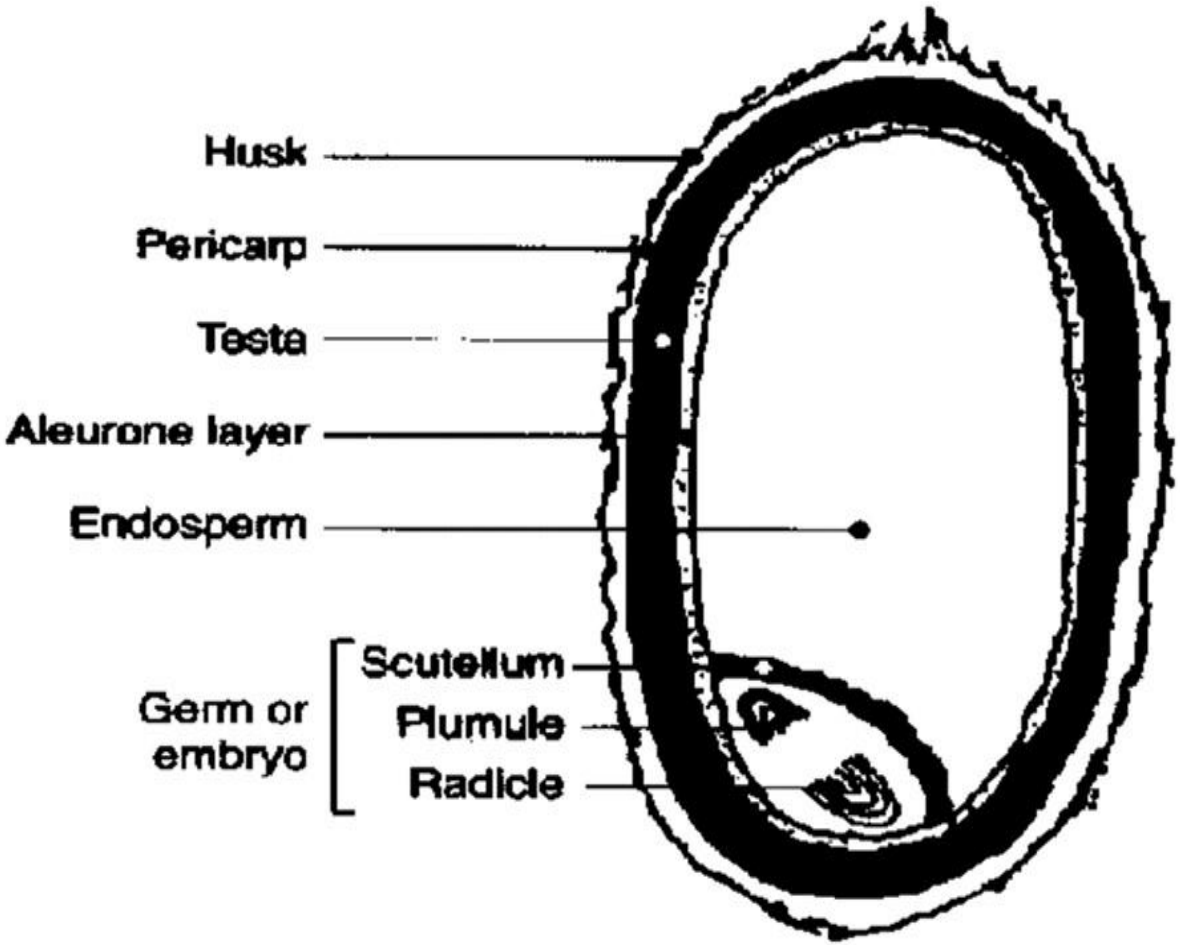
TYPES OF RAW MATERIAL

State	Varieties
Tamil Nadu	GPU 28, CO 13, TNAU 946 (CO 14), CO 9, CO 12, CO 15
Andhra Pradesh	VR 847, PR 202, VR 708, VR 762, VR 900, VR 936
Jharkhand	A 404, BM 2
Orissa	OEB 10, OUAT 2, BM 9-1, OEB 526, OEB-532
Uttarakhand	PRM-2, VL 315, VL 324, VL-352, VL 149, VL 146, VL-348, VL-376, PES 400
Chattisgarh	Chhattisgarh-2, BR-7, GPU 28, PR 202, VR 708 and VL 149, VL 315, VL 324, VL 352, VL 376
Maharashtra	Dapoli 1, PhuleNachani, KOPN 235, KoPLM 83
Gujarat	GN 4, GN 5, GNN 6
Bihar	RAU 8
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

PROCESS & MACHINERY REQUIREMENT

Raw Material Aspects:

- To produce flour, finger millet can be milled as a first step in processing.
- 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.
- 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.
- The primary product of finger millet, is whole grain flour.
- Prior to grinding, moistening the millet seeds helps mechanically extract the bran without causing damage to the rest of the crop.

PROCESS & MACHINERY REQUIREMENT

Source of Raw Material:

- Finger millet is a strong laxative and prevents constipation due to its rich fibre 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.

PROCESS & MACHINERY REQUIREMENT

Technologies

- **Hand operated flour mill:**

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

TECHNOLOGIES

- **Saddle 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.

TECHNOLOGIES

➢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. Electric motors are used in modern flour mills as power source.

TECHNOLOGIES

➢ **Roller mills:**

As the population multiplied and the need for 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.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

- **Grain delivery:**

The grain is supplied by covered trucks and hopper railcars to factories. After arriving at the mill, grain stocks will often have gone through a variety of accumulation processes (farmer, country elevator, terminal elevator, etc.).

- **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.

- **Cleaning the barley grains:** It can take as many as eight steps.

- **Magnetic separator** – The grain first passes by a magnet that removes ferrous metal particles.

- **Separator** – Vibrating or rotating drum separators remove bits of wood, straw etc.

- **Aspirator** – Air currents act as a vacuum to remove dust and lighter impurities.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

- **Cleaning the barley grains:** It can take as many as eight steps.

- **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** –It rejects anything longer, shorter, more round, more angular or in any way a different shape.

- **Scourer**– The scourers eliminates the outer husks, the soil in the kernel crease, and other minor impurities.

- **Impact Entoleter**– The centrifugal force cuts down some unsound kernels or insect eggs and the aspiration rejects them from the flow of the mill.
- **Colour Separator** – Newer mills may also utilize electronic colour separators to simplify the cleaning process.

- **Grinding**: 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.

- **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.

- **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.

- **Packing:** The packaging is carried out as per required weight. Then sealing is done.

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine Name	Description	Machine Image.
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.	
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.	

Machine Name	Description	Machine Image.
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.	
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.	

Machine Name	Description	Machine Image.
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.	
Flour testing kit	This is the type of kit that measure moisture of flour before packaging of final product.	
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.	

PROCESS & MACHINERY REQUIREMENT

Additional Machine & Equipment:

Machine and Equipment	Uses	Pictures
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	

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ADDITIONAL MACHINE & EQUIPMENT

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Machine and Equipment	Uses	Pictures
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.	

PROCESS & MACHINERY REQUIREMENT

General Failures & Remedies:

General Failures	Remedies
Ball bearing failure of various machine	1. Proper periodic lubrication of all bearings in various machines. 2. Regular replacement of all bearing to prevent critical failures.
Power Drive Overload	1. Ensure proper weighing & metering specially in case of semi-automatic plant. 2. Install warning sensor in buffer region of loading capacity to ensure efficient operation.
Mechanical Key Failure	1. Ensure that mechanical keys are replaced as per there pre-defined operational life. 2. Prevent Overloading.
Loss of Interface	1. Provide proper physical shielding for the connections.

PROCESS & MACHINERY REQUIREMENT

Nutritional Information:

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

PROCESS & MACHINERY REQUIREMENT

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.
- 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.
- Ragi has an important protein portion, methionine amino acid, which makes it an important low-cost ingredient for millions of poor people.

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PM-FME Scheme

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

For More details Contact:

National Institute of Food Technology and Entrepreneurship and Management
Ministry of Food Processing Industries
Plot No. 97, Sector-56, HSIIDC, Industrial Estate, Kundli,
Sonipat, Haryana-131028

Website: http:www.niftem.ac.in

Email: pmfmecell@niftem.ac.in
Call: 0130-2281089