Ministry of Food Processing Industries
Government of India

सत्यमेव जयते

NIFTEM
Knowledge. Innovation. Outreach

PROCESSING OF BAJRA FLOUR

AATMANIRBHAR BHARAT

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

INTRODUCTION

Industrial Overview:

- Cereals are an essential component of the human diet.
- They are important source of starch and other dietary carbohydrates (dietary fiber).
- Cereals play an important role in human consumption of energy and nutrients.
- Bajra is a common Hindi name for the *Pennisetum glaucum* seed
- Bajra is the important crop of India, It has the same protein quantity as wheat.
- The protein contains a high proportion of globulin and albumin-followed prolamine
- It is more usually ground into flour and made into chapati.

INTRODUCTION

Industrial Overview:

- Pearl millet, or bajra, is a gluten-free grain
- Bajra flour is made by grinding the Bajra (pearl millet) grains.
- It is grayish in color and has a nutty flavor.
- Bajra flour is an excellent source of iron, protein, folic acid, and fiber.
- Due to its productivity and high-temperature conditions, short growing season under dry conditions for the crop is preferred.
- Millets are native to many parts of the globe.

INTRODUCTION

Industrial Overview:

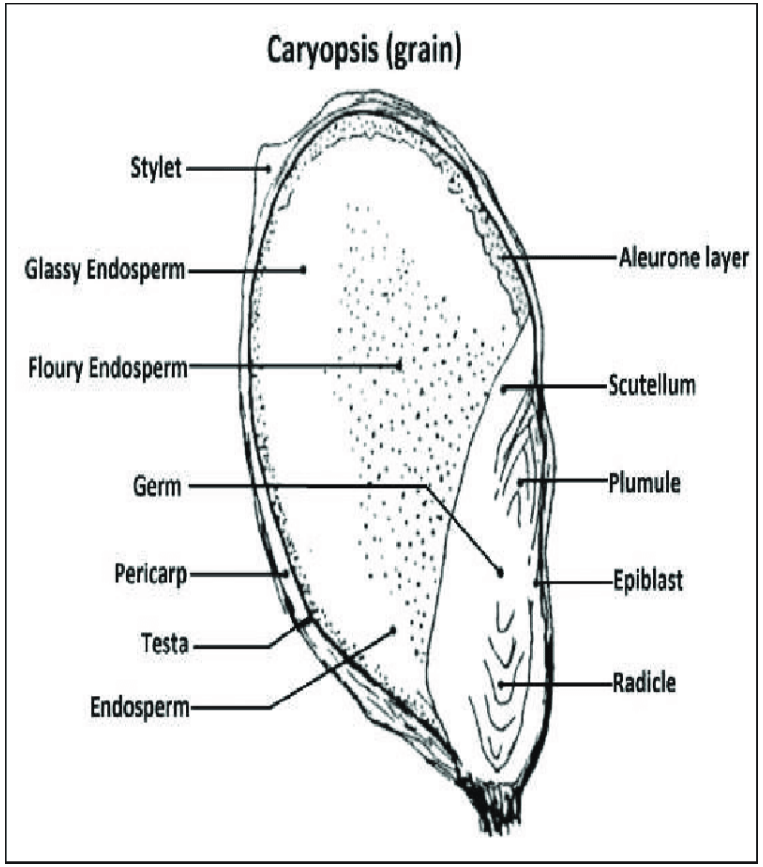
A whole grain consists of 3 main parts:

Bran: The hard, outer layer of the grain. It contains fiber, minerals and antioxidants.

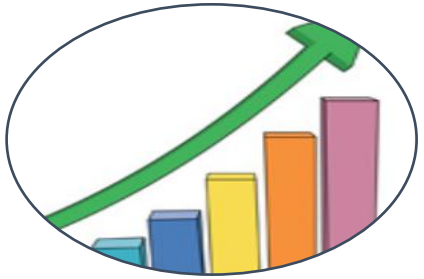
Germ: The nutrient-rich core that contains carbs, fats, proteins, vitamins, minerals, antioxidants and various phytonutrients. The germ is the embryo of the plant, the part that gives rise to a new plant.

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.



INTRODUCTION



Market Potential:

- In Africa and India, where it is a significant source of nourishment, the grain is essentially formed.
- From its malted seeds, an intoxicating drink is obtained.
- The size of the global demand for millets was US$ 9,407.
- In 2018, 8 million is anticipated to rise at a CAGR of 4. 6 percent to cross US$ 14,026 from 2019 to 2027.
- By 2027, 3 million Millets are small-seeded grasses that are commonly cultivated as cereal crops or grains for food and human food throughout the world.

INTRODUCTION

Raw Material Description

- In Africa and India, where it is a significant source of nourishment, the grain is essentially formed.
- Nonetheless, it is also produced and spent in various different places far and wide.
- Bajra refers to pearl millet plants' palatable seeds.
- They grow in various shades of purple, white, yellow, dark, earthy, and pale blue.
- The seeds are cooked as an oat grain on a daily basis or are now and then finely ground and used as flour.
- The amount of protein Bajra has is the same as wheat.

INTRODUCTION

Types of Raw Material:

The predominant crop in India is pearl millet.

It has the same protein quantity as wheat.

Pearl bajra leaves most of the germs intact to around 8 percent polish, and the nutritional value is not significantly affected.

Pearling enhances the products' look and taste.

Also, the grain is ideal for malt preparation.

When de-husked and cooked in the same way as rice, it is eaten.

PROCESS & MACHINERY REQUIREMENT

Raw Material Aspects:

- The larger kernels in all types of millet can be almost white, pale yellow, orange, grey slate blue, or purple.
- the bajra grains are ovoid 3 to 4 mm in length.
- The weight of 1000 seeds will be anywhere from 2.5 to 14 g, with an average of 8 g.
- Pearl millet contains a substantially high percentage of proteins (12-16%) and lipids (4-6 %), 11.5 of dietary fiber are contained in it.

PROCESS & MACHINERY REQUIREMENT

Source of Raw Material:

- Rajasthan is the country's largest producer of coarse cereals.
- Millets are cultivated in 21 States in India.
- Top Bajra producing state in Rajasthan followed by Maharashtra, Haryana, Gujarat, and Uttar Pradesh.
- The top high-yielding stats is Tamil Nadu.
- Bajra grows well in dry and warm climate conditions.
- it’s the drought-tolerant crop that requires low annual rainfall ranging between 40 cm to 60 cm.

PROCESS & MACHINERY REQUIREMENT

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.
- These hand stones were used to crush the grain and fairly coarse flour was made.
- These rotating querns are hand-powered and are thus constrained by their operator's strength in size and milling capability.

PROCESS & MACHINERY REQUIREMENT

Technologies:

Mills and mill stones:

- As the agricultural production of cereals been the need for more efficient methods of flour production.
- In such mills, even larger circular-shaped stones are used.
- To move the spinning motion of the runner stone, power sources have been used.
- Electric motors are used in modern flour mills that use spinning millstones.
- 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.

PROCESS & MACHINERY REQUIREMENT

Technologies:

Roller mills

- By moving the grain through a series of paired counter-rotating rollers with fluted surfaces, these mills work.
- the process is necessary to separate the bran from the starchy endosperm.
- It is a super-fine white flour that is the finished result.
- To obtain brown flour a proportion only of the extracted material is added back.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Grain delivery:

- The grain is supplied by covered trucks and hopper railcars to factories.
- The distance traveled 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.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Grain standard:

- Before Pearl Millet is unloaded in a factory, the assessment is required with samples.
- The millets 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 Pearl Millet and assess end-user values during unloading

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Cleaning the Pearl Millet

- Grain storing is a science.
- It is necessary to maintain the correct moisture, heat, and air or mildew, sprout or ferment Pearl Millet.
- The grain can also be fumigated to eradicate insect pests during transportation.
- During the process In terms of nutrient level and consistency, Pearl Millet is stored.
- The time of storage varies.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Cleaning the Pearl Millet:

It can take as many as six steps. The machines that clean the grain are collectively called the cleaning house.

- Magnetic separator
- Separator
- Aspirator
- De-stoner
- Disc separator
- Scourer
- Impact Entoleter
- Colour Separator

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Grinding Pearl Millet:

- The kernels of Pearl Millet are now ready to be milled into flour.
- Pearl Millet kernels are weighed or fed from bins to roller mills, corrugated cylinders made of chilled steel.
- The modern milling process is a gradual reduction of the Pearl Millet kernels through the grinding and sifting process.
- This science of analysis, blending, grinding, sifting, and blending results inconsistent end product.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Sifting

- Through pneumatic tubes, the broken particles of Pearl Millet are elevated and then dropped into huge, vibrating, box-like sifters.
- where they are shaken to separate the larger from the smaller particles.

Blending

- From the fiber, the flour is separated and the process is repeated again.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

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.
- 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.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Packaging of Product

- The packaging is carried out in a much simple process than milling.
- The Pearl millet flour is fed to the holding tank of the packaging machine.
- Then it simply fills the packet as per the required weight & seals the other end, generating the required packet.

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine	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.	

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine	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.	

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine	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.	
Packet Filling & Packaging Machine	It's a simple packaging machine, designed to fill the given food-grade plastic material's continuous pouch with the required product.	

PROCESS & MACHINERY REQUIREMENT

Additional Machine & Equipment:

Machine Name	Description	Description 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.	

PROCESS & MACHINERY REQUIREMENT

Additional Machine & Equipment:

Machine Name	Description	Description Image
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:

S. No.	General Failures	Remedies
1.	Emery Roller Wear in Dehusker	➢ They should be checked for their frictional properties & diameter periodically. ➢ Regular replacement of emery roller to ensure smooth & efficient operation.
2.	Ball bearing failure of various machine	➢ Proper periodic lubrication of all bearings in various machines. ➢ Regular replacement of all bearing to prevent critical failuraes.
3.	Power Drive Overload	➢ Ensure proper weighing & metering specially in case of semi-automatic plant. ➢ Install warning sensor in buffer region of loading capacity to ensure efficient operation.

PROCESS & MACHINERY REQUIREMENT

General Failures & Remedies:

S. No.	General Failures	Remedies
4.	Mechanical Key Failure	➢ Ensure that mechanical keys are replaced as per there pre-defined operational life. ➢ Prevent Overloading.
5.	Loss of Interface	➢ 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. ➢ Provide proper physical shielding for the connections.

PROCESS & MACHINERY REQUIREMENT

Nutritional Information:

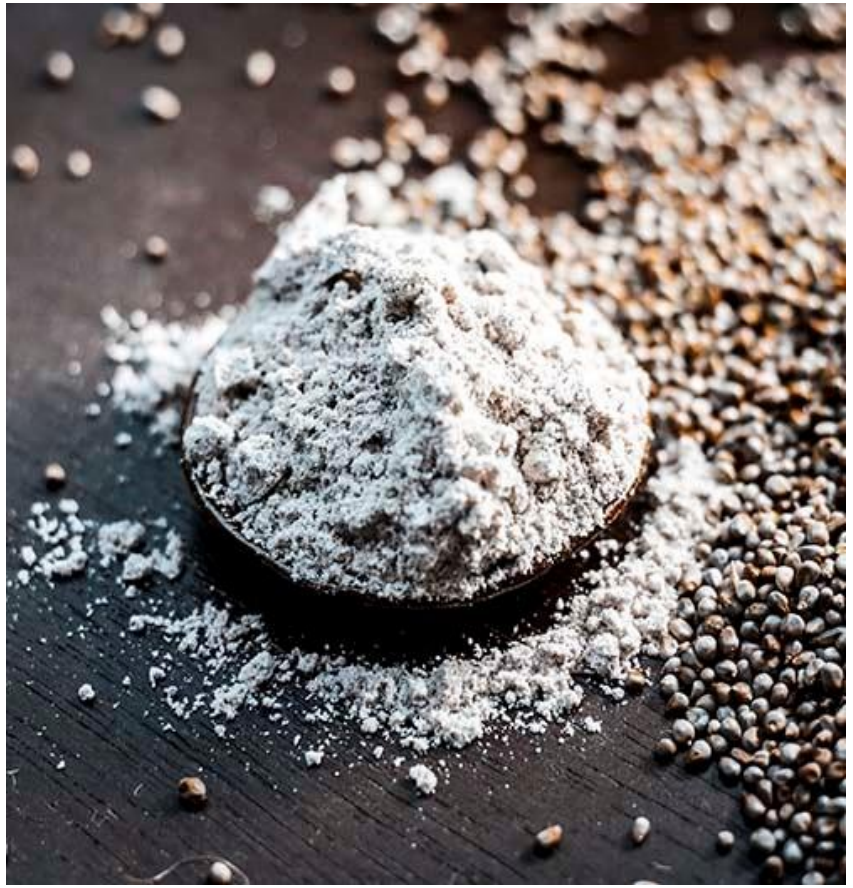
	Protein (g)	Fat (g)	Ash (g)	fiber (g)	Carbs (g)	Energy (kcal)	Ca (mg)	Fe (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)
Pearl millet	11.8	4.8	2.2	2.3	67.0	363	42	11.0	0.38	0.21	2.8

- Nutrient composition of millets and other cereals (per 100 g edible portion; 12% moisture)
- All values except protein are expressed on a dry weight basis.

PROCESS & MACHINERY REQUIREMENT

Export Potential & Sales Aspect:

- One of the oldest cereals known to mankind is bajra or pearl millet.
- The cereal is high in vitamins that include calcium, fiber, and B-complex.
- In recent years, owing to improvements in its use, it has been turned into a more market-oriented crop.
- Millets are cereals with small seeds that maintain high nutritional characteristics.
- Due to the health benefits associated with it, growing marketing of millet flour through social media, food blogs, etc. makes it a popular nutritious food in the world market.



PM-FME SCHEME

The objectives of the scheme are:

- 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.
- https://mofpi.nic.in/pmfme/docs/SchemeBrochureI.pdf

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