Ministry of Food Processing Industries
Government of India

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Reading Manual for Bajra Flour

Under PMFME Scheme

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Chapter1
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:

Millets are a group of highly variable small-seeded grasses that are widely cultivated around the world for fodder and human food as cereal crops or grains. In the semi-arid tropics of Asia and Africa (in particular in India, Mali, Nigeria and Niger), millets are important crops, with 97 percent of millet production in developing countries. 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. Pearl millet, which is a significant crop in India and parts of Africa, is the most widely grown millet. Significant crop species also include finger millet, proso millet, and foxtail millet. Just one of several styles of millet is Bajra pearl millet. Some other common millet varieties are:

- Pearl Millet
- Fonio,
- Finger millet (ragi),
- Job's tears, foxtail
- kodo millet.

The predominant crop in India is pearl millet, also known as cumbu. It has the same protein quantity as wheat. The protein contains a high proportion of globulin and albumin-followed prolamine. Pearling 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.It is more usually ground into flour and made into chappathi. It is rendered into thin porridge as well. The Bajra pearl millet is only one of several millet varieties.Fonio, finger millet (ragi), Job's tears, foxtail, and kodo millet are some other popular assortments of millet. Most millets, like bajra, have noteworthy dietary profiles. Here's the usual 1 cup (170 grams) cooked millet nourishing profile:

Nutritions	**Value**
Calories	201
Protein	6 grams
Fat	1.7 grams
Carbs	40 grams
Fiber	2 grams
Sodium	286 mg
Folate	8% of the Daily Value (DV)
Iron	6% of the DV
Magnesium	18% of the DV
Thiamine	15% of the DV
Niacin	14% of the DV
Phosphorus	14% of the DV
Zinc	14% of the DV
Riboflavin	11% of the DV
Nutrient B6	11% of the DV[i]

1.3.Market Potential:

Bajra is a common Hindi name for the Pennisetum glaucum seed, otherwise called pearl millet. It is also known as dukn, cumbu, gero, sanio, kambu, babala, or bulrush millet. 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.

India, led by China, is one of the major countries dominating the millet market in the Asia Pacific. The amount of protein Bajra has is the same as wheat. A high proportion of prolamine, followed by globulin and albumins, is found in the protein. Pearling enhances the look and taste of the products. Until dehusked and prepared in the same way as rice, it is eaten.More regularly, it is ground into flour and turned into sheets. It is rendered into thin porridge as well. After it is parched, the grain is occasionally consumed. The commodity is equivalent to popcorn. The grain is suited for malt preparation. 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 and is anticipated to rise at a CAGR of 4. 6 per cent 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.

The global production of millet has been estimated at 27.8 million tons. With a 41.0 percent global market share, India is the largest global producer. The importance of millet as a food staple, particularly in India, has declined over the last two decades due to various factors, including growing incomes, increasing urbanization, and government policies.More than 50 percent of millet production, as opposed to its use only as a staple, is currently finding its way into alternative uses. Demands for food and beverage products are further driven by the increasing population, which in turn contributes to growth in the millet market in India.The bakery sector is one of the fastest-growing sectors of consumer goods with high demand opportunities for foreign businesses. Due to its immense potential for value addition, especially within the food processing industry, the Indian food sector has emerged as a high growth and high-profit sector.

The global consumption of millet has decreased at a rate of 0.9 percent and is projected to show positive movement over the forecast period. India, Niger, and China are the world's

largest millet producers, accounting for over 55 percent of global production. India was the world's largest producer of millet for several years. However, millet production has significantly increased in Africa in recent years.

1.4. Raw Material Description:

Higher fibre content millets contribute significantly to the nutritional protection of a wide section of the population living in millet growing areas, considered the most vulnerable communities, and their protein quality and mineral composition contribute significantly. Millets are best known nutritionally for being a healthy source of magnesium, manganese and phosphorus minerals.Research has linked magnesium to a reduced risk of heart attack, and for body tissue growth and energy metabolism, phosphorus is essential. Millets are also abundant in phytochemicals, including phytic acid, which is thought to reduce cholesterol, and phytate, which is associated with a decreased risk of developing cancer.Therefore, in terms of their food, nutritional and livelihood protection and their position in local agro-ecosystems, millets are strategic.

However, the food uses of millets were restricted to conventional consumers only; they were limited, in particular, to their cultivation areas and were still underutilized. Their food uses will definitely be diversified by processing those using conventional as well as contemporary methods for the preparation of value added and convenience items.Their exploitation for the preparation of ready-to-use or ready-to-cook items will lead to the increase of millet consumption among non-millet consumers and thus to food protection.

1.5. Types of Raw Material:

The predominant crop in India is pearl millet, also known as cumbu. It has the same protein quantity as wheat. The protein contains a high proportion of globulin and albumin-followed prolamine. Pearlbajra 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. After it is parched, the grain is often consumed, the result being similar to popcorn. Also, the grain is ideal for malt preparation. When de-husked and cooked in the same way as rice, it is eaten. More generally it is ground into flour and made into chapattis.

Pearl millet can be cultivated on various soils. In soil vulnerable to waterlogged conditions, it does not grow well. Once or twice, the field should be ploughed followed by harrowing to create fine tilth.Most of the pearl millet area is grown with hybrids while the varieties are

preferred in drought prone ecologies. The latest list of hybrids and varieties of pearl millet is given below.

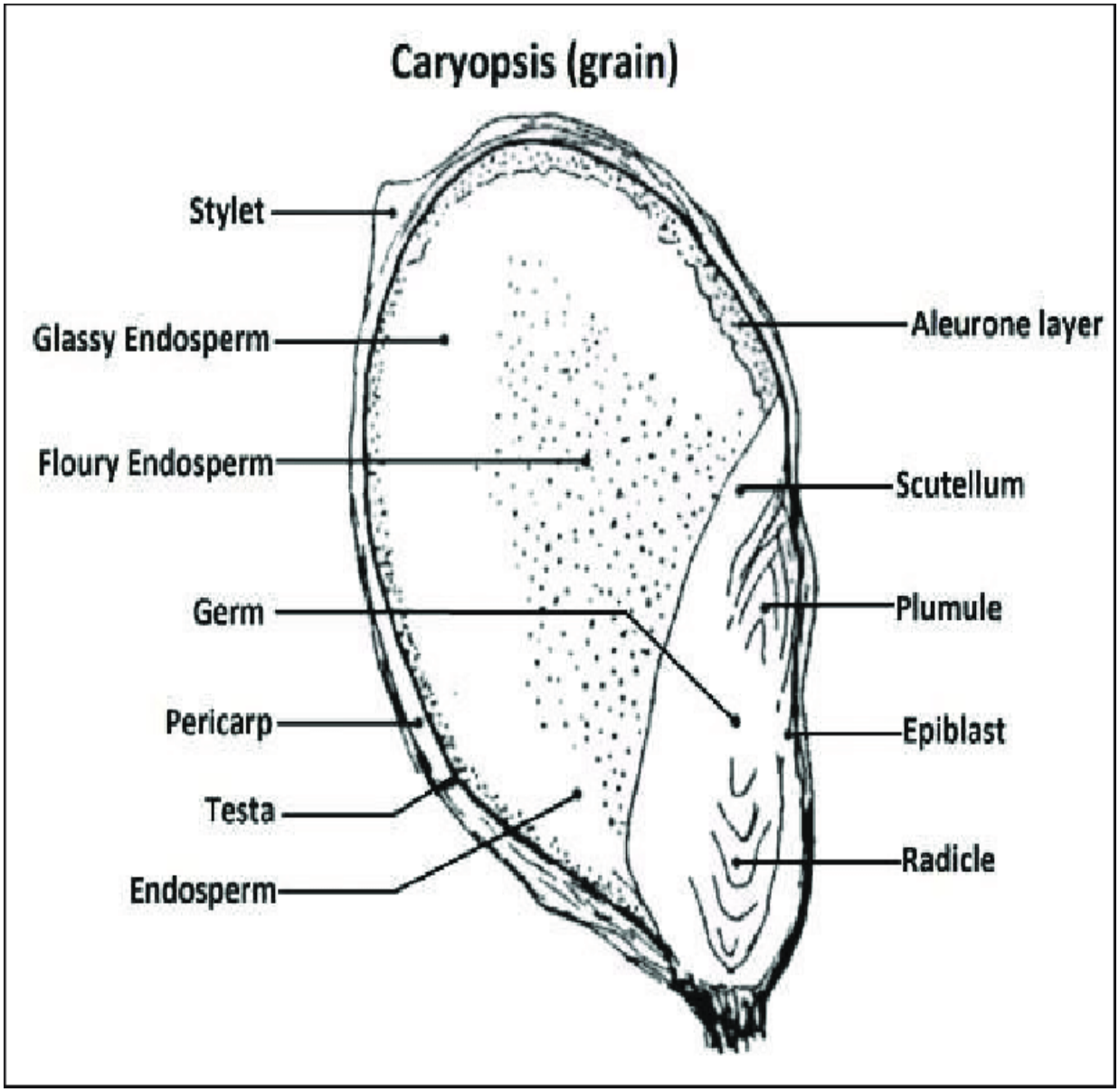
Districts/Season	Varieties/Hybrid
1. IRRIGATED	
i. Chithiraipattam (March-April)	
All pearl millet growing districts except Nilgiris	CO 7, CO (Cu) 9, X 7, ICMV 221, TNAU cumbu hybrid, Co 9
ii. Masipattam (January-February)	
All pearl millet growing districts except the Nilgiris,	CO 7, CO (Cu) 9, X 7, ICMV 221, TNAU cumbu hybrid Co 9
2. RAINFED	
i. Adipattam (June-July)	CO 7, CO (Cu) 9, X 7, ICMV 221, TNAU cumbu hybrid Co 9
ii. Purattasipattam (September - October)	October)CO 7, CO (Cu) 9, X 7, ICMV 221, TNAU cumbu hybrid Co 9[ii]

Chapter 2

Process & Machinery Requirement

2.1. Raw Material Aspects:

The larger kernels in all types of millet can be almost white, pale yellow, orange, grey slate blue or purple with ovoid grains of 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 fibre are contained in it.



2.2.Source of Raw Material:

In the semi-arid tropics of Asia and Africa (in particular in India, Mali, Nigeria, and Niger), millets are essential crops, with 97% of millet production.

Rajasthan is the country's largest producer of coarse cereals. Millets are grown in about 21 States. There is a major impetus in Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Telangana, Uttarakhand, Jharkhand, Madhya Pradesh, and Haryana. We are trying to push millets in Manipur, Meghalaya, and Nagaland because it is a major staple diet for the tribes in that region. Millets are cultivated in 21 States in India. There is a major impetus. Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Telangana, Uttarakhand, Jharkhand, Madhya Pradesh, and Haryana. Manipur, Meghalaya, and Nagaland covered a small area of millets production.

2.3.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 been 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 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. It is a 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.

2.4. 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 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.
- **Cleaning the Pearl Millet:** 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 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.
- **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 – 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 Pearl Millet flows into the grinding bins, large hoppers that regulate the feeding of the Pearl Millet to the actual milling process.
- ✓ Colour Separator – Newer mills may also utilize electronic color separators to simplify the cleaning process.

- **Grinding Pearl Millet**: The kernels of Pearl Millet are now ready to be milled into flour.

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 in consistent end product.Pearl Millet 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 Pearl Millet particles to granular “middling” that are as free from bran as possible.

- **Sifters**- 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 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 foodborne disease.
- **Packaging of Product:** The packaging is carried out in a much simple process then milling, the Pearl millet 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.

2.5.Flow Chart:

Steps	Machine	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 Bajra	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 Bajra	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.	

2.6. 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.	
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.	

2.7. General Failures & Remedies:

S. No.	General Failures	Remedies
1.	Emery Roller Wear in Dehusker	1. They should be checked for their frictional properties & diameter periodically. 2. Regular replacement of emery roller to ensure smooth & efficient operation.
2.	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.
3.	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.
4.	Mechanical Key Failure	1. Ensure that mechanical keys are replaced as per there pre-defined operational life. 2. Prevent Overloading.

5.	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. 2. Provide proper physical shielding for the connections.

2.8. Nutritional Information:

Nutrient composition of millets and other cereals (per 100 g edible portion; 12% moisture)

Food	Protein (g)	Fat (g)	Ash (g)	fiber (g)	Carbs (g)	Energy (kcal)	Ca (mg)	Fe (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)
Rice (brown)	7.9	2.7	1.3	1.0	76.0	362	33	1.8	0.41	0.04	4.3
Wheat	11.6	2.0	1.6	2.0	71.0	348	30	3.5	0.41	0.10	5.1
Maize	9.2	4.6	1.2	2.8	73.0	358	26	2.7	0.38	0.20	3.6
Sorghum	10.4	3.1	1.6	2.0	70.7	329	25	5.4	0.38	0.15	4.3
Pearl millet	11.8	4.8	2.2	2.3	67.0	363	42	11.0	0.38	0.21	2.8
Finger millet	7.7	1.5	2.6	3.6	72.6	336	350	3.9	0.42	0.19	1.1
Foxtail millet	11.2	4.0	3.3	6.7	63.2	351	31	2.8	0.59	0.11	3.2
Common millet	12.5	3.5	3.1	5.2	63.8	364	8	2.9	0.41	0.28	4.5
Little millet	9.7	5.2	5.4	7.6	60.9	329	17	9.3	0.30	0.09	3.2
Barnyard millet	11.0	3.9	4.5	13.6	55.0	300	22	18.6	0.33	0.10	4.2

Kodo millet	9.8	3.6	3.3	5.2	66.6	353	35	1.7	0.15	0.09	[iii]

- 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.

2.9.Export Potential & Sales Aspect:

Describe sales aspect in ODOP district, nation & in other nations i.e. export.

One of the oldest cereals known to mankind is bajra or pearl millet. With an annual planting area of 10 million hectares, India is the largest producer of this staple food, producing about 7.5 million tonnes of grain. Production in Gujarat, Maharashtra, and Rajasthan is concentrated. One-third of the world's population is sustained by the consumption of millet. The cereal is high in vitamins that include calcium, fibre, and B-complex. In recent years, owing to improvements in its use, it has been turned into a more market-oriented crop. India is currently exporting pearl millet to many countries, such as Pakistan, Sudan, the UAE, Yemen, and Vietnam. Millets are cereals with small seeds that maintain high nutritional characteristics. They are available in different colours and varieties, such as white, red, pale yellow, and grey. In relation to their nutrient properties, they are comparable to other highly eaten cereal grains, such as wheat and rice. 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.

The market of millet flour can be segmented by product type, by nature, by end-use, by application and by channel of distribution. The demand for millet flour is segmented into different categories, such as pearl, finger, foxtail, and others, depending on the product type. On the basis of end-use, the millet flour market can be segmented into industrial use and household use. The millet flour market can be segmented into bread making and bakery goods on the basis of use. The millet flour market can be segmented into organic and traditional, on the basis of design. The millet flour market can be segmented into direct sales and indirect sales on the basis of a distribution system. The indirect sales market can be further sub-segmented into the hypermarket, supermarket, convenience stores, and online retailers

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. In open condition it gets infested within 2 months, affecting bajra flour's shelf life. Bajra flour is infested for a variety of reasons-

- The moisture content of the bajra 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 millets grains
- 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.Bajra flour Packaging:

Flour is packed directly in gunny bags, gunny poly-line bags for bulk sale, and for retail sale in laminated pouches or poly-bags.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 odor/taste to the product
- Must be FDA approved.

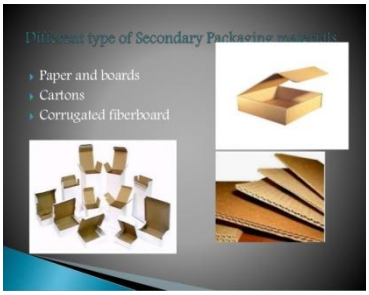
- **Hanging Bags-** Hanging bags in grocery stores and other shopping outlets are commonly used. They are a type of plastic bag that is also sealed with a back-middle seam on both ends as well.Hanging bags have a pre-cut hole that makes it easier for them to hang from hooks so that they can be seen in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

Food Standards

Standards of Sorghum (Jowar) and its flour, whole and decorticated peal millet grain (Bajra) and its flour, Finger Millet (Ragi), and Amaranth are prescribed in the sub-regulation 2.4 of Food Safety & Standards (Food Product Standards and Food Additives) Regulations, 2011.
For sub-regulation 2.4.17, following shall be substituted, namely:-

Sl.No.	Characteristics	Requirement
1.	Moisture, %by mass, not more than	13.0
2.	Crude protein, % on dry mass basis, Not more than	2.5
3.	Acid insoluble ash, % on dry mass basis,Not more than	13.0
4.	Particle Size, %	Shall pass through 1mm sieve (18 mesh).
5.	Uric acid (mg per kg), Maximum	100
6.	Protein (N×5.7)(per cent on dry matter basis), Not less than	8.0
7.	Fat (% on dry mass basis), Not more than	7.0
8.	Alcoholic acidity (with 90 percent alcohol) expressed as H2SO4, % on dry weight basis, Not more than	0.15

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, Colors and Flavors
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 coloring 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 color-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 color-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 Labeling) Regulation 2011" and the Compendium of Food Safety and Standards (Packaging and Labeling) 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 Labeling Regulation 2011, "prepackaged" 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 UdyogAadhar;
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.

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