



MILLETS

YOJANA (JANUARY 2023)



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1. International Year of Millets 2023

Introduction:

- India's effort has resulted into **United Nation's** declaration of year **2023** as **international year of millets (IYM)**.
- India is on the way to become the global hub of millet production with more than **80% of Asia's share** of production of millets.
- Government of India has declared to celebrate the IYM as a *Jan Andolan* so that Indian millets, recipes and value-added products are accepted globally.
- The **Food and Agriculture Organisation (FAO)** has held that it would raise the awareness about production of millets in its member nations.
- Once in life-time event of COVID-19, the ill-effects of climate change have led to the challenge of food and nutrition security across world.
- Millets, which are drought proof crop and nutrient rich crop can solve this problem.
- IYM 2023 aims to contribute to the UN 2030 Agenda for Sustainable Development, particularly SDG 2 (Zero Hunger), SDG 3 (Good health and well-being), SDG 8 (Decent work and economic growth), SDG 12 (Responsible consumption and production), SDG 13 (Climate action) and SDG 15 (Life on land).

1. The sustainable cultivation of millets can support climate-resilient agriculture

- Millets are hardy species, which can tolerate water stresses, at the same time they can help in carbon sequestering. Hence millets are suitable crops to fight with climate change (SDG 13) and to have a positive impact on life on land (SDG 15).

2. The sustainable production of millets can fight hunger and contribute to food security and nutrition

- Millets can be grown in water scarce dry regions; they are also nutrient rich compared to any other grains. Hence, they are better suited for the fight to end hunger (SDG 2).

3. Millets can be important part of a healthy diet; SDG 3 (Good health and well-Being)

- Millets are good sources of minerals, dietary fibre, antioxidants and protein. With a low glycaemic index, they are a good option for people with high-blood sugar.
- Millets are also gluten-free and an excellent and cost-effective source of iron for iron-deficient diets.
- As whole grains, each variety of millets provide different amounts and types of fibre. Dietary fibre has a role in regulating bowel function, blood sugar and lipids, and satiation.

4. Greater consumption of millets can offer opportunities to smallholder farmers to improve their livelihoods

- The consumption of millets would increase the market demand of millets, which is grown by some of the poorest regions and by some of the poorest farmers across world. Hence it would provide the decent works and economic growth (SDG 8) to some of the backward regions of the world.

5. Proper handling of millets is key to maintaining their high quality and nutritional benefits; SDG 2 (End Hunger) and SDG 3 (Good Health and Well-Being)

- Innovative agro-processing, especially in the production of nutritious foods, could target both traditional and non-traditional markets such as youth, urban consumers, tourists, etc.
- This value addition could lead to market expansion, and increased food and nutrition security and incomes for smallholder farmers.

6. Greater trade in millets can improve the diversity of the global food system

- Greater emphasis on millets production, which accounts less than 3% of global trade would increase the resilience of food inflation in market.
- This not only improve the decent work and economic growth (SDG 8) but also the sustainable consumption and production (SDG 12) in the world.

2. Millets: Ancient Grains for a Healthy Future

Introduction: Un has declared year 2023 as the international year of millet, India being the largest producer of millets has lots to gain by promoting millet as a main course of diet. Millets have proved their usefulness in dealing with malnutrition, management of diabetics, heart conditions and anemia; at the same time conserving water, sequestering carbon from atmosphere.

Consumer Awareness: A retrospective and forward view

- Although millets were grown and used in Indian Subcontinent since ancient times, its use decreased significantly since green revolution came to India.
- Many ancient Indian texts cites cultivation and use of millets, many songs and couplets are written on millets.
- Over the years due to a multitude of factors. Socio-economic dynamics resulting from the hardy nature of the crop, relegated them to be the grain of the poor.
- Many places the use of millets is systematically discourages from cultivation; for example, *Kodo Kotki Hatao Soyabean Lagao* (Remove Kodo and Little millets and grow soyabean) was a famous slogan from 2000s undivided Madhya Pradesh.
- ‘A study assessing Millets and Sorghum Consumption Behavior in Urban India in 2021’ found that-
 - Major people don’t eat millets because-
 - It is not available at home (40%)
 - They don’t like millet’s taste (22%)
 - People who are health conscious (91%) and people who were sure that millet is healthy (40%).
 - In rural India, the challenge continues to be the socio-economic view on consuming millets which discourages widespread consumption.

- In USA and Europe, the gluten intolerance and Celiac disease is on rise (at a rate 7.5% per year since several decades), which makes the future prospects in these market for millets very bright.

Production and Processing of millets

- To establish the millets as a mass consumed grain, its production must be increased and its processing must be made efficient, at the same time the logistic cost for transfer of millets from farm to fork must also be decreased.
- The de-hulling machines are available, which can make the de-hulling process faster and cost effective for farmers.
- Startups must be promoted, who can tap the gluten free export market of USA and Europe. It should make sure labeling of these millets as gluten free food, vegan food, vegetarian foods etc.
- A number of studies have established healing power of millets, these studies can be made available to doctors, nutritionists and medical community. For example,
 - A study published in August 2021 concludes that consumption of millets reduces hyperlipidemia and hence hypertension, and raises the levels of HDL-C (good cholesterol), which can be beneficial for managing the associated risk of developing hypertension and atherosclerotic cardiovascular diseases in the future.
 - Another study published in October 2021 showed that millets can reduce Anemia caused due to iron deficiency.

Conclusion: IYM 2023 places the agenda of millet promotion on an international stage. In order to make this sustainable and truly manifest the spirit of the International Year of Millets, it needs to become a mass movement. Supporting farmers, creating an enabling environment for industry and startups, and increasing awareness among consumers are key to the future of millets. A number of steps have already been taken toward this through India's visionary leadership and the international agenda set for this year.

3. Millets in Diet: The Right Approach

Introduction: There is renewed interest among people for promotion of millets in day-to-day diet. A lot is being done to promote their uses; a lot is being said about their health benefits. It is equally important to note the right approach for their consumption.

The five main guidelines that must be kept in mind regarding millets consumptions-

Eat millet as per season:

- It will ensure not only availability of millets but also the nutritional requirement of human body-
 - Bajara and Makai are for winter and must be eaten with ghee and jaggery.
 - Jowar must be for summer and eaten with chutney.
 - Ragi/Nachni can be eaten year-round.
 - The lesser-known millets' use must be linked to festivals.

Eat millets with the right food combination

- The millets must be complemented with other food grains. This combination must balance the bodily requirements of protein, fibre, vitamins, calories etc.
- For example, millets combined with pulses balance vitamins minerals with proteins and amino acids. Similarly, hard to digest millets must be taken with ghee or white butters.

Nutrition from millets

- Apart from being inexpensive and easier to grow, they are a rich source of many vitamins, minerals, and fibre.
- Some of these are-
 - Niacin, a type of Vitamin B found in millets is useful in energy production, and nerve health and keeps the digestive tract healthy. Good for food intolerances.
 - The magnesium. Zinc, and fibre found in millets make it an excellent food for blood sugar regulation, especially for PCOD and Diabetes.
 - Folic acid helps with iron assimilation and improves skin, health, and fertility.

Eat millets in all forms

- Millets must be eaten in all forms like soaking, fermenting, roasting the whole grains, grinding them and taking them as sattu etc.
- This is to be done to avoid the taste fatigue while eating nutritious and healthy food.

Don't eat multigrain

- Multigrain is not always good. There is a balance of nutrients, minerals, fibres, proteins etc. in each and every millet.
- Hence mixing them would make this balance redundant.

Don't replace all grains with millets

- We cannot all over foods with millets. The proper mixture of rice, wheats with millets is way forward.

Conclusion: Moving away from traditional foods reduces farming of traditional foods, which in turn has an adverse effect on soil health and ecology, putting not just our health but our entire future at risk.

4. Millet Cultivation in North-East India

Introduction:

- Millets are often grown in tropical and subtropical regions at an altitude of 2,100 m. Being a heat-loving plant, 8-10° C is the required minimum temperature for germination.
- Ideal growth temperature for millets is between 26-29° C for optimum production and crop yield. Sandy, loamy, and alluvial soils with good drainage are the best types of soil for them.

- The absence of gluten makes it simple to digest. The cereal primarily contains unsaturated fat, which has a low-fat content.
- Given its lower glycemic response or reduced capacity to spike blood levels, it helps diabetics maintain blood sugar levels. Millets are one of the most nutrient-dense cereals.

Importance of organic agriculture in millets

- Indian agriculture entered a new phase after green revolution, where traditional cultivation method was replaced by chemical intensive, water intensive and capital-intensive cultivation methods.
- These methods produced inconsequential problems like, water scarcity, pollution of India river system, destroying the fertility of soils etc.
- India and nations around the world are also reeling under the heatwaves. Like recent heatwaves in **Madhya Pradesh**, the ‘**wheat bowl**’ of India impacted the yield of wheat.
- Increasing heatwaves and droughts are going to be frequent in future due to climate change, hence an emphasis on organic millet farming is needed.

Nutrient management in organic millet cultivation

- Unlike regular cereals, production of millets does not require chemical fertilisers.
- Farmers on an increasing scale are using organic fertilisers, green manures, efficient crop cycles, integrated nutrient and pest management etc.
- Millet farmers frequently succeed in enhancing the physical and chemical characteristics of the soil for sustained productivity by using techniques like:
 1. Using organic material, such as compost, vermicompost, farm yard manure, and bio-fertilisers, to preserve soil organic matter and deliver nutrients.
 2. Using cover crops to recycle soil nutrients and biologically fix nitrogen from the atmosphere.
 3. Planting green manure legumes in situ or using green leaf manuring and incorporating them into the soil.
 4. Intercropping or growing multiple crops simultaneously.
 5. Rotation of crops.
 6. Management of crop residues.

Shifting cultivation of millets in hill/tribal areas

- The majority of the crops planted on lands under shifting agriculture are millets, specifically finger millet, small millet, foxtail millet, proso, kodo millet, pearl millet, and sorghum.
- In addition to millets, valuable commercial crops are grown, including red gram, horse gram, castor, plantain, and turmeric.
- A variety of millet varieties, including finger millet, foxtail millet, pearl millet, barnyard millet, little millet, and sorghum, are broadcast on hill slopes during the summer, and paddy seeds are typically sown as the monsoon season approaches.
- Vegetables and other crops are also grown at the same time.
- Since shifting cultivation does not use chemical fertilisers and pesticides and at the same time uses animal dungs for manures, we can say that shifting cultivation in India is practically similar to organic cultivation.

- Although the problem of soil erosion and drop in land productivity as well as risk to biodiversity must be tackled properly.

Application of organic matter to the soil

- **Manures:** although, application of manures is beneficial, for millets applying phosphorus to soil may not fetch optimal result as millets are unable to extract phosphorus from manures. Hence excess phosphorus can lead to runoff waste.
- **Compost:** Composting makes the organic material lean and nutrient rich. It kills some diseases and weed seedlings and it is also easier to handle than bulk organic matters.
- **Cover crop:** In organic farming, cover crops can be a sustainable and affordable source of nutrients by supplying plants' needs for micronutrients, phosphorus and potassium.
- **Green manures:** green manures like Leguminous plants, which make up the majority of green manures grown in fields, are often integrated into the soil once they have grown sufficiently. *Sunhemp, dhaincha, pillipesara, cluster beans, and Sesbania rostrana* are the most significant crops for producing green manure
- **Crop rotation:** crop productivity, nutrient availability, insect control, nutrient usage efficiency and soil physical qualities can all be improved through crop rotation.

Consumption habits of millets in North-east

- **Zan:** The millet flour dish is favourite dish in **Arunachal Pradesh**
- **Apong:** *Apong and Madua Apong* are two popular beverages in Arunachal Pradesh, made up of rice. It is taken by *Adi and Nyishi* tribes. It is important to Adi tribes' shamanic practices, ritualistic principle and folklores. It is also served during Adi tribes' *Solung* festival in the month of September.

Conclusion: Millets are said to be the forerunner of the evergreen revolution and therefore, also can be referred to as Miracle Grains and a boon to the region.

5. India's Wealth: Millet for Health

Introduction: Celebration of year 2023 as international year of millet is pride for India, which is the world's largest producer of these millets, accounting **20% of global production** and having **average yield of 1237 kg/hectare** more than global average of **1229 kg/hectare**.

What are Millets?

- They are a collective group of small-seeded annual grasses that are grown as grains crops, primarily on marginal land in dry areas of temperate, sub-tropical and tropical region.
- In India, millets can be clubbed into major, minor, and pseudo categories.
 1. **Major Millets:** Sorghum (Jowar), Pearl Millet (Bajra), Finger Millet (Ragi/Mandua)
 2. **Minor Millets:** Foxtail Millet (Kangani/Kakun), Proso Millet (Cheena), Kodo Millet, Barnyard Millet (Sawa/Sanwa/ Jhangora). Little Millet (Kutki)
 3. **Pseudo Millets:** Buck-wheat (Kuttu) and Amaranth (Chaulai).
- The top five state producing millets are Rajasthan, Karnataka, Maharashtra, Uttar Pradesh and Haryana.

What is the importance of millets?

Climate-friendly crop:

- Millets are resilient to climate change as they are pest free, adapted to a wide range of temperature and moisture regimes, and demand less input of chemical fertilisers to grow; thus, making them bio-diverse and climate-smart crops.
- They have low carbon and water footprint.

Viable options for small farmers:

- Due to low investment and hardy survival capability these crops are suitable for small and marginal farmers.

High in nutrition and health benefits:

- Millets are known to be a storehouse of nutrition as they are good sources of calcium, zinc, magnesium, phosphorous, copper, vitamin, iron, folate, carbohydrates, micronutrients, antioxidants and phytochemicals with nutraceutical properties.
- They are gluten-free and are also considered good for celiac patients.

Economic and food security:

- They are comparatively cheaper in price.
- Under India's National Food Security Mission, the area, production of millets has increased.
- Over the years, the production of millets has increased from 14.52 million tonnes (2015-16) to 17.96 million tonnes in 2020- 21 (Department of Agriculture and Farmers Welfare).
- Due to increase in oversea popularity, there is a possibility of forex earning from millets' exports.

Millet as a part of the Food basket

- Millets were included in government of India's **POSHAN Abhiyan**.
- The **POSHAN 2.0**, which was launched in 2021 also included millets and emphasized on popularizing millets in local recipes.
- Under **POSHAN maah** or National nutrition month every September, ministry of Women and Child Development encourages the use of millets in local recipes and ways to enhance the share of millets in Supplementary nutrition Programme of Anganwadi Services.

Initiatives towards making IYM 2023 a success

- Government embarked on nationwide *Jan Andolan* to popularize use of millets.
- Millets have been showcased in various reputed events like India International Trade Fair, Dubai Expo and Surajkund Mela, etc.
- Over 500 startups are working in millet value chain while the Indian Institute on Millet Research has incubated 250 startups under **RKVY-RAFTAAR**.
- More than Rs. 6.2 crores have been disbursed to over 66 startups while about 25 startups have been approved for further funding.

- Food Safety and Standards Authority of India (FSSAI) is actively spreading awareness of the health benefits of the miracle crop by celebrating “*Recipe Ravivar*” every Sunday on social media platforms where each month is dedicated to a specific variety of millet.
- The Government of India has launched a set of seven sutras in the run-up to IYM 2023 and has allocated different government departments for the same.
- The seven sutras outline areas in the enhancement of production/productivity, and health benefits, value addition, processing, and recipe development, entrepreneurship/startup/collective development, awareness creation-branding, labelling and promotion, international outreach, and policy interventions for mainstreaming.

Conclusion: As India is entering the “*Azadi ka Amrit Kaal*” the strong *Jan Bhagidari* to bring millets from being ‘poor man’s food’ to ‘healthier and environmentally favorable superfood’ looks more possible than ever.

6. Health Benefits for Lifestyle Diseases

Introduction:

- Millets have been promoted as superfoods for their enhanced nutrient content and health benefits.
- Millets include many bioactive principles that have been shown to reduce cardiovascular risk, diabetes, aging, and even cancer.
- Millets are also ‘**nutritional supplements**’ that have phytochemicals such as flavonoids, saponins, tannins such phenols, tannins, flavonoids, alkaloids, and terpenoids and anti-nutrients that are essential for preserving good health and having a significant impact on the treatment of chronic illnesses.
- They include vital amino acids, carbs, lipids, fibres, folic acid, vitamins like thiamine, niacin, and riboflavin, as well as minerals like iron, calcium, and potassium.
- The dietary items made from millet products feed the body and guard against several illnesses including diabetes, cardiovascular disease, cancer, inflammation, gastrointestinal problems, and others.
- **Around 71%** of all fatalities worldwide are now attributed to non-communicable illnesses, a burden that has escalated as a result of this consumption pattern.

Benefits of millets

Impact of millets on Diabetes Mellitus and Heart Disorders

- Dietary fibre is crucial for glucose regulation.
- Millet is an excellent source of leucine, slowly digesting carbohydrate (and minerals), blunting the otherwise sudden increase in post-prandial glucose level, thus making it a nutritious food for diabetes.
- Millets retard the absorption of dietary cholesterol.
- Thus, millets-rich foods are suggested as one of the means to reduce the risk of heart disorders.

Impact of millets on cancer

- Millet grains include phenolic components such as phenolic acids, flavonoids, and tannins, making them anti-nutrients that lower the incidence of colon and breast cancer in animals.

- In-vivo study found that adding foxtail millet to one's diet promotes the activation of the gut receptor, which in turn aids in the treatment of colon cancer linked to colitis.

Impact of millets on brain disorders

- It has been found that high fat diet increases the risk of dementia.
- Additionally, oxidative stress is reportedly a catalyst and aggravating factor for neurodegenerative conditions like **Addison' s disease (AD)**.
- High quantities of polyphenols in millet demonstrated remarkable oxidation resistance. Hence reduces risk of neurodegenerative diseases.

Conclusion: Millets due to their low carbohydrate-fibre ratio, high antioxidants, and other effects are useful in lifestyle diseases like cancer, diabetes, and cardiovascular problems.

7. Millets for pregnant and lactating women

Introduction:

- Pregnancy is a physiological condition, where there is an increased demand of nutrients for human body to raise a fetus.
- Pregnant and Lactating mothers suffer from iron-deficiency, calories and protein deficiencies.
- A study indicated that taking millet-based foods in diet during pre-natal and post-natal period play an important role in improving the nutritional status of pregnant women and lactating mothers.
- The millet-based supplementary food products are very nutritious for pregnant women and lactating mothers.
- Millet milk malt is prepared from the flour of various millets, jaggery and milk powder.
- Ragi cutlets are prepared from Ragi (Finger millets) flour which is a rich source of protein, iron, calcium, phosphorus, and dietary fibres.
- Pearl millets also known as Bajra is an excellent source of iron which helps in improving hemoglobin levels in pregnant and lactating mothers. It is also rich in dietary fibres, antioxidants, zinc, magnesium, copper and Vitamin B-Complex.
- Studies show that millet-based foods contribute to improving the Body Mass Index (BMI) in pregnant women and lactating mothers.
- Lactating mothers are also advised to consume Ragi to increase the production of breast milk.
- Kodo millets are highly nutritious. They are gluten-free, easy to digest, and rich in phytochemical constituents, antioxidants and dietary fibre.

Malted ragi flour

- Enzyme rich/Amylase-rich foods may also be prepared from finger millet. Puffed whole grain proso millet is produced as breakfast cereal for pregnant women and lactating mothers.
- Examples of enzyme rich foods that are prepared from millets are-
 1. Millet-based probiotic Yoghurt

2. Cereal mix-based probiotic functional food
3. Pearl millet-based food blend
4. Finger millet and oats-based symbiotic drinks

Shelf life of millet-based products

- The shelf life of any raw **millet flour** is about **1-2 months** and it is only **5-7 days for pearl millet** because they are easily prone to oxidative rancidity due to the free fats and sugars.
- The techniques like **parboiling, irradiation and germination** can enhance the shelf life of millet.
- Consistent research and development programmes for enhancing the shelf life of processed millets and their products with the aid of inactivating lipases, use of permitted antioxidants and suitable packaging are being explored.

8. Startups making millets popular

Introduction: As world is celebrating the year 2023 as international millet year, the startup sector of the world can not remain silent. India, which is the largest producers of millets and 3rd largest destination of startups of the world sees the perfect marriage between both. More and more startups are coming forward to make the IYM 2023 a success globally.

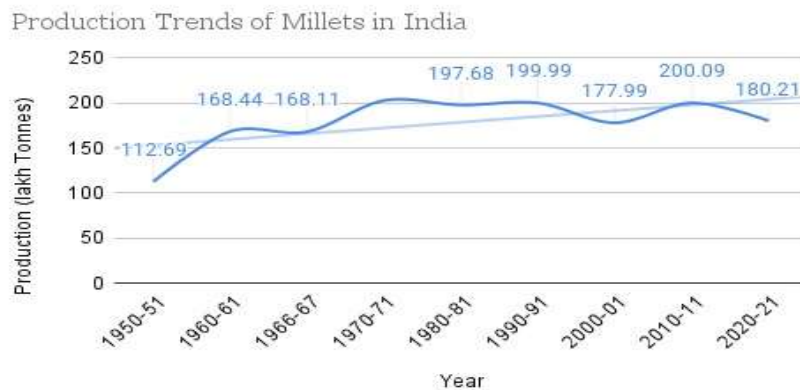
Case studies:

- According to the **Indian Council of Agricultural Research (ICAR)**, more than a thousand startups are working on coarse grains in the country.
- **Hyderabad-based Indian Institute of Millet Research (IIMR)** has set up a technology incubator **NutriHub** with the help of the Department of Science and Technology (DST) to promote millets. Here, people are trained for startups.
- Dozens of startups have successfully launched their millet-based food products in the market under the guidance of IIMR.
- Startups are provided grants of upto Rs 25 lakh under the Government's **Rashtriya Krishi Vikas Yojana (RKVY-RAFTAAR)**.
- The Government is also enabling startups for the export promotion of value-added products like noodles, pasta, breakfast-cereal mix, biscuits, cookies, snacks, and sweets in the **Ready to Eat (RTE)** and **Ready to Serve (RTS)** categories. For this, the Ministry of Commerce has made necessary policy amendments.
- Most of these startups procure coarse grains directly from farmers. After processing them, they prepare products and sell them online and offline.
- An Agri startup from Tamil Nadu has launched many products, including South Indian dishes using millets, such as dosa, pongal, and rava dosa.
- Another startup in Hyderabad has prepared snacks by adding fruits and vegetables to coarse cereals.
- A Bengaluru-based startup has developed several ready-to-cook products from millets.
- A startup based in the Nandyal district of Andhra Pradesh has worked among the farmers. It has prepared laddoos, biscuits, cookies and all kinds of food products using jowar, bajra and ragi.
- Another startup from Hyderabad has come up with multi-millet noodles.

- *Pani poori* is a famous street food from India, a Vijayavada based startup has prepared it using multi-millets.

Millet production in India

- According to **World Food Programme**, there are an estimated 1.2 billion people who consume millet as part of their diet.
- Millet production has been stable over the past few years, with an estimated production of **28 million metric tons in 2020**.
- India is the largest producer of millet, followed by Niger and China.
- In India production of millet has been on rise in recent years. (As shown in following graph)



9. Processing Technology in Millets

Introduction: Processing of food products are done to raise its value, increase its taste, to increase its self-life etc. In case of millets, processing is also done to increase its digestibility.

Overview of millet processing

- Millets are processed in traditional methods in semi-arid regions, where they are primarily grown for human consumption.
- Traditional methods are laborious, monotonous and manual.
- Traditional techniques that are commonly used include decortication (usually by pounding followed by winnowing or sometimes sifting), malting, fermentation, roasting, flaking, and pounding.
- These methods are mostly labor-intensive and give a poor-quality product.
- Indian Institute of Millets research (IIMR) is developing modern methods for food processing and value additions like- dehulled millet, semolina or suji, flakes, extruded products (vermicelli and pasta), biscuits, millet -rich multigrain roti and millet-rich multigrain flour to improve the nutritional quality.
- Food processing involves following operations-
 1. **Primary processing:** Purification of raw materials by removing foreign matter, and immature grain and making it into a suitable form for secondary processing through grading, destining, and dehulling. The bulk operations of these processes can be done mechanically.

2. **Secondary processing:** Processing of primary processed raw material into a product which is suitable for food uses or consumption such as **Ready-To-Eat (RTE) and Ready-To-Cook (RTC)** products, which minimises the cooking time and makes it a convenient food.

Importance of processing intervention

- One of the major reasons of less popularity of millets consumption is lack of their ready-to-use and ready-to-eat alternatives.
- Processing reduces this hindrance, at the same time increasing millets' self-life and taste.
- The manual de-husking of millets is the reason for poor quality of millet flours, this is being reduced by IIMR's intervention through automatic, mechanical de-husking process.
- At IIMR, an attempt has been made to create demand for millet through processing interventions by diversifying its food uses; integrating all functions from on-farm production to consumption in a 'production to consumption' value chain.

Processing of value-added products from millets

- Value addition in food processing has a high degree of interdependence with forward and backward linkages and hence can play an important role in accelerating economic development.
- Value addition has many consumer benefits such as simple, low-cost processing and packaging technologies which can improve the shelf life and storage quality of food and preserve many of the health-promoting compounds.

Processing of millet grains

- Processing involves cleaning, grading, partial separation and/or modification of the three major constituents of the millet grain- the germ, the starch-containing endosperm, and the protective pericarp.
- At IIMR, processing interventions in millet are attempted to remove the inconveniences in recipe making by developing and standardising millet product technologies.
- Primary and secondary processing methods have been developed and fine-tuned using specialised equipment to prepare good quality millet.
- IIMR has developed & commercialised millet products to widen the commercialisation of millet in the country.