IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 Journal UGC CARE Listed (Group-I) Volume 11, Issue 13 Dec 2022

MILLETS –A TREASURE HOUSE FOR HUMAN NUTRITION

Shily, C.[1], Jeeva, S.[2]

[1,2]Department of Botany, Scott Christian College (Autonomous), Nagercoil, – 629 003
(Affiliated to Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli – 627 012),
Tamil Nadu, India.

Abstract

Millets are small-grained cereals that have been a vital part of our diet for centuries. They serve as the main food source in semi-arid tropics and help ensure nutritional security for the poor. Millets are environmentally friendly, requiring less water and inputs. They are nutrient-rich, boosting our health and supporting weight loss, and are also gluten-free. As climate-resilient crops, millets play a significant role in reducing greenhouse gases. Bajra, or Pearl millet, contains fibre that enhances its health benefits. Finger millet, or ragi, is the highest source of calcium and potassium. It also contains high levels of dietary fibre, minerals, and sulphur-containing amino acids. Little millet has a high protein, fat, and dietary fibre content, along with minerals and low trans fats. Barnyard millet is particularly effective at lowering blood glucose and lipid levels. These hardy plants can grow in water-scarce and low-nutrition areas, making them e+ssential crops for the future to eradicate poverty.

Keywords: Ragi, Bajra, dietary fibre, Barnyard millet

Introduction

Millets are small cereal grains grown in many parts of the world under unfavourable conditions to grow other crops(McDonough *et al*., 2000). They were very popular agricultural crops till the green revolution, after which a rise in importance was given to cereal crops like rice and wheat to alleviate poverty prevailing in any part of the world.(Gowri and Shivakumar, 2020) They are highly nutritious, non-glutinous and not acid-forming foods. Hence they are soothing and easy to digest. They are considered to be the least allergenic and most digestible grains available(Malathi *et al*., 2016). Compared to Paddy rice, especially polished Paddy rice, millets release a lesser percentage of glucose over a longer period of time. This lowers the risk of diabetes. Millets are particularly high in minerals like iron, magnesium, phosphorous and potassium. India is the largest producer of Many kinds of millet, which are often referred to as coarse cereals (Anbukkani *et al* ., 2017). However, realizing the nutrient richness of these grains, they are now considered" nutria-cereals". Small millets, as a group, includes several grain crops, namely finger millet (rage), kodo millet (varagu), and little (panivaragu). Small millets can be grown even in poor soil and climatic conditions. They have a short growing season and can be very well fitted into multiple cropping systems under irrigated and dry farming conditions (Karuppasamy, 2015). They can provide nutritious grain and fodder in a short span of time. Their long storability under ordinary conditions has made them "famine reserves". Since Indian agriculture faces an unstable climatic conditions, these crops are very suitable in many parts of our country. Millets are generally grown in marginal lands by poor communities seen in hilly regions. They cultivate the crops with their own seeds and without other external inputs, and they do their own agricultural practices (Sharma & Niranjan, 2018).

Growing millets become very important due to challenging scenarios like rising global warming, water scarcity and the projected malnutrition among the poor and vulnerable sections. Millets are agricultural crops that can be cultivated to cope with these problems. Promoting millet cultivation and popularising it among the population may greatly help millet farmers and bring food and nutritional security to the nation. These include finger millet (*Eleusine coracana*)foxtail millet (*Setaria italica*), Proso millet (*Panicum miliaceum* L.), little millet (*Panicum sumatrense*), barnyard millet (Echinochloa crusgalli L.) & (Echinochloa colona L.) and kodo millet (Paspalum scrobiculatum L.).

Millets are among the most nutritious food grains available in India, and the people who consume millets on a regular basis are decidedly more healthy than those who do not. Those who consume millet are found to be fit even in their old age(Sharma & Niranjan, 2018). Regular consumption of millet can reduce the chance of various life-threatening diseases such as diabetes, obesity, cardiovascular diseases, osteoporosis, and even age-associated diseases. Considering their climate resilience, and role in nutritional and health security, the Government of India has declared the year 2018 as the "National Year of Millets" and the year 2023 as the "International Year of Millets" by the United Nations.

Materials and methods

We visited some of the traditional farmers growing millets and collected seeds from them. We have sown the seeds in our field and noted the different characters of each millet. Literature about the millets has been collected, and noted the salient features of these crops.

Finger millet

Finger millet, *Eleusine coracana,* is a cereal grown for food in Africa and Southern Asia, mainly India (the states of Uttar Pradesh, Bihar, Tamil Nadu, Karnataka, and Andhra Pradesh) and Nepal. Finger millet is an annual tufted growing from about 40 to 150 cm tall and takes from 3 to 6 months to mature. The inflorescence consists of a variable number of spikes ranging from 3 to 20 arranged in a bird's foot style. It resembles fingers on a hand, hence its common name, "finger millet" (Dida & Devos, 2006). Finger millet (Ragi) is the richest in calcium content, about ten times that of Paddy rice or wheat. Finger millet varieties are primarily grouped into two types based on crop duration: early maturity (90–100 days) and late maturity (110–120 days) (Thilakarathna & Raizada, 2015). Finger millet ranks third in importance among millets in the world (Duressa & Bonso, 2022). Finger millet has excellent nutritional value (Karuppasamy, 2015). The seed coat of this millet is a rich source of phenolic compounds, minerals and dietary fibre. When we consume 100g foxtail millet, we get 336kcal energy, 7.7g protein, 1.5g fat, 2.7g ash, 3.6g crude fibre, 72.6 carbohydrate, 102mg phenols, and 2.7g minerals (Kumar *et al*., 2021).

Pearl millet

Pearl millet (*Pennisetum glaucum* L.) is a C4 plant having very high photosynthetic efficiency and dry matter production capacity (Yadav and Rai, 2013).In India, pearl millet is the third most widely cultivated food crop after rice and wheat. It is grown on 9 million ha with average productivity of 1,000 kg ha-1(Basavaraj *et al*.,2010) The major pearl millet growing states are Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana, which account for more than 90

% of pearl millet acreage in the country. Pearl millet is primarily grown for food and dry fodder. Its grains are highly nutritious with high levels of metabolizable energy and protein, have high densities of iron and zinc, and have a more balanced amino acid profile (Karuppasamy, 2015). Pearl millet is also an excellent forage crop because of its lower hydrocyanic acid content. Its green fodder is rich in protein, calcium, phosphorous and other minerals with oxalic acid within safe limits. A significant portion of pearl millet grain is also used for non-food purposes such as poultry feed, cattle feed and alcohol extraction. When we consume 100g Pearl millet, we get 361kcal energy, 11.6g protein, 5g fat, 2.2g ash,2.3g crude fibre, 67.5g carbohydrate,51.4mg phenols, and 2.3g minerals (Kumar *et al*., 2021).

Barnyard millet

The two species under the genus Echinochloa, E.frumentacea(Indian barnyard millet) and E.esculenta(Japanese barnyard millet) are cultivated for food and fodder by hilly and tribal communities in Asia, particularly in India, China and Japan. In India, barnyard millet is the second most important small millet after finger millet (Sood *et al*., 2015). Barnyard millet has a wide adaptation capacity and can be grown up to an altitude of 2000 m above mean sea level during the summer season. The crop plant is a tall, robust annual and grows up to 220 cm high. It completes the life cycle from seed to seed in 45–60 days. Leaf blades are flat and wide with no ligules. The inflorescence is a terminal panicle 10–25 cm long with dense racemes of 3 to 4mm long spikelets. Grain is 2–3 mm long and 1–2 mm wide and enclosed in white shining hardened lemma and palea (Renganathan *et al*.,2020). Barnyard millet is highly suitable for commercial foods for diabetics, infants and pregnant women because of its high iron content (Karuppasamy, 2015). In terms of nutritive value, barnyard millet is superior to major and minor millet. Barnyard millet grains are a rich source of dietary fibre, iron, zinc, calcium, protein, magnesium, fat, vitamins, and some essential amino acids. When we consume 100g barnyard millet, we get 300kcal energy, 6.2g protein, 2.2g fat, 4.4g ash, 9.8g crude fibre, 65.5g carbohydrate, and 4.3g minerals (Kumar *et al*., 2021).

Foxtail millet

Foxtail millet (*Setaria italica* L.) has been identified as a major millet in terms of worldwide production, as it is the sixth highest-yielding grain. It is a crop that grows 2-5 feet tall and can be cultivated in drier and cooler regions when compared with other millets. It can grow in sandy and loamy soils. It can grow at higher elevations around

1.5 km, as well as in lower-lying lands close to sea level. It can be harvested in 75–90 days after planting and is considered to be economically important in the semi-arid tropics. It can also be grown under saline conditions (Karuppasamy, 2015). Foxtail millet contains a pertinent amount of nutritional components, especially starch, protein, vitamins, and minerals. Foxtail millet, like most millets, is also a good source of crude fibre, helps in the digestive process and helps to induce a bowel movement, thus producing a laxative effect that is beneficial for a healthy digestive system (Sharma & Niranjan, 2018). When we consume 100g foxtail millet, we get 331kcal energy, 12.3g protein, 4.3g fat, 3.3g ash, 8g crude fibre, 60.9g carbohydrate, 106mg phenols, and 3.3g minerals (Kumar *et al*., 2021).

Proso millet

Proso millet (*Panicum miliaceum* L.) is a warm-season grass with a growing season of 60–100 days. It is a highly nutritious cereal grain used for human consumption, bird seed, and/or ethanol production. A compact panicle droops at the top like an old broom, hence proso millet's common name, "broom corn". Grains are round, about 3 mm long and 2 mm wide, and enclosed in a smooth hull with varying colours. Proso millet ranges from 30 to 100 cm tall, with few tillers and an adventitious root system. Proso millet avoids drought sensitivity by reaching maturity rapidly. Proso millet can be grown on sandy loam, slightly acidic, saline, and low-fertility soils (Karuppasamy, 2015). Proso millet can be a substrate in distilled liquors and beers and is used to make fermented beverages in Africa and Asia (Habiyaremye *et al*., 2017). When we consume 100g proso millet, we get 341kcal energy, 12.5g protein, 1.1g fat, 1.9g ash, 7.2g crude fibre, 70.4g carbohydrate, and 1.9g minerals (Kumar *et al*., 2021).

Kodo millet

The Kodo millet (*Paspalum scrobiculatum*), is also known as cow grass, rice grass, ditch millet, Native Paspalum, or Indian Crown Grass. It is grown in India, Pakistan, Philippines, Indonesia, Vietnam, Thailand and West Africa. It is a major food source in the Deccan plateau of India, some regions of Maharashtra, Odisha, West Bengal, Rajasthan, Uttar Pradesh and the Himalayas and is consumed traditionally as health and vitality foods in rural India. Kodo millet has a shallow root system which may be ideal for intercropping. The iron content in kodo millet ranges from 25.86ppm to 39.60ppm (Karuppasamy, 2015). Among the millets, it has the least amount of phosphorous content. Kodo millets also contain high amounts of polyphenols, antioxidants, tannins, phosphorous and phytic acids. Apart from using it as human food, it is also a good choice of animal fodder for cattle, goats, pigs, sheep, and poultry. It is used to prevent soil erosion. It has been noted that it makes a good cover crop (Deshpande *et al*.,2015). Kodo millets are known for their anti-diabetic, anti-cancer, and anti-ageing properties, and they are good against cardiovascular diseases (Bunkar *et al*., 2021). When we consume 100g kodo millet, we get 353kcal energy, 8.3g protein, 1.4g fat, 2.6g ash, 9g crude fibre, 65.5g carbohydrate, 368mg phenols, and 2.6g minerals (Kumar *et al*., 2021).

Little millet

Little millet(*Panicum sumatrense* L.) is a highly fibrous cereal which is comprised of polyunsaturated fatty acids. The major little millet-growing states are Orissa, Gujarat, Maharashtra, Karnataka, Andhra Pradesh and Madhya Pradesh. It is a short-duration cereal which can withstand both drought and waterlogging (Karuppasamy, 2015). When we consume 100g little millet, we get 329kcal energy, 7.7g protein, 4.7g fat, 1.5g ash, 7.6g crude fibre, 67g carbohydrate, and 1.5g minerals (Kumar *et al*., 2021).

Factors Limiting the Productivity of millets

Production of millets is less due to the following factors. Millets are generally grown on poor or marginal soils where no other crops can be cultivated. Soils may have low moisture retention capacity. Farmers generally broadcast the seeds, which may cause some loss of seeds. Inter-cultivation operations and effective weed control are not possible in this condition. Millets are mainly cultivated without adding any inputs like fertilizers and manures. Not many

research activities have been undertaken so far on these crops. There is no organized programme for the production and supply of seeds of improved varieties. There is no ready market for the disposal of surplus produce at a remunerative price. There is a lack of extension and development support (Gowri and Shivakumar, 2020).

Suggestions for improving the millets cultivation

Awareness programmes among farmers about the new cultivation practices and the improved varieties may bring changes in the production scenario. The improved seed should either be supplied free or subsidized by the Government. Product diversification with millets may be promoted. Farmers should be easily accessible to markets so that they get the maximum price for their products. Millets need to be integrated into the existing Public Distribution System (PDS). Also, introduce millet meals twice a week in the ICDS, school mid-day meals, welfare hostels and other schemes of the Government.

Conclusion:

Millets are crops suited for climate-resilient agriculture. As climate change is recognized as a major threat to humanity, this will provide food for the future. So each and every country should encourage millet cultivation to tackle the upcoming food shortages. Since millets are natural healers for many disease conditions, the cultivation of millets and their use should be promoted.

References:

1. Duressa, M. and Bonso, A.B., 2022. *Popularization of Finger Millet Production, Value Addition, and Marketing in Wayu Tuka Were-da, East Wollega Zone* [online]
2. Sood, S., Khulbe, R.K., Gupta, A.K., Agrawal, P.K., Upadhyaya, H.D. and Bhatt, J.C., 2015. Barnyard millet–a potential food and feed crop of future. *Plant breeding*, *134*(2), pp.135-147.
3. Renganathan, V.G., Vanniarajan, C., Karthikeyan, A. and Ramalingam, J., 2020. Barnyard millet for food and nutritional security: Current status and future research direction. *Frontiers in genetics*, *11*, p.500.
4. Gomashe, S. S. (2017). Barnyard millet: present status and future thrust areas. *Millets and sorghum: biology and genetic improvement*, 184-198.
5. Thilakarathna, M.S. and Raizada, M.N., 2015. A review of nutrient management studies involving finger millet in the semi-arid tropics of Asia and Africa. *Agronomy*, *5*(3), pp.262-290.
6. Dida, M.M. and Devos, K.M., 2006. Finger millet. In *Cereals and millets* (pp. 333-343). Berlin, Heidelberg: Springer Berlin Heidelberg.
7. Sharma, N. and Niranjan, K., 2018. Foxtail millet: Properties, processing, health benefits, and uses. *Food reviews international*, *34*(4), pp.329-363.
8. Michaelraj, P.S.J. and Shanmugam, A., 2013. A study on millets based cultivation and consumption in India. *International Journal of Marketing, Financial Services & Management Research*, *2*(4), pp.49-58.
9. Habiyaremye, C., Matanguihan, J.B., D'Alpoim Guedes, J., Ganjyal, G.M., Whiteman, M.R., Kidwell, K.K. and Murphy, K.M., 2017. Proso millet (Panicum miliaceum L.) and its potential for cultivation in the Pacific Northwest, US: a review. *Frontiers in plant science*, *7*, p.1961.
10. Deshpande, S.S., Mohapatra, D., Tripathi, M.K. and Sadvatha, R.H., 2015. Kodo millet-nutritional value and utilization in Indian foods. *Journal of grain processing and storage*, *2*(2), pp.16-23.

11. Bunkar, D.S., Goyal, S.K., Meena, K.K. and Kamalvanshi, V., 2021. Nutritional, functional role of kodo millet and its processing: a review. *International Journal of Current Microbiology and Applied Sciences*, *10*(01), pp.1972-1985.
12. Kumar, A., Tripathi, M.K., Joshi, D. and Kumar, V. eds., 2021. *Millets and millet technology* (p. 438). Singapore: Springer.
13. Gowri, M.U. and Shivakumar, K.M., 2020. Millet scenario in India. *Economic Affairs*, *65*(3), pp.363-370.
14. Malathi, B., Appaji, C., Reddy, G.R., Dattatri, K. and Sudhakar, N., 2016. Growth pattern of millets in India. *Indian Journal of Agricultural Research*, *50*(4), pp.382-386.
15. Yadav, O.P. and Rai, K.N., 2013. Genetic improvement of pearl millet in India. *Agricultural Research*, *2*, pp.275-292.
16. McDonough, C.M., Rooney, L.W. and Serna-Saldivar, S.O., 2000. The millets. In *Handbook of cereal science and technology, revised and expanded* (pp. 177-201). CRC Press.
17. Basavaraj, G., Rao, P.P., Bhagavatula, S. and Ahmed, W., 2010. Availability and utilization of pearl millet in India. *SAT ejournal*, *8*.
18. Anbukkani, P., Balaji, S.J. and Nithyashree, M.L., 2017. Production and consumption of minor millets in India-A structural break analysis. *Annals of Agricultural Research*, *38*(4).
19. Karuppasamy, P., 2015. Overview on millets. *Trends in Biosciences*, *8*(13), pp.3269-3273.