

6. Foxtail Millet

Raise A. Bhat

KVK, Kupwara.

Ruby Jan

Division of Agronomy, FoA, SKUAST-KASHMIR.

Muzzammil Kousar

Aligarh Muslim University.

Nazir A. Bumla

KVK, Kupwara.

Sadaf Saad

Jamia Hamdard University New Delhi.

Gazanfar Gani

KVK Srinagar.

Abstract:

Foxtail millet (Setaria italica L.) originated in East Asia, likely in China. The ancestor of foxtail millet is the green foxtail grass (Setaria italica viridis L.). It is an important cereal crop that is widely cultivated in arid and semi-arid regions of Asia, Africa, and America. It is one of the oldest cultivated millets in the world and ranks second in production after pearl millet.

This chapter examines the significance of foxtail millet in ensuring food security and promoting nutritional health. Renowned for its resilience to drought and poor soil conditions, foxtail millet is a key crop for sustainable agriculture in challenging environments. Nutritionally rich in protein, fiber, vitamins, and minerals, it supports balanced diets and addresses malnutrition. The grain's low glycemic index and gluten-free properties make it beneficial for managing diabetes and celiac disease.

Keywords:

Millets, Foxtail, proteins and fibres.

6.1 Introduction and Importance of Foxtail Millet:

The main components of foxtail millet are starch, protein, dietary fibres, fat, vitamins, and minerals (Yang *et al.*, 2013).

Foxtail millet contains significant levels of protein, fiber, mineral, and phytochemicals (Sharma and Niranjana 2018). Foxtail millet is an important cereal crop that offers significant nutritional and cultivation benefits:

6.1.1 Nutritional Importance:

- Foxtail millet is rich in dietary fibre, protein, and low in fat, making it a suitable food for diabetics as it releases glucose steadily without affecting metabolism. Foxtail millet consumption is associated with reduced diabetes prevalence and is considered a healthy heart food due to its magnesium content (Reddy, 2017).
- It is high in vitamins and minerals like iron, calcium, and B-complex vitamins, providing excellent nutritional value. Foxtail millet is good source of beta – carotene, which is the precursor of Vitamin A (Murugan and Nirmalakumari, 2006).
- Foxtail millet is gluten-free, making it a suitable option for people with gluten sensitivity.
- The high fibre content aids digestion and promotes gut health. Ren et al., (2016), stated that starch digestibility and glycemic responses of foxtail millet were influenced by different processing methods.
- foxtail millet protein is reported to have a positive effect on type 2 diabetes and cardiovascular diseases (Choi *et al.*, 2005).
- Foxtail millet has been found to possess some phytochemicals with considerable antinutrient effects (Saleh *et al.*, 2013)

6.1.2 Cultivation Advantages:

- Foxtail millet is a hardy, drought-tolerant crop that can grow in arid and semi-arid regions with moderate rainfall of 500-700 mm annually.
- It is well-suited for cultivation in challenging climates and poor, dry soils where other crops may not thrive.
- Foxtail millet has a short growing season of less than 120 hours of daylight, allowing it to be grown as a catch crop or in sequence with other crops.
- It can be intercropped with groundnut, cotton, or finger millet + pigeon pea, making it a versatile option for diverse cropping systems.

Overall, foxtail millet's nutritional profile and adaptability to difficult growing conditions make it an important cereal crop, especially in regions facing food security challenges due to climate change.

6.2 Cultivation Practices for Foxtail Millet:

Soil and Climate:

Foxtail millet can be grown in both tropical and temperate climates with moderate rainfall of 500-700 mm annually. It requires moderately fertile, well-drained soil and is not tolerant to flooded soils or severe drought.

Varieties:

Popular foxtail millet varieties include SiA 3088, SiA 3156, HMT 100-1, PS 4, TNAU 196, TNAU 43, Prathap Kangani (SR 1), and PRK 1.

Sowing:

- Sowing is done in July-August in Karnataka, first fortnight of July in Andhra Pradesh, and second-third week of July in Maharashtra.
- Spacing is maintained at 25-30 cm between rows and 8-10 cm between plants within a row.
- Seed rate is 8-10 kg/ha for line sowing and 15 kg/ha for broadcasting.

Nutrient Management:

- Apply 5 tonnes/ha of farmyard manure 2-3 weeks before sowing.
- Fertilizer requirements vary by state, e.g. 40:30:0 NPK kg/ha in Andhra Pradesh, 30:15:0 in Karnataka, and 20:20:0 in other regions.
- Apply entire phosphorus and half nitrogen at sowing, remaining nitrogen at 30 days after sowing.

Weed Control:

- Two intercultivations and one hand weeding are recommended in line sown crops.
- Two hand weedings are needed in broadcasted crops.

Cropping Systems:

- Intercropping with groundnut (2:1), cotton (5:1), or finger millet + pigeon pea (5:1) is practiced.
- Relay cropping with rabi sorghum is done in Andhra Pradesh.
- Profitable sequence cropping includes foxtail millet-mustard, foxtail millet-green gram, foxtail millet-pigeon pea, and foxtail millet-sunflower.

Pests and Diseases:

- Major diseases are blast, brown spot, rust, grain smut, and green ear.
- Spraying Mancozeb (0.2%) is recommended if diseases appear early.
- Seed treatment with Carboxin or Carbendazim (2g/kg) controls grain smut.

Value Addition:

Value addition is crucial to increase the adoption and consumption of foxtail millet. Some key aspects of value addition:

s

Processing Methods:

Contemporary processing methods include refining, malting, fermentation, popping, flaking, extrusion cooking, and baking.

Value-Added Products:

Refined flour, malted flour, popped products, extruded products, and health foods are some value-added options. Foxtail millet can be used to make roti, porridge, cooked grains, bakery products, noodles, and beverages.

Nutritional Benefits:

Foxtail millet is rich in protein, fibre, vitamins, and minerals. Value-added products have higher protein (10.98-16.10 g/100g) and fibre (up to 3.86 g/100g) compared to control products.

Challenges:

- Lack of awareness, non-availability of ready-to-use products, and low shelf stability due to high fat content.
- Opportunities
- Developing gluten-free products, promoting traditional foods, and improving processing technologies.

In summary, value addition through innovative processing and product development can increase foxtail millet's consumption, enhance nutrition security, and provide livelihood opportunities. Overcoming processing challenges and promoting awareness are key to realizing its full potential.

6.3 References:

1. Choi YY, Osada K, Ito Y, Nagasawa T, Choi MR and Nishizawa N. Effects of dietary protein of Korean foxtail millet on plasma adiponectin, HDL-cholesterol, and insulin levels in genetically type 2 diabetic mice. *Biosci. Biotechnol. Biochem.* 2005, 69, 31–37.
2. Murugan R and Nirmalakumari A. 2006. Genetic divergence in foxtail millet [*Setaria italica* (L.) Beauv.].
3. Reddy OSK. 2017. Smart millet and human health. *Green Universe Environmental Services Society*, 24-37.
4. Ren X, Chen J, Molla MM, Wang C, Diao X and Shen Q. In vitro starch digestibility and in vivo glycemic response of foxtail millet and its products. *Food Funct.* 2016, 7, 372–379.
5. Saleh ASM, Zhang Q, Chen J and Shen Q. Millet grains: Nutritional quality, processing, and potential health benefits. *Compr. Rev. Food Sci. Food Saf.* 2013, 12, 281–295.

6. Sharma N and Niranjan K. 2018. Foxtail millet: Properties, processing, health benefits, and uses. *Food reviews international*, 34(4), 329-363.
7. Yang XS, Wang LL, Zhou XR, Shuang SM, Zhu ZH, Li N, Liu F, Liu SC, Lu P and Ren GX. Determination of protein, fat, starch, and amino acids in foxtail millet [*Setaria italica* (L.) Beauv.] by Fourier transform near-infrared reflectance spectroscopy. *Food Sci. Biotechnol.* 2013, 22(6), 1495–1500.