

Foxtail millet:

Nutritional importance and cultivation aspects

K Hariprasanna*

ICAR-Indian Institute of Millets Research, Rajendranagar, Hyderabad, Telangana 500 030

Foxtail millet (Setaria italica) also known as Italian millet, German millet, Chinese millet or Hungarian millet, is one of the oldest cultivated millets in the world. It is cultivated in about 23 countries of Asia, Africa and America. It is a self-pollinating, short-duration, drought tolerant and C4 cereal crop good as food for human consumption, feed for poultry and cage birds, and fodder for cattle; mainly cultivated in poor or marginal soils. It plays an important role in the world agriculture providing food to millions of people dependent on poor or marginal soils in southern Europe and in temperate, subtropical and tropical Asia.

Keywords: Climate change, Diabetes, Drought tolerance, Nutritious, Rainfed

IN India, foxtail millet is known by different names in different languages, and was an important crop in the rainfed areas of central and southern states in the early 1980s. The area under its cultivation and production has come down over the years. At present foxtail millet is grown on a limited area mostly to meet the domestic needs of the rural people. It is still used as an energy source for pregnant and lactating women, sick people, and children. Nutritionally it is rich in dietary fibre (6.7%), protein (11–12%) and low in fat (4%). Foxtail millet is recognised as diabetic food as it releases glucose steadily without affecting the metabolism of the body. The incidence of diabetes is found to be rare among the population consuming foxtail millet diet.

Geographical distribution

Foxtail millet is believed to be originated in China. It can grow in altitudes from sea level to 2000 m. It is adapted to a wide range of elevations, soils and temperatures. In India, it is cultivated on about 0.8 lakh ha area with 0.6 lakh tonnes production in Andhra Pradesh, Karnataka, Telangana, Rajasthan, Maharashtra, Tamil Nadu and north eastern states. The area under foxtail millet in India has come down by more than half during 1990's mainly due to introduction of more profitable crops like sunflower and soybean in black soils.

The important foxtail millet growing districts in Andhra Pradesh are Kurnool, Kadapa and Anantapur while Mahboob Nagar and Rangareddy districts are important in Telangana. In Karnataka it is mostly grown in Bellary, Koppal, Chitradurga, Belgaum, Gadag,

Davangere and Dharwad. In North Eastern region foxtail millet is mainly grown in East Siang, Siang, Upper Siang, Lower Dibang Valley, Tirap, Longding, Changlang, Namsai, Shiyomi districts of Arunachal Pradesh and West Garo Hills of Meghalaya.

Nutritional importance and health benefits

The grains of foxtail millet are small and ovoid in shape, around 2 mm long, pale yellow to orange, red, brown or black in colour. Grain is enclosed in thin hulls and de-hulling is necessary to use as food. The foxtail millet grains have long shelf-life. It is usually cooked whole like rice or made into meal. It can be prepared as upma, pulao, khichdi or biriyani. In addition, foxtail millet is consumed as porridge called *sargati*, or as leavened bread known as *roti*, after the de-hulled grain milled into flour. Other food preparations are pudding, breads, cakes, chips, rolls, noodles, etc. Foxtail millet is fermented to make vinegar and wine in China and to make beer in Russia and Myanmar. Sprouted grains are also eaten as vegetable in some regions.

Foxtail millet is highly nutritious (Table 1) and is a rich source of fibre, protein, zinc, and magnesium. It has a moderate glycaemic index (GI) of 59. Eating foxtail millet results in slow release of sugar to the blood as compared to wheat and rice. The fibre in the form of β -glucans (42.6%) leads to increased metabolism of sugar and cholesterol resulting in lower levels of sugar and cholesterol, which is beneficial for prevention of diabetes and cardiovascular diseases. Foxtail millet is used in the preparation of low GI foods for

treating diabetes, particularly type 2 diabetes and also cardiovascular diseases. Consumption of foxtail millet effectively reduces body weight, fasting blood sugar levels, improves blood pressure and lipid profile. High fibre content in foxtail millet improves digestion and eases constipation, lowers the risk of heart diseases, hypertension and stroke. It contains good amount of B vitamins such as thiamin (B1), riboflavin (B2), niacin (B3) and folate (B9). These B vitamins are essential for nervous system and brain function. Foxtail millet is also rich in antioxidants, such as flavonoids which protect neurons from inflammation, which may improve memory function.

Table 1. Nutritive value of foxtail millet vs. fine cereals (per 100 g)

Item	Foxtail millet	Wheat (whole)	Rice (raw, milled)
Carbohydrates (g)	60.9	71.2	78.2
Protein (g)	12.3	11.8	6.8
Fat (g)	4.3	1.5	0.5
Energy (KCal)	331	346	345
Crude fibre (g)	8	1.2	0.2
Mineral matter (g)	3.3	1.5	0.6
Amylose (%)	17.5	25	12-19
Amylopectin (%)	82.5	75	88-81
Ca (mg)	31	41	10
P (mg)	290	306	160
Fe (mg)	2.8	5.3	0.7
Zn (mg)	2.4	2.7	1.4
Mg (mg)	81	138	90
Na (mg)	4.6	17.1	-
K (mg)	250	284	-
Cu (mg)	1.4	0.68	0.14

Source: Nutritive value of Indian foods, NIN, 2007

Cultivation aspects

Foxtail millet varieties can mature in 75–90 days. It grows well where rainfall ranges from 500 to 700 mm and where rains fall during summer. Foxtail millet grows better between 16 and 26°C though it can tolerate up to 35°C. It can grow on sandy to heavy clay soils (except saline soils) but requires fairly fertile soils for good yields. Light soils including red loams, alluvials and black cotton soils are suitable for its cultivation. The recommended package of practices are given in Table 2.

Table 2. Recommended package of practices for foxtail millet

Operation	Practice
Land preparation	Plough once with mould board plough before the onset of monsoon, harrow or plough twice with local plough with the onset of monsoon, make the field smooth and well levelled
Time of sowing	<i>Kharif</i> : July-August (Karnataka), July (Tamil Nadu, Andhra Pradesh), 2–3 rd week July (Maharashtra) <i>Rabi</i> : August-September (Tamil Nadu) Irrigated/Summer: February-March.
Seed rate	8 kg/ha

Operation	Practice
Spacing and optimum plant population	25–30 cm (row to row), 8–10 cm (plant to plant); 4–4.5 lakh/ha
Seed treatment	Fungicide: ridomil mz @2 g/kg, carbendazim @2 g/kg; Bio-fertilizer: <i>Azospirillum brasilense</i> and <i>Aspergillus awamouri</i> @25 g/kg
Manures and fertilizers (for rainfed crop)	FYM: 5–7.5 t/ha Urea: 52 kg/ha DAP: 33 kg/ha
Inter-cultivation	Using a tyne-harrow when crop is 30 days old
Irrigation/ drainage	2–5 irrigations in summer crop depending upon soil type and climatic conditions; drain out excess rain water to avoid water logging
Weed control	Isoproturon (0.5 kg ai/ha) (pre-emergent); 2,4-D (0.75 kg ai/ha) (post-emergent 15–20 DAS)
Disease control	Rogue out downy mildew affected plants, spray mancozeb @2 g/litre if diseases appear at early stage of crop growth
Pest control	1. Early sowing in the month of May wherever possible 2. In late sown crop increase the seed rate one and half times 3. Seed treatment with chloropyriphos @2 ml/litre water for 1 kg seed or imidachloprid @0.7 ml/litre water
Harvesting	Harvest when the earheads are dry either by cutting the whole plant by sickle or the ears separately
Threshing	Thresh after drying for a few days with a stone roller or by trampling under the feet of bullocks
Inter-cropping	Foxtail millet : pigeon pea (5:1), Foxtail millet : ground nut (2:1); Foxtail millet : cotton (5:1)

Blast disease is one of the major diseases of foxtail millet. Other diseases are leaf spot, downy mildew, sheath blight and rust. Shoot fly is one of the important pests, which results in dead hearts leading to yield loss. Lodging is another important yield and quality reducing factor depending on the environmental conditions. The field should be kept free from weeds for higher yields.

Improved varieties

A number of varieties with high yield potential have been released for different states (Table 3). New varieties have a yield potential of 2000–2600 kg/ha. Short duration varieties like SiA 3085 and SiA 3088 (Surya Nandi) are becoming popular in the major cultivated areas. Foxtail-chickpea system has significantly increased the income in Kurnool, Andhra Pradesh. In paddy fallows also, short-duration foxtail millet is becoming popular in Kurnool in view of limited water supply.

Table 3. Popular foxtail millet varieties

State	Varieties
Andhra Pradesh and Telangana	Renadu (SiA 3223), Garuda (SiA 3222), SiA 3088, SiA 3156, SiA 3085, Lepakshi, SiA 326, Narasimharaya, Krishnadevaraya, PS 4
Karnataka	HN 46, DHFT-109-3, HMT 100-1, SiA 3156, SiA 3088, SiA 3085, SiA 326, PS 4, Narasimharaya,



Renadu (SiA 3223)



Garuda (SiA 3222)



ATL 1



SiA 3156

High yielding varieties of foxtail millet

State	Varieties
Tamil Nadu	ATL 1, CO (Ten) 7, TNAU 43, TNAU-186, TNAU 196, CO 1, CO 2, CO 4, CO 5, K2, K3, SiA 3088, SiA 3156, SiA 3085, PS 4
Rajasthan	Prathap Kangani-1 (SR 51), SR 11, SR 16 (Meera), SiA 3085, SiA 3156, PS 4
Uttar Pradesh	PRK 1, PS 4, SiA 3088, SiA 3085, Sreelaxmi, Narasimharaya, SiA 326, S-114
Uttarakhand	PS 4, PRK 1, Sreelaxmi, SiA 326, SiA 3156, SiA 3085
Bihar	RAU-2, SiA 3088, SiA 3156, SiA 3085, PS 4

management. The area under the crop is declining due to competition from other crops. There is scope to expand area through organized seed production of high yielding varieties and supply to different parts of the country. Better crop management has to be adopted to realise high yield potential of improved varieties. Policy interventions to promote foxtail millet cultivation can ensure food, nutrition, fodder and livelihood security. Good processing interventions and value-added food products will definitely enhance the profitability to the foxtail millet farmer.

SUMMARY

Foxtail millet is a nutritious, climate change-compliant crop that grows well under marginal soils with less

*Corresponding author's e-mail: hari@millets.res.in

Water

Even though households are relatively low consumers of water, population growth and expanded water use have outweighed the effect of water saving technology and behavior.

- Less than 3% of the world's water is fresh (drinkable), of which 2.5% is frozen in the Antarctica, Arctic and glaciers. Humanity must therefore rely on 0.5% for all of man's ecosystem's and fresh water needs.
- Man is polluting water faster than nature can recycle and purify water in rivers and lakes. More than one billion people still do not have access to fresh water.
- Excessive use of water contributes to the global water stress. Water is free from nature but the infrastructure needed to deliver it is expensive.

- See more at: http://www.unep.org/wed/theme_water.asp#sthash.ki5vg3lB.dpuf
 Courtesy: United Nations Environment Programme website - <http://www.unep.org/wed>