

Improved Production Technology for Foxtail millet

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Project Coordinating Unit

ICAR-AICRP on Small Millets
GKVK, Bengaluru - 560 065

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Published by

Project Coordinating Unit
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Designed & Printed by



9901556099

Foreword

Foxtail millet is known as Italian millet, Kangu, Kangani, Koni and Kaon in different parts of India. It is one of the oldest crops cultivated for food, grain, hay and pasture. It is an important grain crop in temperate, subtropical, tropical Asia and in parts of Southern Europe. Foxtail millet is well recognized as a short duration and drought tolerant crop. In India it is cultivated over an area of 0.87 lakh ha with total production of about 0.66 lakh tones and with productivity of 762 kg/ha during 2015-16.

Foxtail millet is a rich source of protein, iron and Beta-carotene, which is a precursor of Vitamin A. It has low glycemic index, used for preparation of low glycemic index biscuits and burfi, a sweet product and it is an ideal food for people suffering from diabetes.

Low productivity in farmers' field in foxtail millet can be increased by adopting improved production technologies. The information contained in this technical bulletin would help to create the much needed awareness among farmers and extension personnel on the latest released varieties, crop growing conditions, and plant protection technologies. I am confident that the information given in this bulletin will assist the farmers and extension workers in their efforts to increase foxtail millet production. I appreciate the efforts put in by the scientists in bringing out this bulletin in an impressive manner.



(PRABHAKAR)

Project Co-ordinator
AICRP on Small Millets

Date: 8-12-2017

Place: Bengaluru

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Introduction

Common name : Kakun

Vernacular Names : Foxtail millet (English), Kangni (Hindi), Navane (Kannada), Thinaï (Tamil), Kang (Gujarati) and Rala (Marathi).

Family : Gramineae

Foxtail is also known as Italian millet and German millet. It is generally grown as a rainfed crop in India. It has an erect leafy stem, that grow 60-75 cm tall and bend quite a bit at maturity due to heavy weight of earhead. Foxtail grain contains 10% to 12% Protein, 4.7% fat, 60.6% carbohydrates, 2.29% to 2.7% Lysine and 0.59 (mg) Thiamin. In India it is cultivated over an area of 0.87 lakh ha with total production of about 0.66 lakh tones and with productivity of 762 kg/ha during 2015-16.

Climate and soil

Foxtail can be grown in tropics as well as temperate regions both under low and moderate rainfall. The crop can be grown even at an altitude of 2000 m and 50-75 cm annual rainfall. Foxtail grows well on well-drained loamy soils. They will not tolerate water-logged soils or extreme drought.



Season

- August – September in Tamil Nadu.
- July-August in Karnataka.
- First fortnight of July in Andhra Pradesh.

- Second and third week of July in Maharashtra.
- In Tamil Nadu, *Kharif* irrigated crop is planted from the beginning of June to end of July and summer irrigated crop in January
- Plains of Uttar Pradesh and Bihar, middle of June.



Varieties

A number of varieties with high yield potential have been released for different states.

Table 1: Latest and popular varieties recommended for different states of India.

Sl. No.	State	Varieties
1	Andhra Pradesh	SiA 3088, SiA 3156, SiA 3085, Lepakshi, SiA 326, Narasimharaya, Krishnadevaraya, PS-4
2	Karnataka	SiA 326, HMT 100-1 and PS 4, Narasimharaya, SiA 3088, SiA 3156, SiA 3085, DHFt-109-3, PS-4
3	Tamil Nadu	TNAU 43, TNAU-186, TNAU 196, CO 1, CO 2, CO 4, CO 5, K2, K3, SiA 3088, SiA 3156, SiA 3085, PS-4
4	Rajasthan	Prathap Kangani (SR 1), SR 51, SR 11, SR 16, SiA 3085, SiA-3088, SiA-3156, PS-4
5	Uttar Pradesh	PRK 1 and PS 4, SiA 3088, 3085, Sreelaxmi, Narasimharaya, S-114, SiA 326, PS-4
6	Uttarakhand	PS 4 and PRK 1, Sreelaxmi, SiA 326, SiA 3088, SiA 3156, SiA 3085, PS-4
7	Bihar	RAU-1, SiA 3088, SiA 3156, SiA 3085, PS-4

Spacing

- 25-30 cm between rows and 8-10 cm between plants within a row

Seed rate

- 8-10 kg ha⁻¹ for line sowing
- 15 kg ha⁻¹ for broadcasting



Manures and fertilizers

Apply 5 tones of farm yard manure per hectare 2-3 weeks prior to sowing.

Table 2 : Fertilizer required for different states is as follows

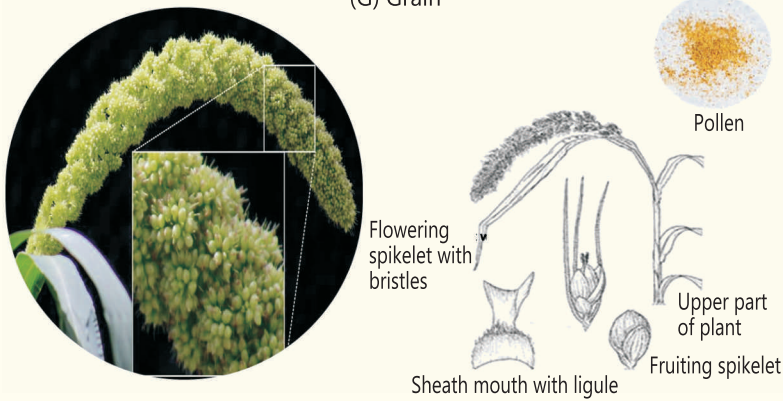
State	Fertilizer recommended NPK kg ha ⁻¹
Andhra Pradesh	40:30:0
Jharkhand	40:20:0
Karnataka	30:15:0
Maharashtra	20:20:0
Tamilnadu	40:20:0
Other regions	20:20:0

Apply entire quantity of phosphorus and half of nitrogen at sowing and remaining half of nitrogen at 30 days after sowing.



Foxtail millet inflorescence and its parts

(A) Foxtail inflorescence; (B) Spikelet's cluster; (C) Subtended spikelet; (D) Opened spikelet; (E) Outer glume; (F) Grain enclosed in lemma and palea (G) Grain



Floral Structure

Table 3 : Popular varieties and their special features

Variety	Co 7 (TNAU 196)	HMT 100-1	SiA 3085	Suryanandi (SiA 3088)	SiA 3156	RAU (Rajendra Kauni 1-2)
Pedigree	Co 6 × ISe 247	RS 118 × PS 3	Pure line from SiA 2644	Pure line from SiA 1244	Pure line from 2871	Selection from local germplasm of Laukaria Raxaul, East Champaran
Maturity (days)	85-90	90-95	80-85	70-75	85-90	80-83
Average yield (q/ha)	18-19	20-25	20-30	20-25	20-25	23-25
Special characters	High protein (13.62 to 14.0%) and fodder yield (3.7 to 4.0 t/ha)	High tillering, suitable for early and late sowing	Resistant to blast and downey mildew.	Non-lodging, early duration, suitable for double cropping.	Highly responsive to nitrogenous fertilizers	Resistance against leaf blast, rust, smut, brown spot, downey mildew and leaf blight. High iron content of 15.45 (mg/100g) and Zinc (5.02mg/100g).
Area of adaptation	Tamil Nadu	Karnataka	All foxtail millet growing areas of the country	All foxtail millet growing areas of the country	Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh, Tamil Nadu and Uttarakhand	Irrigated and rainfed upland of Bihar

Table 3 : Popular varieties and their special features (continued)

Variety	SiA326 (Prasad)	SiA 2644 (Srilakshmi)	PS 4 (Pant Setaria 4)	TNAU 186	DHF-t-109-3	PS-4
Pedigree	Pure line selection	Pure line selection	Mutant of 543/SiA 2616	Co-5 x SiA 326	Co-5 x GPUS-30	SiA 2616 (0.2% EMS induced mutant)
Maturity (days)	70-75	80-85	80-85	80-85	86-88	80-85
Average yield (q/ha)	18-22	23-25	18-20	18-20	25-29	18-20
Special characters	Non lodging, rich in protein (13.21-13.30%), early duration	Resistant to downy mildew and rust, tolerant to moisture stress	Long panicles and profuse tillering	Tolerant to drought, profuse tillering	Variety suitable for contingency planting	Wider adaptability
Area of adaptation	All foxtail millet growing areas of the country	All foxtail millet growing areas of the country	All foxtail millet growing areas of the country	Andhra Pradesh, Tamil Nadu, Karnataka	Agro-climatic Zone-3 and 8 of Karnataka state.	All foxtail millet growing areas of the country



SiA 326 (Prasad)



SiA 3085



Suryanandi (SiA 3088)



SiA 3156



SiA 2644 (Srilakshmi)



PS 4 (Pant Setaria 4)

Water management

Foxtail millet sown during Kharif season does not require any irrigation. However, if dry spell prevails for longer period, then first irrigation at 25-30 DAS and second irrigation at 40-45 DAS must be given to boost the yields.

Weed control

Important weeds

Among grassy weeds, *Echinochloa colonum*, *Echinochloa crusgalli* (sawan), *Dactyloctenium aegyptium* (makra), *Eleusine indica* (kodo), *Setaria glauca* (banra), *Cynodon dactylon* (doob), *Phragmites karka* (narkul), *Cyperus rotundus* (motha), *Sorghum halepense* (banchari) are common. The broad-leaved weeds are *Celosia argentea* (chilimil), *Commelina benghalensis* (kankoua), *Phyllanthus niruri* (hulhul), *Solanum nigrum* (makoi) and *Amaranthus viridis* (chaulai).

Weed Control

- Two to three weedings with hand hoe are sufficient to keep the weeds in control.
- Post-emergence application of 2, 4-D sodium salt (80%) @ 1.0 kg a.i./ha at 20-25 DAS. Isoproturon @ 1.0 kg a.i. /ha as pre-emergence spray is also effective in weeds control.
- Two inter cultivations and one hand weeding in line sowing
- Two hand weeding in broadcasted crop

Cropping systems

Inter cropping

- Andhra Pradesh: Foxtail millet+ ground nut (2:1 ratio)
- Foxtail millet + cotton (5:1 ratio) - Rayal seema regions.
- Foxtail millet + pigeon pea in 5:1 row ratio.



Relay cropping

Andhra Pradesh: If monsoon is early, sow foxtail millet at 45 cm row spacing and introduce Rabi jowar as relay crop when foxtail millet is nearing maturity.

Sequence cropping

Foxtail millet-mustard, foxtail millet-green gram, foxtail millet-pigeon pea and foxtail millet-sunflower are profitable than one crop of foxtail millet.

Harvesting Time

The crop matures in 80-100 days. The crop is harvested when the earheads are dry, either by cutting the whole plant by sickle or the ears separately. The crop is usually harvested during Kharif season from September to October and Rabi season from January to February.

Yield

Grain-15-18 qtl/ha and Straw-20-40 qtl/ha.



HMT 100-1



Narasimharaya

Table 4 : Insect Pests of foxtail millet

Common name & Scientific name	Nature of Damage	Management
Shoot fly (<i>Atherigona</i> spp.)	The damage of this pest is observed from sowing to six weeks of old crop. As result of it's feeding the central shoot starts drying and shows the typical symptoms of dead heart in the early stage and profuse tillering in the later stage, which are also affected. Damaged tillers may produce ear heads, but with no grains (white ears). Maximum incidence occurs during late July or early August.	• Early sowing of crop i.e. second fortnight of July or with the onset of monsoon. • Adopt higher seed rate (1.5 times the recommended seed rate) to make up for seedling mortality • Monitored by fishmeal trap • Soil application of phorate 8-10 kg/acre in furrow is effective in checking shoot fly infestation. • Carbofuron 3G (1.5 kg a.i./ha) as soil application was most effective in reducing shoot fly incidence. • Spraying of quinolphos (2ml/lit) effectively reduced shoot fly infestation.

Insect Pests and Diseases of Foxtail millet



Shoot fly adult



Dead heart plant



Fish meal trap



Green ear of setaria

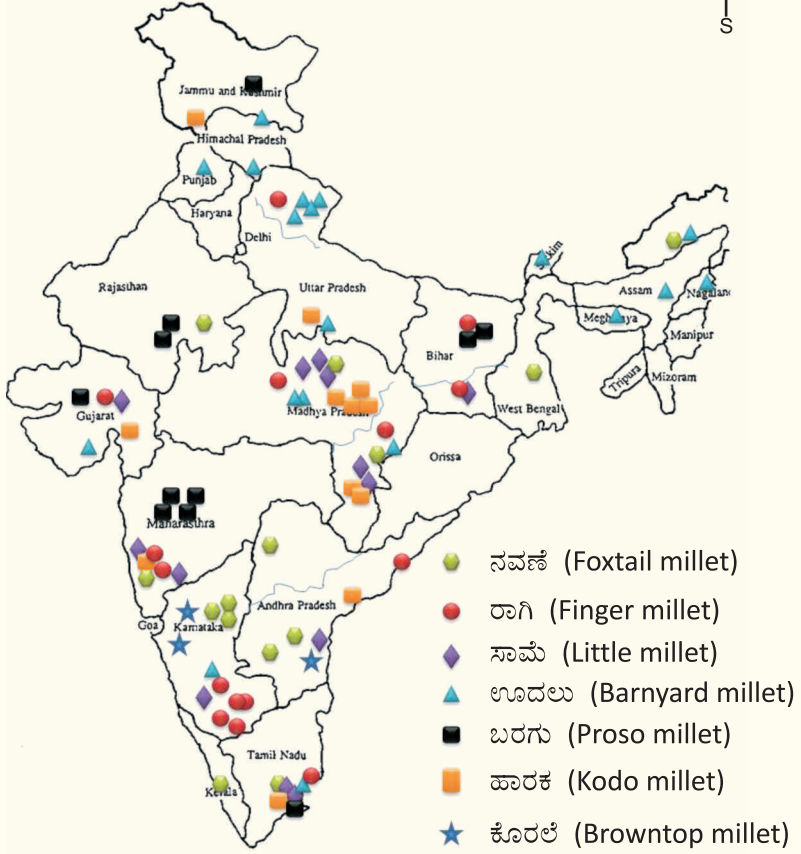
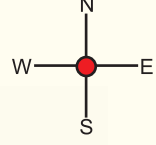


Rust

Table 5 : Diseases of foxtail millet

Common name & Scientific name	Occurrence/Distribution	Symptoms	Management
Blast, <i>Pyricularia setariae</i>	First reported from Japan, whereas in India 1919 reported from Madras province.	Typical spindle shaped spots on leaf lamina. Under highly congenial conditions such spots enlarge, coalesce and leaf blades especially from the tip towards base give a blasted appearance. Causes blast of foxtail millet with only foliage symptoms.	Sprays of Saaf (0.2%) or carbendazim 0.05% or tricyclazole 0.05% with first spray at 50 per cent flowering followed by the second spray after 10 days
Rust, <i>Uromyces eragrostidis</i>	On Setaria, rust is prevalent in the states of Maharashtra, Uttar Pradesh, Madhya Pradesh, Tamil Nadu, Karnataka, Andhra Pradesh and Bihar. During certain years, it becomes epiphytotic and causes extensive reduction in grain yield. In 1944, it appeared in a very severe form in Andhra Pradesh and Karnataka states.	Numerous minute brown uredosori appear on both sides of the leaf. Rust pustules are oblong, brown, often formed in linear rows. They are also produced on the leaf sheaths, culms and stems. If the infection is severe premature drying of leaves and poor grain set are observed.	

Small millet growing areas in different states of the country



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NOTES

