

Seed production technologies in small millets

A. Thanga Hemavathy

Assistant Professor (Plant Breeding and Genetics), Department of Pulses, Tamil Nadu Agricultural University, Coimbatore-641 041.

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Abstract

Millets are small grained cereals, the smallest of them include finger, kodo, foxtail, proso, little and barnyard millets. They are the staple food of the millions inhabiting the arid and semiarid tropics of the world. They are distributed in most of the Asian and African countries and parts of Europe. The grains of small millets, being nutritionally Superior to rice and wheat, provide cheap proteins, minerals and vitamins to poorest of the poor where the need for such ingredients is the maximum. Practically devoid of grain storage pests, the small millets have indefinite storage life. The untapped grain yield potential coupled with nutritional superiority makes the small millets potential future food crops particularly in the more difficult rainfed areas.

Small millets are a group of crops which are hardy and grow well in dry zones as rainfed crops under marginal conditions of soil fertility and moisture. These are some of the oldest food grains known to human kind and possibly the first cereal grains to be used for domestic purposes.

Millets are also unique due to their short growing season. India is the world's largest producer and consumer of millets. These crops form an important component of nutritional and livelihood security of resource poor farmers of India.


They exhibit wide adaptation in marginal production and niche areas and provide farmers with best available opportunity for assured harvest, staple

food, required nutrition and sufficient fodder in environments characterized by scanty rainfall. These crops are climate change compliant. Besides, these millets also provide raw materials for agro industries such as poultry and cattle feed, value added products, potable alcohol, starch, bio-fuel etc.






Small Millets

These crops are widely grown in hilly and rainfed areas. They are self pollinated crops and require an isolation distance of 3 metres. They are as follows

Millet	Common name	Botanical name
Finger Millet	Ragi	<i>Eleusine coracana</i>



Corresponding Author: A. Thanga Hemavathy, Assistant Professor (Plant Breeding and Genetics), Department of Pulses, Tamil Nadu Agricultural University, Coimbatore-641 041.
E-mail: hemavathytnau@gmail.com, hema_gene@yahoo.co.in

Millet	Common name	Botanical name	
Little Millet	Samai	<i>Panicum sumatrense</i>	
Proso Millet	Panivaragu	<i>Panicum miliaceum</i>	
Barnyard millet	Kudiravalli	<i>Echinochloa frumentacea</i>	
Kodo millet	Varagu	<i>Paspalum scrobiculatum</i>	
Foxtail millet	Tenai	<i>Setaria italica</i>	

Seed Production Stages

Breeder seed - Foundation seed - Certified seed

Land Selection

Small millets can be grown in poor to fertile soil. Finger millet and barnyard millet can tolerate salinity better than any other crops. Well drained loam or sandy loam soils rich in organic matter are ideal for cultivation. The selected land should be free from volunteer plants. The land should not be cultivated with same crop in the previous season. Land should be ploughed 2 - 3 times to get fine tilth and levelled.

Field Selection and Sowing

Finger millet is a season bound crop and the best season to take up sowing is December - January and June - July. Seeds used for seed production should be of good quality certified seeds from an

authentic source. Seeds should be healthy with required germination percentage. Recommended seed rate is 2 kg/acre (5 kg/ha). Selected seeds should be treated with *Azospirillum* @ 125gms/kg of seeds.

The main field is prepared with 2 - 3 ploughing to make it a fine tilth and formed into ridges and furrows. During final plough apply compost or farmyard manure @ 5 tonnes/acre (12.5 tonnes/ ha) and incorporate into the soil. 20-25 days old seedlings transplanted to the main field. Two seedlings per hill should be planted. Follow a spacing of 15× 15 cm.

For all other small millets the recommended seed rate is 4 kg/acre (10 kg/ha). Selected seeds should be treated with *Azospirillum* @ 60 gms/kg of seeds. Treated seeds should be sown with a spacing of 30 x 10 cm. Seeds should be sown in June-July or September - October onset of monsoon rains. Summer crop should be sown in the month of February -

March. Seeds are broadcasted manually or raised in flat beds.

Nutrient Management

Before final ploughing compost or farmyard manure @ 5 tonnes/acre (12.5 tonnes/ha) should be applied and ploughed into the soil. Instead of this cattle penning can also be practiced. 50 kg neem cake and 500 kg vermicompost per acre (125 kg neem cake and 1250 kg vermicompost per hectare) should be applied as basal manure. After first weeding at 20 – 25 days after sowing first top dressing should be done using enriched vermicompost (2 kg *Azospirillum*, 2 kg *Phosphobacterium* and 2 litres *Panchagavya* mixed with 250 kg vermicompost and kept covered for a week and then used) @ 250 kg/acre (600 kg/ha) followed by the second top dressing at 40–45 days after sowing using 25 kg neem cake and 250 kg vermicompost per acre (60 kg neem cake and 600 kg vermicompost per hectare).

During flower initiation stage 10% tender coconut solution (1 litre tender coconut water + 9 litres of water) should be sprayed. For rainfed crop, 50 kg pungam cake and 250 kg vermicompost should be applied as basal manure just before sowing. First top dressing should be done at 20 – 25 days after sowing using 250 kg/ acre of enriched vermicompost. At 40 – 45 days after sowing apply 25 kg pungam cake and 250 kg vermicompost per acre (60 kg pungam cake and 600 kg vermicompost per hectare) as second top dressing. Spray 10% tender coconut water at the time of flower initiation. All the above mentioned inputs should be applied to the rainfed crop only when the soil is wet.

Weed Management

The seed production field should be maintained weed free from the initial stage. The first weeding should be done on 15th day after planting and followed by the second one on 30th day. After hand weeding allow the weeds to dry for 2–3 days.

Irrigation

The irrigation should be done once a week after life irrigation on the third day of sowing. Irrigation during flowering and grain setting stages are very critical.

Pest and Disease Management

Ragi is affected by pests and diseases like pink

stem borer, aphids, root aphids, earhead caterpillars, blast, brown spot, mottle streak virus etc., at different growth stages. Detailed management measures for these pests and diseases are provided in Annexure- I.

Roguing

Roguing should be done often to remove the offtypes, volunteer plants and diseased plants from the seed production field to avoid the genetic contamination. Roguing should be done upto the flowering stage. Maximum percentage of offtype permitted at the final inspection is 0.05% for foundation and 0.10% for certified seed production.

Field Inspection

A minimum of two inspections should be done between flowering and maturity stages by the Seed Certification Officer. The first inspection is done at the time of flowering to check the isolation and offtypes and the second done during the maturity stage prior to harvest to check the off-types and to estimate the yield.

Harvesting and Processing

Harvest is done once the earheads are physiologically mature. Physiologically mature earheads will turn from brown to green colour. Harvesting is done in two pickings since, the maturation of the earheads are not uniform because of the tillering habit of the crop. Second harvesting should be done seven days after the first one. Mature earheads should be harvested and threshed with bamboo sticks. Threshed grains are further cleaned by winnowing.

Drying and Storage

The cleaned seeds should be sun dried to attain a safe moisture level of 12%. Care should be taken while drying to avoid mechanical injury to the seeds and contamination. Seeds can be stored upto 13 months under proper storage conditions.

Seed Standards

The percentage of minimum physical purity of certified and foundation seeds should be 97% with a minimum of 75% of germination capacity and 12% of moisture content. The presence of inert matter should not exceed 2.0%.

Annexure I

Crop	Common pest and disease	Management measures
Finger millet	Ragi blast (<i>Pyricularia grisea</i>) (attacks at the early vegetative phase)	Crush and apply the bark of <i>Careya arborea</i> @ 2-3 kg, boil 1 kg wild Tulsi leaves in 2 litres of water and spray this solution @ 2 ml/litre of water for twice at 15 days interval.
	Rice tungro virus, Mottle streak virus of ragi (attacks at all the growth stages of the crop)	Spray the fermented cow's urine (fermented for one week) over the crops to control bacterial and fungal diseases, spray a solution of cow's urine (1 litre) and buttermilk (1 litre) diluted with 8 litres of water and spray 300 ml of sweet flag extract mixed with 1 litre of cow's urine and 8.7 litres of water to control the disease spread.
	Ragi (<i>Helminthosporium nodulosum</i>), (attacks at the early vegetative phase)	Treat the seeds with 20% mint leaf extract for 24 hours, spread the leaves of <i>Cleistanthus collinus</i> @ 25 quintals/ha the field and allow them to decay and irrigate after three days.
	Pink stem borer of Ragi (<i>Sesamia inferens</i>) (attacks in the later vegetative phase)	Plough deeply soon after harvest to destroy the eggs and pupae, apply neem cake @ 42 - 50 kg/ha as basal manure, using pheromone traps to attract and destroy male adult moths and using <i>Trichogramma</i> cards.
	Aphids - root aphid (<i>Tetraneura nigriabdominalis</i>) - (attacks in the vegetative phase)	Spray garlic extract (100 gms crushed and mixed with 50 litres of water) or apply manure prepared using <i>Adhatoda vasica</i> .
	Ear head caterpillar of ragi- (Damage is severe after earhead formation)	Managed by planting the crops in early kharif season.
	Shoot fly (<i>Atherigona varia soccata</i>)- (attacks from early vegetative to maturation stage)	Managed effectively by keeping fish meal traps @ 12 numbers / ha.

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