

Finger millet:

Scientific production technologies and its nutritional importance

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Finger millet (Eleusine coracana L.) is a yearly cultivated plant which is commonly used as a cereal in Asia and Africa's dry regions. It is popular minor millet and staple diet in various parts of the country, especially hilly regions. In southern states like Karnataka, Andhra Pradesh and Telangana, it is still one of the key elements in the staple diet and locally known as ragi, particularly in Karnataka. It is used as grain for food, and straw or green foliage for fodder purpose. Ragi is high in mineral nutrients and the richest calcium source, used in a variety of dishes like cakes, puddings, sweets etc. It comes in various forms and formulations like ragi dosa, ragi ball, ragi roti, ragi porridge, ragi upma, ragi biscuits and ragi cakes which are some of the most popular ragi meals. In addition to being used to manufacture beer and liquor, finger millet also produces by-products that are fed to livestock.

Keywords: Cereal, Fodder, Minor millet, Ragi, Staple diet

MILLETS are most imperative dry land crops cultivated in considerable sections of the country since antiquity. These crops are grown under a variety of climate circumstances as well as marginal soil and moisture conditions. India is one of the world's most important millets growers despite the fact that millet farming in India has declined substantially over time owing to shrinking land. Finger millet is the most outstanding one with respect to its nutrition and health benefits along with its suitability to various aberrations. The white cultivars of finger millet contain more protein than the brown varieties. Compared to other grains, which only contain 33.9% essential amino acids, it has 44.7% of them. Ragi is a great grain substitute for gluten-free folks because it does not contain gluten.

Climate and soil

Finger millet is a crop that may be produced in tropical and subtropical climates up to 2100 m amsl. It is a heat loving plant that needs temperature between 26–29°C for ideal growth

and crop yield, and a minimum of 8–10°C for germination. Finger millet can thrive on a variety of soils, from the most infertile to the richest and it can tolerate mild alkalinity. The best soil is alluvial, loamy and sandy with good drainage.

Land preparation

Before planting, secondary tillage with a cultivator and a multiple-

tooth hoe is necessary to create a smooth seed bed. Seeds are quite tiny which can germinate in 5–7 days. As a result, healthy seeds and proper site preparation aid in greater germination, weed control and soil moisture conservation. Digging and turning of soil helps in eradicating perennial weeds, smoothening of land and keeping inward slope with a shallow drain



Inter-cultivation in finger millet



Booting stage of finger millet

help in draining out excess rain water where regular ploughing operations are complicated.

Seed rate, spacing and sowing time

For drill sowing, a seed rate of 8–10 kg/ha is optimal, while for producing saplings for transplantation, a seed rate of 4–5 kg/ha found optimal. It is advised to treat the seeds with thiram @2.5 g/kg before sowing. The optimum spacing of 22.5–30 cm × 10 cm is ideal with 3–4 cm sowing depth. The optimal sowing time for rainy (*khari*) season is June–July, winter (*rabi*) season is September–October and summer season is January–February.

Sowing method

Line sowing: Line sowing is advantageous because, it aids in

inter-cultivation and effectively reduces weeds. An ideal plant population of 4–5 lakh plants/ha must be maintained. The best plant population is achieved by line sowing with a seed drill at a spacing of 22.5–30 cm between rows and 7.5–10 cm between plants.

Transplanting and nursery management: Irrigated conditions are used for transplanting. To raise seedlings for 1 ha of planting, 150 m² area is necessary. There is a need of 35–38 beds, each measuring 4 feet wide and 25 feet long. Apply 2–3 baskets of well decomposed Farmyard manure per bed together with 1 kg SSP, half a kg of MOP, 1 kg of ammonium phosphate and 750 g zinc sulphate. The seeds should be sown in regular intervals of 3 inches between rows. Each bed should be covered with water, well-decomposed FYM, soil or sand. It is appropriate to transplant seedlings that are 21–25 days-old, in rows that are 22.5–25 cm apart and 2 seedlings per hill with 10 cm distance between hills.

Nutrient management

The physical condition of soil can be improved by the addition of organic matter, enabling it to hold moisture for a longer period of time. Manures are administered at a rate of 5–10 t/ha about a month before sowing. It is advised to use 60 kg of nitrogen, 30 kg of phosphorus and 30 kg of potassium per hectare when irrigating. Under rainfed condition, it is advised to use 40 kg

of nitrogen, 20 kg of phosphorus and 20 kg of potassium per hectare. Entire phosphorus and potassium should be applied in full at the time of sowing and nitrogen should be applied in 2 or 3 split doses depending on the availability of moisture.

Irrigation management

The crop planted in the rainy season usually does not require watering. Irrigation is required during two important growth stages, viz. tillering and flowering. If the rainfall stop for an extended period, than irrigation is necessary to achieve a better harvest. A total of 8–14 irrigation are required according to soil, weather conditions and cultivar longevity.

Weed management

During the initial phases of plant growth and development, weed control is essential. Use a hand hoe to perform inter-cultivation and weeding at 25 days after sowing (DAS). In broadcast crops, 2 efficient hand weeding will reduce weeds. In line sowing, 2–3 inter cultivations and 1 hand weeding is recommended. Pre-emergence sprays with isoproturon (0.5 kg a.i./ha) and oxyflurofen (0.1 litre a.i./ha) and post-emergence sprays with 2, 4-D sodium salt (0.7 kg a.i./ha) efficiently control weeds in areas with guaranteed rainfall and irrigation.

Cropping system

Intercropping: The popular intercropping systems in Karnataka, Andra Pradesh and Tamil Nadu comprised of ragi+red gram (8–10:2), ragi+field bean (8:1) and ragi+soybean (4:1) while Bihar comprised of ragi+red gram (6:2) and Maharashtra comprised of ragi+green gram (6–8:1).

Crop rotation: Rotation with legumes including rice bean, soybean, black gram or green gram occurs in northern states and red gram, field bean, groundnut or horse gram occurs in southern states, respectively.

Pest management

Army worms and cut worms:



Flowering or anthesis stage of finger millet



Grain filling stage of finger millet



Ear head stage of finger millet

They start to appear early on and continue till harvest. In their early phases of development, caterpillars slice saplings at the base, giving the impression that a domestic animal has been grazing on them. They are most active at night and hide under rocks and clumps during the day. During the last stages of plant growth, these insects serve as defoliators. Dust with quinolphos 1.5% @24 kg/ha or malathion 5% @24 kg/ha as symptoms start to manifest. Make use of poison baits that are composed of 10 kg of rice bran, 1 kg of jaggery and 1 litre of quinolphos (25% EC).

Aphid: They are found during the crop's growing season. Nymphs and adults suck sap from delicate stems and leaves. They can seriously harm plants for up to 30 days while, they are still in the seedling stage. Quinalphos (0.05%) or dimethoate (0.05%) spraying provides efficient control.

Stem borer: The larva eats through the stem, leaving a dead heart behind. Borer control is aided by applying 0.07% metasystox to the crop.

Ear head caterpillars: At the dough stage, ear head caterpillars grow on the ear and remain there until harvest. The mature seeds are devoured by the caterpillars, which use the grains to create a delicate web. Dust with quinolphos 1.5% or malathion 5% @24 kg/ha provide good control.

Disease management

Blast: Diamond-shaped lesions with a grey centre and a dark

margin appear on the leaf and this condition can damage any part of the plant, including peduncles, grains and leaves. Infected ear head grains become shriveled and low in weight. Applying fungicides like carbendazim @2 g/kg to seeds the day before sowing and spray carbendazim (0.05%) or kitazin (0.1%) at nursery provides efficient control.

Brown spot: Small to medium sized brown to dark spots forms on leaf sheath or leaf. Drought or nutrient deficiency could cause significant damage to the crop through this. Proper nutrition and water control can effectively manage this condition. Mancozeb spraying based on need (0.2%) is also beneficial.

Harvesting and yield

Depending on the tract and variety, the crop develops in 95–110 days (early maturing varieties) and 115–125 days (medium to late

maturing varieties). The straw is chopped close to the ground and the ear heads are picked using conventional sickles. In some rainfed areas, the entire plant including the ear is cut and heaped to dry and then threshed. Grain may be harvested at a rate of 25–30 q/ha, while fodder can be harvested at a rate of 60–70 q/ha. Finger millet straw creates healthy feed and can be preserved by erecting well constructed stakes.

Nutritional importance of finger millet

Compared to other millets, finger millet has higher lysine, threonine and valine. Black finger millet contains 8.71 mg of fatty acids per gram of dry weight and 8.47 g of protein per gram of dry weight. There are 12, 11, and 2% of total dietary fibre (TDF), insoluble dietary fibre (IDF), and soluble dietary fibre (SDF) in finger millet, respectively. According to studies, it contains 3.6% crude fibre and 18.6% dietary fibre. With a total



Finger millet ear head after harvest



Finger millet grains

nursing women who are not producing enough milk.

SUMMARY

Millets, a type of small-seeded cereal grain, are excellent food source because of their higher level of minerals, phytochemicals, dietary fibres, vitamins (B) and carbohydrates. Finger millet is the most promising of the six regularly used millets since it contains significant amounts of calcium, potassium, salt and iron. The positive strength for health benefits in finger millet is the relatively high fibre and slowly absorbed starch. Regular consumption of finger millet lowers the chance of developing heart disease, diabetes and gastrointestinal cancer. It is also recommended for people with celiac disease as a cereal substitute. Therefore, finger millet is recommended to grow in order to get benefit, as it is an important source of nutrients for wider population exclusively pregnant women and children and also to diversify the feeding habits of the people instead only rice and wheat. Even though finger millet is incredibly healthy and nutritious, a high intake may cause the body to produce more oxalic acid. Therefore, it is not advised for those who have kidney stones.

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carotenoids content ranging from 78–366 mg per 100 g, finger millet was discovered to have a higher overall antioxidant capacity. In contrast, the finger millet contains phytates (0.48%), polyphenols, tannins (0.61%), trypsin inhibitory factors, and dietary fibre, which for a long time were considered to be “anti-nutrients” because of their abilities to chelate metals and inhibit enzymes.

Finger millet meets a numerous health benefits due to its extreme nutritional quality. It contains tryptophan that suppresses hunger and is absorbed at a slower rate, which stops one from consuming too many calories. Its fibers also offer a feeling of fullness, which

helps avoid overeating. It is high in calcium, which aids in bone health particularly for developing kids and the elderly. It helps to prevent diseases like osteoporosis and may lower the risk of fractures. The phytochemical in finger millet aid digestion by slowing it down. This aids in the regulation of blood sugar levels in diabetics. The amino acids methionine, lecithin and threonine found in finger millet help to lower cholesterol levels by removing excess fat from the liver. It can help prevent malnutrition, degenerative disorders and premature ageing if consumed consistently. Green ragi is used to treat high blood pressure, liver problems, asthma and heart failure and recommending for

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