

A CASE STUDY :

Unique technique of finger millet production under SRI system for higher yield potential in eastern India

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SUMMARY : Finger millet is a staple food crop in dryland, tribal areas and Diayara areas. It is cultivated both for grains and ‘fodder. SRI principles have been creatively adopted to suit the cultivation practices for finger millet, making it possible to produce 3-4 times more crop yield than with farmers’ traditional practices, without depending on new varieties. It does use small amounts of purchased inputs along with mostly organic inputs. It is cultivated mainly in Asia and Africa. It is staple food crop in many hilly regions of the country and it is grown both for grain and forage. In Northern hills, grains are eaten in the form of chapatias and in South India, grain flour is used for preparing gruel, cakes or unleavened bread, puddings, porridges, sweets etc. Germinating grains are malted and fed to infants and good for pregnant woman. It is considered as nutritive food for adults of different ages. Grains contain 9.2 per cent protein, 1.29 per cent fat, 76.32 per cent carbohydrates, 2.24 per cent minerals 3 per cent ash and 0.33 per cent Ca. It also contains vitamins A and B with small amount of P. It is good for persons suffering from diabetes. Green straw is suitable for making silage.

KEY WORDS :

Unique technique,
 Finger millet
 production, SRI,
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BACKGROUND AND OBJECTIVES

Finger millet is a very hardy crop that grows even in arid regions with minimal water. Finger millet is also available in a range of varieties that can be grown in monsoon-heavy regions to dry areas and in the Himalayas as well, upto an altitude of 2300 meters. Finger millet originated in Africa and has been cultivated for many thousands of years in Uganda and Ethiopia. In India, the crop was probably introduced 4000 years ago, and has been found in archeological excavations in the Harappan civilization. There are also

significant quantities of tryptophan, cystine, methionine and total aromatic amino acids. If that sounds too complicated, all you need to know is that these are considered crucial to human health, and that most cereals are deficient in these components. This high protein content makes finger millet a very important factor in preventing malnutrition. It is also rich in phosphorus, potassium and iron. Calcium is of course an important component in maintaining bone density and health. Thus, finger millet would be a healthier alternative to over-the-counter supplements, especially

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for people who might be at risk of osteoporosis or low hemoglobin levels. Finger millet has also shown promise in accelerating wound healing among diabetics. Finger millet is also rich in antioxidants, which have sort of become a byword in health books today. Antioxidants prevent excessive oxidation (how surprising!), which could otherwise cause cancer and ageing because of cell damage. Considering all these benefits, it is extremely surprising that in a world desperate for health foods and miracle cures, most people have never heard of *Ragi*. In many places where it is grown, it is looked upon as a “poor person’s crop” or a “famine food.” Hopefully, there will be a turnaround in finger millet’s fortunes. Take a look at the recipes below, and if you enjoy them, include more *Ragi* in your diet. That would be one miniscule step in the right direction. Also, Isha Shoppe offers many *Ragi*-based products with home delivery in India.

How to grow nursery? :

Prepare the land thoroughly when dry rendering to a fine tilth. Then, make beds of one metre width with convenient length. Remove the soil from either side of the bed and put in seed bed. The bed automatically gets raised in height. Place wooden planks of bamboo slits all around the bed for support so that the soil will not loosen and get carried away with rain. Soak the seed in water for 12 hours. Put the seed in a wet gunny bag and leave it for 24 hours for incubation. Level the seed bed. Spread a thin layer of well decomposed FYM on the bed. On this layer, broadcast the seed sparsely. See that 1.25 kg seed is sown on 40 m² area. Apply another layer of F.Y.M.

to cover the seeds. Irrigate carefully every morning and evening. Do not apply any agrochemicals to the nursery bed, in 10-12 days, vigorous and healthy seedlings are ready for transplanting.

Field preparation :

Plough the field three times; two of these ploughings should be done within an interval of 8-10 days in between during the nursery preparation. For transplanting mark lines on the field in a square grid pattern, at a distance of 30 cm apart, one direction being perpendicular to the gradient; wooden markers can be used for lines.

Organic manure :

FYM or Compost is applied @10 tonnes/ha. This is quite sufficient as a source of nutrients. As a result, more plant growth is achieved because of better soil health and more balanced nutrient supply. Apply diverse organic manures. Organic manures act as food for micro-organisms.

Varieties :

Short duration varieties :

VR 708, VL 352, GPU 45, RAU 3 and VL 348- (85-95days).

Medium and late maturity varieties :

VL 149, GPU 28, GPU67, GPU85, RAU 8, BM 2 and A404 are most suitable for Bihar region- (100-115 days).

Table 1 : Plant protection

Sr. No.	Name of disease or insect	Symptoms	Control
1.	Blast	Grey-green to yellow lesions are formed on leaf blade grains of infected over heads are shriveled and become light in weight.	Seed treatment with thiram @2.5 g/kg seed. This disease can be controlled by spraying of carbendazim 0.1% Grow resistant varieties like CO RA (14), Paiyur (RA)-2, GPU-28, GPU-45, GPU-48 and L-5
2.	Downy mildew	Plants are stunted and leaves may arise close together in a bunch.	Keep the field free from weeds. Spray dithane M 45 (0.02%) solution on standing crop
3.	Seedling blight	A minute, oval, light brown lesion on the young leaves and become dark brown.	Seeds treatment with captan or thiram @4g/kg seed Spray mancozeb @ 1.25 kg/ha.
4.	Stem borer	Central shoot may die causing “Dead heart”. If it is partial the plants may turn yellow.	Spray carbaryl 50 WP 1 kg per ha. Phosphamidon 85 WSC 0.5 ml/lit or dimethoate 30 EC 1.7ml/lit.
5.	Aphids	Insects suck the sap and reduce the vigour of the plant.	Intercropping with pulses, sorghum, maize, etc. Spray methyl demeton 25 EC@ 20 ml/ha or dimethoate 30 EC@ 20 ml/ha (mixed 10 lit of water using high volume sprayer)

Weeding and aeration :

Use simple mechanical hand weeder (rotary hoe) to churn the soil for weed control. Rotate the weeder at least 2-4 times at 10-12 days after transplanting at 10 days intervals this incorporate the weeds into the soil. Working with rotary weeders helps in greater aeration which results in moreroot growth, reduces weed competition, more oxygen and nitrogen to roots.

Water management :

Water should not be allowed to stagnate under SRI method. Give regular irrigations to keep the soil moist. Alternate 'wetting and drying' should be done which gives aerobic and anaerobic soil conditions for better nutrient mobilization by soil biota.

Benefits of SRI system for finger millet production:

- Higher grain and straw yields,
- Lesser chemical inputs,
- Lesser water requirements,
- Less chaffy grain,
- Grain weight increase without change in grain size,
- Higher head *Ragi* recovery,
- Withstood cyclonic gales,
- Soil health improves through biological activity.

Harvesting and threshing :

It does not mature uniformly and hence harvest is done in two stages. 1st harvest is done when ear head of main shoot and 50 per cent of ear heads turn brown. Cutting and drying the ear heads is done. Then, threshing and cleaning is done. Second harvest is done seven days after first harvest. All the ear heads including green ones are cut with sickles first then the straw is harvested. Curing is done by heaping the harvested ear heads in shade for one day without drying to make greener ear

heads to mature. Then drying, threshing and cleaning are done. Harvested heads are threshed using conventional beating with sticks and treading under the feet of animals. Machine threshing is also common in some areas.

Yield :

With improved package and practices, it is possible to 20-25 quintals of grain and 80-120 quintals of greenfodder per hectare.

Uses of finger millet :

Finger millet is the richest source of calcium and iron among other cereals. Therefore, this can be given as ideal food supplement to growing children and aged people who need calcium supplement.

Bread :

Some finger millet is ground into flour and used for bread and various other baked products. All are relished for their flavour and aroma.

Malt :

Malted finger millet (the sprouted seeds) is produced as a food in a few places. It is nutritious, easily digested, and is recommended particularly for infants and the elderly.

Beverage :

Much finger millet is used to make beer. Its amylase enzymes readily convert starch to sugar.

Fodder :

Finger millet straw makes good fodder better than that from pearl millet, wheat or sorghum. It contains upto 61 per cent total digestible nutrients.

Table 2 : Benefits of SRI system for finger millet production

Sr. No.	Conventional method	SRI method
1.	3-5 kg seed is used per hectare	1.25 kg seed is used per hectare
2.	25 to 30 day old seedlings are transplanted	Only 8-12 day old seedlings are transplanted
3.	Seedlings are pulled with force, roots, washed, bundled, stacked thrown thereby causing lot of trauma and shock to the plants	Seedlings are treated very gently by scooping. No pulling, no washing, no bundling and no stacking.
4.	Planted at random	Planted in square pattern
5.	3 or more plants are planted in clumps	Only one plant is planted per hill
6.	Application of NPK, fertilizers as recommended	Application of organic manures only basal dose of fertilizers at present. No top dressing

Popped products :

Finger millet can be popped. It is widely enjoyed in this tasty form in India. The leaf juice has been given to women in childbirth. Finger millet is a folk remedy for leprosy, liver disease, measles, pleurisy, pneumonia and small pox. Weight conscious individuals can use it. By eating finger millet preparations, the constant desire to eat will be limited, reducing the daily calorie intake.

Source of protein due to high protein content :

The grain's protein content is comparable to that of rice. However, some *Ragi* varieties have shown double that level. More importantly, this protein content is quite unique. The main protein fraction is eleusin, which has a high biological value, meaning that it is easily incorporated into the body. There are also significant quantities of tryptophan, cystine, methionine and total aromatic amino acids. If that sounds too complicated, all you need to know is that these are considered crucial to human health.

Uses as source of minerals :

It is very rich source of minerals. It has been found to have between 5-30 times the calcium content found in other cereals. It is also rich in phosphorus, potassium and iron. Calcium is of course an important component in maintaining bone density and health. Thus, finger millet would be a healthier alternative to over-the-counter supplements, especially for people who might be at risk of osteoporosis or low hemoglobin levels.

Uses for controls diabetes :

The rapid rise in the prevalence of diabetes has led to a great demand for foods containing complex carbohydrates with high dietary fibre levels and beneficial phyto-chemicals. Especially with finger millet, the grain's seed coat is richer in polyphenols as compared to grains such as barley, rice, maize and wheat. For example, it has 40 times the phenolic content of rice and 5 times that of wheat. Among the millets, it is comparable to foxtail millet and second only to kodo millet. Initial studies have also shown that finger millet controls blood glucose levels and hyperglycemic and oxidative stress.

Uses as anti-cancer potential :

Finger millet is also rich in antioxidants, which have sort of become a byword in health books today.

Antioxidants prevent excessive oxidation (how surprising), which could otherwise cause cancer and ageing because of cell damage. The phenolic acids, flavonoids and tannins present in finger millet seed coats have very effective antioxidant properties.

Use for different recipes (*Ragi Ladoo*) method :

In a shallow pan and low heat, dry roast black sesame, groundnuts and grated fresh coconut separately. Keep them aside to cool. Remove the skin from the groundnuts. Add a tsp of ghee to the pan and toast the almonds for a minute or two and keep them aside. Add the *Ragi* flour to the pan along with 2-3 tbsp of ghee and roast for 15-20 minutes. Add more ghee if needed. Add the roasted almonds, groundnuts, coconut and black sesame. Keep stirring add the palm sugar and cardamom powder. Stir for another 2 minutes. Take off the heat and let it cool. Apply ghee onto your palm; take 3-4 tbsp of the mixture and roll into a *Ladoo*. Add more ghee if needed to make a firm, round *Ladoo*.

***Ragi Pakoda*- (Method) :**

Peel and mince the ginger. Coarsely chop the coriander and curry leaves. Mix the veggies and herbs – cabbage, capsicum, ginger, coriander and curry leaves – in a bowl. Mix the dry ingredients – *Ragi* flour, besan, cashew pieces, sesame seeds, salt and black pepper powder/chili powder – in a large mixing bowl. Heat the oil for frying. Add 2 table spoons of this hot oil to the dry mix. Now add the vegetables to the dry ingredients and mix well. Add just enough water to form dough. Make bite-sized *Ragi Pakoda* pieces and fry them in hot oil. Sprinkle with chaat masala before serving.



Ragi Dosa-method :

Heat a tawa and ladle the dosa mix onto the tawa. Gradually spread the mix a thin circle by lifting and rotating the tawa. *Ragi Dosas* are usually difficult to spread with a ladle as they tend to tear. Grease with some oil on the edges and middle. Flip over to the other side after a few minutes. Transfer to a plate after a few minutes.



Conclusion :

Traditionally, pearl millet is given to infants and young children as a *Ragi* malt because it is easier to digest, though its nutritional value is somewhat

decreased. Considering all these benefits, it is extremely surprising that in a world desperate for health foods and miracle cures, most people have never heard of *Ragi*. In many places where it is grown, it is looked upon as a “poor person’s crop” or a “famine food.” In the United States, it is often used as birdseed. Though it is in decline in Africa, it is still an important crop in the eastern part of the continent, especially among subsistence farmers. But in India, it is greatly neglected and fast disappearing. This, despite the fact that this is a very hardy crop that grows even in arid regions with minimal water. Finger millet is also available in a range of varieties that can be grown in monsoon-heavy regions to dry areas. Hopefully, there will be a turnaround in finger millet’s fortunes. Take a look at the recipes and if you enjoy them, include more *Ragi* in your diet. That would be one miniscule step in the right direction. Also, Isha Shoppe offers many *Ragi*-based products with home delivery in India.

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