



Cultivating Finger Millet with SRI Principles: A Training Manual

**Based on the experiences of farmers affiliated
with the PRADAN rural development program
in Chhattisgarh & Jharkhand States and
with the SRI Consortium, Chhattisgarh, India**

Foreword

PRADAN has been instrumental in introducing SRI methods to small and marginal farmers in the rural poverty pockets of eastern and central regions of India. The focus has been mainly on cereals such as paddy and wheat. Finger millet is one of the important food grains for tribal households in the central region in India.

SRI principles have been creatively adapted to suit the cultivation practices for finger millet, making it possible to produce 3-4 times more crop than with farmers' traditional practices, without depending on new varieties. It does use small amounts of purchased inputs along with mostly organic inputs.

This manual has specific steps for cultivating finger millet with SRI methods. It should be useful for both farmers and village extension workers. It is intended to help small and marginal farmers with limited resources to produce more for themselves with their available resources and to gain more financially.



Differences between SRI and conventional methods for finger millet cultivation

Description	Traditional methods	SRI methods
Seed rate	5 kg	500 g
Priming of seeds and seed treatment	Not done	With jaggery, cow urine, warm water, and vermicompost
Nursery seedbed	Flat bed, no specification	Raised bed, 40 sq m for 1 acre
Planting method	Broadcasting/transplanting	Square transplanting 20-25 DAS in nursery
Plant spacing	Irregular	10" x 10" in square pattern
Weeding and trolling	Not done	15th, 25th and 40th days after planting
Irrigation (in rabi)	2 times	4 times
Branches per plant	1 to 3	8 to 10
Fingers per tiller	3-4	7-8
Stems	Thin	Thick
Roots	Fairly shallow	Deeper, > 1 foot into ground
Yield per acre	0.4 ton	1-1.5 tons
Yield per hectare	1.0 ton	2.5-3/75 tons

Seed selection, priming, and treatment

There is no specific preference for using any particular variety of millet seed, but it is always better to start with newer seeds rather than use older ones.

Various varieties that are being used in the area now are:

- *Early-maturing varieties* – can be used in less-productive soils
- *Birsa Gourav / A404* – an improved variety for better yield (duration 110-115 days)
- *VK 149* – drought- and disease-resistant (duration 95-100 days)

Seeding rate: 300-400 gm per acre; it is recommended to carry out the *priming of seeds*: soaking seeds in water, and then mixing in 2.5-3 gm/kg of Carbendazim (Bavistin) with the seeds, and leaving the mixture for 24 hours

Seed treatment with *Bijamrita* -- A natural solution for effective protection against pest, diseases and fungi: Wrap 5 kg of cow dung in a large cloth and bind it by tape. Put it in 20 liters of water for up to 12 hours. Take one liter of water and add 50 gm of lime to it and let it stabilize overnight. Next morning, squeeze all of the liquid in the bundle of cow dung out of the bundle and into a bucket, compressing it at least thrice, so as to collect a concentration of cow dung. Add a handful of soil to this liquid solution and stir it well. Then add 5 liters of cow urine or human urine to the solution and add the lime water, stirring all together, making what is called *Bijamrita*. Spread this solution on the seeds of any crops, treating these seeds well by hand, drying them well, and using them for sowing. The micro-organisms and nutrients added this way will make the seedlings that emerge more vigorous.



Nursery preparation

Nursery material: Sow the treated seeds in a nursery with planting material as a mixture of sand, soil and compost (1:1:1).

Area of nursery: **40 sq. meters** for every one acre to be cultivated.

Dimensions of the nursery bed: **1 meter** with the length appropriate for the desired nursery area. Bed should be **9 to 12 inches above ground level**.

Timing for sowing nursery: 1st to 3rd week of July.

Sowing of seeds: Put the seeds into nursery soil at a **depth of 1/2 inch**, and keep the spacing about 3 to 4 inches between the seeds.

Care for seeds: Cover the seeds with **vermicompost**, and then sprinkle *Jiwamrita* regularly over the nursery to keep the soil functioning well.

Preparing *Jiwamrita* (**organic manure**): Put 10 liters of water in a barrel and add 5 kg of cow dung and 5 liters of cow urine to the water. Then add: 250 g of jaggery (raw unrefined sugar), 250 g of pulse flour, and a handful of soil from the bund of the field or termite soil; and stir the solution well. Let it ferment for 48 hours in the shade, and it will be ready for use after this. To use, add 1 liter of solution to 20 liters of water at the time of use.

For every 1 acre of land, use 200 liters of this diluted solution.

Field preparation



- ▶ Plough the field 3 times; 2 of these ploughings should be done within an interval of 8-10 days in between during the nursery preparation.



- ▶ Sprinkle *Jiwamrita* over the field to moisten the soil and preserve the organic matter.
- ▶ After ploughing the field, make it level using a wooden leveler.



- ▶ For transplanting, mark lines on the field in a square grid pattern, at a distance of 10 inches apart, one direction being perpendicular to the gradient; wooden markers can be used for lines.



- ▶ When transplanting, the plants should be spaced at a distance of 10 x 10 inches
- ▶ Furrows and ridges can be made on the field's surface with a cycle wheel or hoe.

Transplanting with SRI methods



- 4-5 days before removing plants, spray the nursery with the fungicide Mancozeb 75 % W.P. @ 2 gm / liter
 - Transplant the seedlings from the nursery into the main field when they are only 15-25 days old.
 - Before transplanting, irrigate nursery for approximately 2 hours in advance, to moisten and loosen the soil for removing the plants easily if the soil is dry in that time.
 - Carefully uproot the seedlings, keeping the soil intact around the roots; if possible lift them out with a trowel or spade as this gives support to the soil and helps to keep it intact with the roots.
 - Transfer the uprooted seedlings to the main plot within the next 30 minutes, before the roots and soil can dry out. The spacing will be 10x10 inches by using a rope or a marker.
 - Transplant the seedlings at a shallow depth in the pits; do not press or injure the roots while placing the seedlings at the intersection of planting lines.
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Weeding and trolling



- ▶ Remove any weeds by hoeing with a cycle hoe or with a hand weeder in between the rows. This removes unwanted weeds and also aerates the soil, helping the plants to grow faster. This should be done 3 times at intervals of 10-15 days.
- ▶ Sprinkle *Jiwamrita* after weeding; mix 1 liter of *Jiwamrita* preparation with 10 liters of water, instead of using undiluted solution.
- ▶ After weeding, pull a straight round pole or bamboo over the plants, bending them over gently. This gentle 'trolling,' by bending the plants over at the base, will stimulate the growth of more tillers & roots from the plant.

Manure and fertilizers



Cow dung manure or compost: 2 tons/acre applied 15-20 days before July transplanting

Chemical fertilizer – apply N:P:K (24:20:12) @ urea 36 kg, DAP 43 kg and MOP 20 kg per acre

- Before preparing furrow and ridge: 12 kg urea + 21.5 kg DAP + 10 kg MOP
- 15-20 days after transplantation -- during 1st weeding: 12 kg urea + 21.5 kg DAP
- 35-40 days after transplantation -- during 3rd (last) weeding: 12 kg urea + 10 kg MOP

Micronutrients: magnesium (20 kg per acre) and calcium (6 kg per acre) or dolomite limestone (40 kg per acre). Apply these micronutrients 20-25 days before transplantation in the field, or 25-30 days after transplantation by sprinkling.

Finger Millet: Improved variety (A404) in center and local variety on right, both grown with traditional management; on left, A404 with SRI management



Pest and disease management using chemical methods



▶ Blast

- ▶ Seed treatment, mixing 2.5 gm/kg of *Carbendazim* (Bavistin) for at least 30 minutes.



▶ Seedling blight

- ▶ Spray *Mancozeb* 75 % W.P. @ 2 gm per liter in the nursery 15 days before sowing, or 15 days after transplantation.



▶ Downy mildew

- ▶ Spray the crop with *Mancozeb* 75 % W.P. @ 2 gm per liter of water at the onset of the disease, or when symptoms are seen in 5-10% of the plants.



▶ Stem borer

- ▶ Use *Regent* granules or its liquid form in the amount of 7 kg/acre. 1 ml of the chemical should be mixed with 2 liters of water.
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Non-chemical pest and disease management

- ▶ **Neem Solution** -- for sucking pests & mealy bug

Add 100 liters of water to a large container along with 5 liters of cow urine. Add also 5 kg of cow dung to this. Crush 5 kg of neem leaves, making a pulp from them, and add this into the pot. Stir the solution and let it stabilize for 24 hours. Stir this solution twice a day by any stick. Filter the liquid through a cloth and spray the filtered liquid (100 ml added to 5 liters of water) for controlling the above pests.

- ▶ **Multi-Purpose Solution** -- for sucking pests, pod borers, fruit borers, etc.

In a pot, add 10 liters of cow urine in it. Crush 3 kg of neem leaves, making a pulp, and add this into the pot. Then add the following tree or plant leaves, ground into a pulp: 2 kg of custard apple leaves, 2 kg of papaya leaves, 2 kg of pomegranate leaves, 2 kg of guava leaves, 2 kg of *Lantana camara* leaves, and 2 Kg *Datura stramonium* leaves (use *Lantana camara* and *Datura* leaves if available). Boil the mixture until it is 1/5th of previous amount. When it is cooled, leave it for 24 hours. Filter the liquid through a clean cloth. Spray the filtered liquid (100 ml in 5 liters of water) for controlling the above pests.

Non-chemical pest and disease management

- ▶ **Fiery Solution** -- for leaf roller, stem borer, fruit borer, and pod borer
 - ▶ Put 10 liters of cow urine in a pot and add 1 kg of tobacco by crushing it in the urine. Add 500 gm of green chilies and garlics separately. Further, add 5 kg of neem leaf (*Azadirachta indica*) to the mixture.
 - ▶ Boil the mixture until it is only 1/5th of the previous amount. When it is cooled, leave it for 24 hours.
 - ▶ Filter the liquid through a clean cloth.
 - ▶ Spray the filtered liquid (100 ml added to 5 liters of water) for controlling the above pests.



Non-chemical pest and disease management

- ▶ Ingredients for **pot solution** -- for controlling borer pests, fungi, and flies

Sl.No	Items	Amount
1.	Cow dung (deshi cow)	1 kg
2.	Cow urine	2 liters
3.	Neem (<i>Azadiracta indica</i>)	1 kg
4.	Akanda (<i>Calotropis zygantia</i>)	1 kg
5.	Karanja (<i>Pongamea pinnata</i>)	1 kg
6.	Jaggery / molasses	50 gm
7.	Plus a handful of termite soil	-

Process of preparation for pot solution

- ▶ Mix all the ingredients in an earthen pot, then cover it with a jute cloth and keep it in a dark place for 7 days.
- ▶ Extract the liquid from the pot after 7 days and dilute it with water.
- ▶ Use 15 ml of the extract per liter of water for mature plants, and 25 ml per liter of water for small plants.
- ▶ On every 7th day thereafter, keep adding 2 liters of cow urine to the leftover solid material in the earthen pot, to be able to use it over the period of next 6 months.
- ▶ This solution is very effective against borers, flies and contact fungus.





Comparison of representative panicles:
SFMI on left and conventional management on right

Expected results

- ▶ SRI-Milletts can give yields of 3-4 tons/ha whereas the yield with traditional farmer practices is only 0.75-1 ton/ha.
- ▶ Thus by using of SRI principles with finger millets, farmers can easily double their yield.
- ▶ With good use of the methods, even more increase is possible.



Cost-benefit analysis for cultivation of millet for one acre (in INR)

			Traditional methods		SRI methods	
Components	Unit	Price per unit	No. of units	Cost	No. of units	Cost
Seed(if purchased)	Kg	30	5	150	0.5	15
Priming of seeds and seed treatment						
Materials (jaggery, cow urine, warm water, vermicompost)	Lump sum	30	0	0	1	30
Labor	PH	16.5	0	0	1	16.5
Nursery preparation	PD	132	0	0	0.5	66
Seeds and nursery preparation				150		127.5
Ploughing for field preparation (rent for plough and buffalo)	Rent per unit	400	2	800	2	800
Labor	PD	132	2	264	2	264
Marking & transplantation	PD	132	1.5	198	3	396
Field preparation				1,262		1,460
DAP	kg	15	43	645	43	645
MOP	kg	10	20	200	20	200
Urea	kg	10	36	360	36	360
FYM	kg	3	1,000	3,000	2,000	6,000
<i>Jiwamrita</i>	kg	5	0	0	10	50
Nutrient inputs				4,205		7,255
Irrigation applications (in rabi)	number	200	2	400	4	800
Labor	PD	132	3	396	6	792
Irrigation costs				796		1,592

Cost-benefit analysis (continued)			Traditional methods		SRI methods	
Components	Unit	Price per unit	No. of units	Cost	No. of units	Cost
Weeding and trolling	Per day	132	15	1,980	8	1,056
Weed control	Total			1,980		1,056
Plant protection						
Chemical and pesticides	Lump sum	200	1	200	1	200
Labor	Per day	132	1	132	1	132
Rent of sprayer	Lump sum	100	1	100	1	100
Crop protection costs	Total			432		432
Harvesting	Per day	132	13.5	1,782	6	792
Threshing and packaging	Per day	132	13.5	1,782	20	2,640
Harvesting costs	Total			3,564		3,432
Total operational costs	Total			12,389		15,355
Management costs (10% of total)	Lump sum			1,239		1,535
Total cost of production	INR			13,628		16,890
Value of production	INR	20/kg	400	8,000	1,250	25,000
Net profit	INR			-5,628		8,110
Production cost per kg of grain	INR			34.07		13.51



