Promotion of SRI-Millet with Small and Marginal Farmers in Chhattisgarh: A Practitioner's Manual

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Increasing the production of millet by using the SRI-millet method may prove to be one of the significant ways to address the poverty and food insufficiency problem in several tribal areas of Chhattisgarh

Chhattisgarh, once a part of Madhya Pradesh, became a separate state of India in 2001 so that it received a greater stimulus for development. Poor tribal communities make up 60 per cent of the rural population in the state. The major sources of livelihood of the people in the area are agriculture, forestry (timber and non-timber products), and livestock. The average landholding per family is very small—only 1–2 hectares (ha), almost all rain-fed, with no irrigation. Households usually have five or six members. Most of the cultivated land is mono-cropped with paddy, with a current average productivity of 2.2 MT/ha. Finger millet is the second major food grain crop in large parts of this state. However, because of the low average productivity of millet, (one tonne/ha), the area under millet cultivation has been decreasing gradually.

Tribal households, especially those that are referred to as the Primitive Tribal Groups (PTGs—Pahari Korbas), continue to cultivate millet as a main crop—they consume millet as a food grain as well as a liquid mixture, locally called *pej*. Considered 'minor' by most agriculturalists, millet has some important uses in the life cycle of PTGs. They use this grain as an essential part of a woman's diet in the advanced stages of pregnancy, because of its high nutritional value. The *roti* (bread) made from millet is slow to digest and it is believed 'stays in the stomach for longer time,' helping nourish hungry people longer and better. Millet is also usually kept in reserve for the lean period when rice stocks start to diminish.

Under the FRA (Forest Rights Act), the tribes who live near forests were given ownership of the land, which unfortunately is of very poor quality. The cultivation of millet, therefore, is a preferred option for PTGs because this crop shows a greater resilience to rainfall variations. Moreover, the prices for millet have gone up four-fold in the last decade, making it a more paying crop. The rise is apparently driven by a demand for millet as an ingredient in poultry feed, for use in the beverage industry and as a nutritious component in the diet for city-dwellers, who are suffering from lifestyle diseases such as diabetes and obesity.

In Chhattisgarh, 13 NGOs (PRADAN plus 12 partners) have formed a state consortium to promote the System of Rice Intensification (SRI). Till 2012, the consortium has covered nearly 11,000 families, mainly through SRI-paddy. Along with paddy, however, for the last three years the consortium has introduced the SRI method of cultivation for crops such as millet, wheat, mustard and vegetables. In the *rabi* season of 2011–12, the consortium received some significant results with SRI-millet, according to the categories of yield.

Productivity (MT/ha)	No. of farmers	Percentage
4–6 MT	13	18.3
2–4 MT	58	81.7
< 2 MT	00	0
Total	71	100

The average productivity of SRI-millet of these 71 farmers was 3.36MT/ha, more than three times the state's average yield. In the last several years, we have seen SRI-millet yields ranging from 2.5–3.5 MT/ha. Motivated by these results, the consortium plans to promote the SRI method for millet with about 500 families in the state during the ongoing *kharif* season. Along with this, the consortium has extended a hand to help partner NGOs and the farmers they work with in Orissa, to promote SRI-millet in Koraput and Raygada districts. Because of the positive experience, SFMI is inviting demonstrations by PRADAN teams in Koraput and Raygada in Orissa.

PACKAGE OF PRACTICES

The following practices, using the farmers' own locally available seeds, have been applied to achieve the results mentioned here.

1. Seed selection, priming and treatment

There is no preference for any variety of millet seed; however, it is always better to start with newer seeds, rather than use older ones. Some varieties that are used in the area are:

- Birsa Gourav/A404 for better yield (duration 110–115 days)
- VK 149, drought and disease-resistant (duration 95–100 days)

a. **Seeding rate:** 300–400 gm per acre, with a recommendation to prime the seeds. Soak the seeds in water; then mix 2.5 to 3 gm/kg of Carbendazim (Bavistin) with the seeds and leave the mixture for 24 hours.

b. **Seed treatment with *Bijamrita*,** a natural solution for effective protection against pests, diseases and fungi. Wrap 5 kg of cow dung in a large cloth and bind it with tape. Put it in 20 litres of water for up to 12 hours. Take one litre of water and add 50 gm of lime to it and let it stabilize overnight. The next morning, squeeze out all the liquid in cow dung 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 five litres of cow urine or human urine to the solution and add the lime water, stirring all these, making what is called bijamrita. Spread this solution on to the seeds treating the seeds well by hand and drying them well, and they are ready for sowing. The micro-organisms and nutrients added this way will make the seedlings that emerge more vigorous.

2. Nursery preparation

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

b. **Area of nursery for cultivating one acre:** 40 sq m.

c. **Dimensions of the nursery bed:** 1 m, with an appropriate length. The bed should be 9–12 inches above the ground level.

d. **Timing for sowing the nursery:** First to third week of July.

e. **Sowing of seeds:** Put the seeds at a depth of half an inch and keep a spacing of about three to four inches between the seeds.

f. **Care for seeds:** Cover the seeds with vermicompost and then sprinkle *Jiwamrita* (organic manure) evenly over the nursery.

g. **Preparing Jiwamrita:** Put 10 litres of water in a barrel. Add 5 kg of cow dung and 5 litres of cow urine to the water. Then add: 250 gm of jaggery (raw unrefined sugar), 250 gm of pulses 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, after which it is ready for use. To use, add one litre of solution to 20 litres of water. For one acre of land, use 200 litres of solution.

3. Field preparation

a. Plough the field three times: Two of these should be done within an interval of 8–10 days, during the nursery preparation.

b. Sprinkle *Jiwamrita* over the field, to moisten the soil and preserve the organic matter.

c. After ploughing, level the field with a wooden leveller.

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

e. In transplantation, the plants should be spaced at a distance of 10 x 10 inches.

f. Furrows and ridges can be made on the field's surface with a cycle wheel or hoe.

4. Transplanting using the SRI method

a. Spray the nursery with a fungicide Mancozeb 75 per cent W.P. @ 2 gm per litre, four to five days before removing the plants.

b. Transplant the seedlings from the nursery into the main field when 15–25 days old.

c. Before transplanting, irrigate the nursery approximately two hours in advance, to moisten and loosen the soil. This makes the removing of plants easier, in case the soil is dry at that time.

d. Carefully uproot the seedlings, keeping the soil around the roots intact; if possible, lift out with a trowel or spade because that gives support to the soil and keeps it attached to the roots.

e. Transfer the uprooted seedlings to the main plot within 30 minutes before the roots and soil dry out. The spacing should be 10 x 10 inches. Use a rope to measure.

f. Transplant the seedlings at a shallow depth in the pits; do not press or injure the roots when placing the seedlings at the intersection of the planting lines.

5. Weeding and trolling

a. Remove any weeds by hoeing with a cycle hoe or with a hand weeder between the rows. This removes unwanted weeds and also aerates the soil, helping the plants to grow faster. This should be done three times at intervals of 10–15 days.

b. Sprinkle *Jiwamrita* after weeding; mix 1

litre of *Jiwamrita* with 10 litres of water, instead of using the plain solution.

c. After weeding, move 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 from the plant.

6. Manure and fertilizers

a. Cow dung manure or compost: Two tonnes per acre applied 15–20 days before the July transplanting.

b. Chemical fertilizer: N : P : K (24 : 20 : 12) Quantity per acre: urea 36 kg, DAP 43 kg, MOP 20 kg

- Before preparing the furrow and ridge: apply 12 kg of urea, 21.5 kg of DAP and 10 kg of MOP
- 15–20 days after the transplantation, during the first weeding: apply 12 kg of urea and 21.5 kg of DAP
- 35–40 days after the transplantation during the third (last) weeding: apply 12 kg of urea and 10 kg of MOP

c. 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 the transplantation in the field, or 25—30 days after the transplantation by sprinkling.

7. Pest and disease management using chemical methods

a. Blast

a. Seed treatment: Mix 2.5 gm per kg of carbendazim (Bavistin) for at least 30 minutes.

b. Seedling blight

a. Spray mancozeb 75 per cent W.P. @ 2 gm per litre, in the nursery, 15 days before sowing or 15 days after transplantation.

c. Downy mildew

a. Spray the crop with mancozeb 75 per cent W.P. @ 2 gm per litre of water at the onset of the disease or when the symptoms are seen in 5–10 per cent of the plants.

d. Stem borer

a. Use Regent—either granules or liquid in the amount of 7 kg per acre. 1 ml of the chemical should be mixed with 2 litres of water.

8. Non-chemical pest and disease management

a. Neem solution (for sucking pests and mealy bug):

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

b. Multi-purpose solution (for sucking pests, pod borers, fruit borers, etc.):

In a pot, put 10 litres of cow urine. Crush 3 kg of neem leaves, make a pulp and add 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 of Datura stramonium leaves (use Lantana camara and Datura leaves if available). Boil the mixture until it is one-fifth of the original amount. Cool and leave for 24 hours. Filter the liquid through a clean cloth. Spray the filtered liquid (100 ml in 5 litres of water) for controlling the above pests.

Fiery Solution (for leaf roller, stem borer, fruit borer, and pod borer):

- Put 10 litres 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 garlic separately. Further, add 5 kg of neem leaf (azadirachta indica) to the mixture.
- Boil the mixture until it is one-fifth of the original amount. Cool and leave for 24 hours. Filter the liquid through a clean cloth. Spray the filtered liquid (100 ml added to 5 litres of water) for controlling the above pests.

c. Ingredients for pot solution (for controlling borer pests, fungi and flies):

Table 2: Proportions of Natural Fertilizers

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

e. Process of preparation: Mix all the ingredients in an earthen pot, tie the lid with a sack and keep in a dark place for seven days. Extract the liquid from the pot after seven days and dilute it with water. Use 15 ml of the preparation per litre of water for mature plants and 25 ml per litre of water for small plants. Add urine to the same solid materials every seven days for the next six months. This preparation is very effective against borers, flies and contact fungus.

9. Expected yields

a. SRI-millet can give yields of 3–4 tonnes per ha, whereas the yield with the traditional practices is only 0.75-1 tonne per ha.

b. Thus, by using the SRI principles with finger millet, the farmers can easily double their yield.

c. A greater increase is possible if the methods are used well.

Table 3: Cost Estimates for the Cultivation of Millet

			Traditional Method		SRI Method	
Components	Unit	Price Per Unit (Rs)	No. of Units	Cost (Rs)	No. of Units	Cost (Rs)
Seed (if purchased)	Kilogram	30	5	150	0.5	15
Priming of seeds and seed treatment						

			Traditional Method		SRI Method	
Components	**Unit**	**Price Per Unit (Rs)**	**No. of Units**	**Cost (Rs)**	**No. of Units**	**Cost (Rs)**
Material (jaggery, cow urine, warm water, vermicompost)	Lump sum	30	0	0	1	30
Labour	PH	16.5	0	0	1	16.5
Nursery preparation	PD	132	0	0	0.5	66
SEED AND NURSERY PREPARATION				**150**		**127.5**
Ploughing for field preparation (rent for plough and buffalo)	Rent per unit	400	2	800	2	800
Labour	PD	132	2	264	2	264
Marking and transplantation	PD	132	1.5	198	3	396
FIELD PREPARATION				**1,262**		**1,460**
DAP	Kilogram	15	43	645	43	645
MOP	Kilogram	10	20	200	20	200
Urea	Kilogram	10	36	360	36	360
FYM	Kilogram	3	1000	3000	2000	6000
Jiwamrita	Kilogram	5	0	0	10	50
NUTRIENT INPUTS				**4,205**		**7,255**
Irrigation applications (in *rabi*)	Number	200	2	400	4	800
Labour	PD	132	3	396	6	792
IRRIGATION COSTS				**796**		**1,592**
Weeding and trolling	PD	132	15	1,980	8	1,056
WEED CONTROL				**1,980**		**1,056**
Plant protection						
Chemical and pesticides	Lump sum	200	1	200	1	200
Labour	PD	132	1	132	1	132
Rent of sprayer	Lump sum	100	1	100	1	100

			Traditional Method		SRI Method	
Components	**Unit**	**Price Per Unit (Rs)**	**No. of Units**	**Cost (Rs)**	**No. of Units**	**Cost (Rs)**
CROP PROTECTION COSTS				**432**		**432**
Harvesting	PD	132	13.5	1,782	6	792
Threshing and packaging	PD	132	13.5	1,782	20	2,640
HARVESTING COSTS				**3,564**		**3,432**
TOTAL COSTS				**12,389**		**15,355**
Management costs (10% of total cost)	Lump sum			1,239		1,535
Grand total cost				13,628		16,890
Production revenue						
Yield	Kilogram	20	400	8,000	1,250	25,000
Profit	INR			–5,628		8,110
Production cost per kg of grain				34.07		13.51

Table 4: Differences between SRI and conventional methods for finger millet cultivation

Description	Traditional Method	SRI Method
Seed rate	5 kg	500 gm
Priming of seeds and seed treatment	Not done	With jaggery, cow urine, warm water and vermi-compost
Seed bed	Flat bed no specification	40 sq m for one acre, raised bed
Planting method in nursery	Broadcasting/Transplant	Square transplanting 20–25 DAS
Plant spacing	Irregular	10 x 10" between plants and rows
Weeding and trolling	Not done	On 15th, 25th and 40th days after planting and trolling in first and second time
Irrigation (in *rabi*)	2 times	4 times
Branches per plant	1 to 3	8 to 10
Finger per tiller	3–4	7–8
Stems	Thin	Thick

Description	Traditional Method	SRI Method
Roots	Fairly shallow	Deeper, below one foot in the ground
Yield per acre	0.4 tonne	1–1.5 tonnes
Yield per hectare	1.0 tonne	2.5–3/75 tonnes

CONCLUSION

With the experiment of SFMI, the food security issue of a very vulnerable community that has a very small quantity of paddy or vegetable land has been met. The Pahari Korbas are a millet-eating people. The intensification technique in finger millet, therefore, directly addresses their food sufficiency. In most of the cases, has been used for millet cultivation. So the poor people with the most low quality land, who are at the bottom of the pyramid, can easily be helped by the intensification technique of millet cultivation.