

SRI

THE SYSTEM OF RICE INTENSIFICATION

Achieving More with Less: A NEW WAY OF RICE CULTIVATION



A Manual for Facilitators



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OVERVIEW

The idea of a Facilitators Guide for SRI (System of Rice Intensification) stems from the CRS training workshop of their Rice Value Chain staff on SRI at the Mendesora Village in Koya Chiefdom, Port Loko District.

CRS is implementing a rice value chain project in Koinadugu (Integrating Savings and Agriculture Development II) which focuses on addressing the major bottlenecks in rice production among smallholder farmers in Koinadugu from production through marketing. In a bid to ameliorate the constraints associated with rice production, the project is promoting the use of the System of Rice Intensification (SRI) techniques in rice production among the target beneficiaries in Sulima and Diang Chiefdoms through the Farmer Field Schools approach. Consistently, the project has hired two field staff and a Project Manager for implementing project activities in the target communities. The training on SRI is therefore eminent to augment the staff's capacity in this direction and to subsequently deliver their services to the target beneficiaries.

This Manual - A "How to" Guide for Facilitators in SRI, is intended to assist Facilitators in taking farmers through the SRI method of rice cultivation using the Farmer Field School approach. The training should be divided into three phases with some practical sessions well-integrated depending if the swamp development activities have been carried out with a focus on SRI methodology. The first phase of the training should deal with the following topics in the first four chapters and the second phase will deal with the fifth and sixth chapters and the third will deal with seventh, eight and ninth chapters.

The Guide is also fully illustrative with pictures depicting the different activities to be carried out at every stage and will help the Facilitator to implement the different activities in the best way possible also taking into account the local context. The step by step guide should be used alongside this Manual.

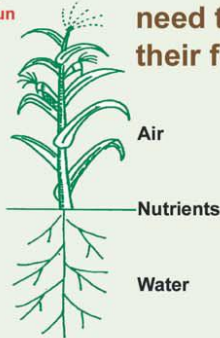
Years of experience suggests that learning and innovation may be the key to designing such developmental initiatives. Understanding isolated communities, their ability to play with the changing world conditions, their changing needs and the like require continuous learning

and sharing at all levels in the development space. From donors and governments to researchers, field workers and community members, all need to learn from each other's experiences to make a real dent at poverty.

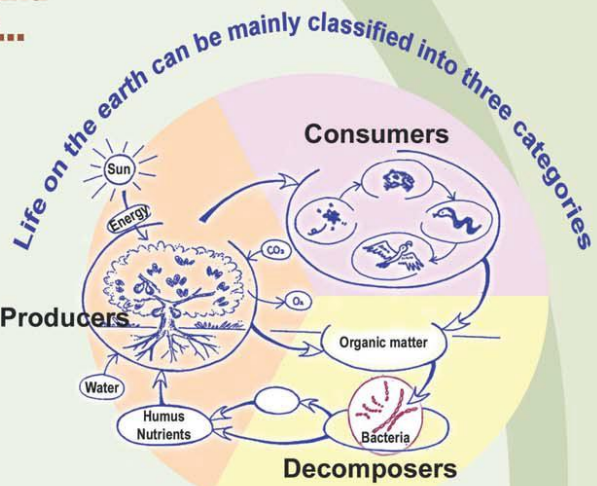
FULL POTENTIALITIES

How to use the potential and full capabilities of a plant...

In Nature plants are the only beings that can prepare their own food



What do plants need to prepare their food?



A plant that can produce its own food is made dependent on chemical fertilisers and pesticides.

Is this the right way of agriculture?



Is this not one of the reasons for farmers becoming indebted?



If a plant has to fully utilize its potentiality...

- * The feeder roots that take in water and nutrients should be healthy and widespread
- * The soil should be fertile and alive with several micro-organisms
- * The plant should be healthy and strong

SRI method of cultivation helps in achieving the above objectives. This method can be followed in crops such as paddy, finger millet (ragi), sugarcane and others. Let us explore the SRI method of practices in paddy cultivation



1. Meaning of SRI Methods

To achieve higher productivity in Rice:



- ❖ A plant should have more number of tillers
- ❖ The number of effective tillers should be higher
- ❖ The number of grains on a panicle should be higher
- ❖ The grain weight should be more,
- ❖ The roots should have extensive and healthy growth

SRI Method of Rice cultivation helps us achieving the above.

The objective of this Guide is to give the opportunities and principles behind the above aspect.



SRI Practices collated in this Guide are based on farmers' practices and their experiences. As innovation and local adoption is the hallmark of SRI, farmers should further refine these practices according to their local situation.

SRI is an acronym for the system of rice intensification. This improved method of rice cultivation was developed in 1983 in Madagascar and has now spread to many parts of the world.

SRI is neither a new variety nor a hybrid

SRI is only a method of rice cultivation

Any rice variety can be cultivated by this method



There is a notion that what has been done in research plots and by scientists is modern and desirable. However, it is farmers who played a key role in designing and developing SRI method of cultivation practices. **Thus every farmer has to be a scientist and an experimenter.** Farmer should not blindly follow what is suggested by others. One has to understand the principles behind it and decide upon what to do base on the local situation and available resources.

This is the key aspect in SRI method of cultivation. SRI is based on the principle of developing healthy, large and deep root systems that can better resist drought, water logging and wind damage. It consists of six key elements to better manage inputs, utilize new

1. Meaning of SRI Methods

ways of transplanting seedlings, and to manage water and fertilizer application. Reports from thousands of SRI farmers around the world indicate that SRI plants

develop stronger root and stalks and more tillers with higher yields and even better flavour quality.

2. Selection of suitable soils

What are suitable soils?

- * Soils that are not affected by salinity
- * Level fields that is convenient to irrigate and drain
- * Fertile soils

Farmers who want to cultivate paddy by SRI method:

- * Should level their plots
- * Should plan for drainage channels, if needed
- * Should make plots of small sizes

2.1 Saline Soils

Saline or alkali soils are not suitable for SRI cultivation. In saline soils paddy yields would be satisfactory when it is cultivated under flooded conditions. But in SRI method the field is drained intermittently. When soil is allowed to dry the salts accumulate in the surface resulting in damage to the rice plant.

2.2 Level plots

Land selected for SRI method should be levelled. When the plot is irrigated the water should spread uniformly across the field. Similarly, whenever needed, there should be provision to drain the excess water.

2.3 Fertile soils

SRI method of cultivation responds better to organic manures rather than chemical fertilisers. The organic matter is the food for the soil microorganisms. When the soil is alive with microorganisms then the nutrients needed for the plant would be in readily available form. This means that rather than cultivated for about 45 days and it takes another 10 days to get decomposed into organic matter. Sow the paddy nursery on the day of incorporating the green manure crop into the soil. By the time the green manure crop gets decomposed the nursery would be

ready for transplantation. Ensuring water for the nutrients in the soil the form in which they are present is more important.

When soil is rich with microorganisms then the plant grows healthily, develops resistance to pests and diseases and yields higher. Thus, methods of improving the soil fertility should be taken up right from the beginning. At least two methods from the following should be practiced every year.

Application of tank silt

Tank silt should be applied at the rate of 15-20 cartloads per acre (40-50 tons/ha). This improves the moisture holding capacity of the soil, which in turn results in better yields.



Farm Yard Manure (FYM)

Application of well decomposed FYM/ compost is a must for SRI method of cultivation. At least 15 cartloads or 3 tractor loads (6tons) of FYM/ compost should be applied per every acre. FYM should be of very good quality. Of late preparation and use of Vermin compost is gaining popularity.

Green manure crop

Green manure crops helps in significantly improving the soil fertility. Green manure crops cultivated up to 50% flowering stage and ploughed back into the soil. Sunn hemp and Sesbania are the common green manure crops. Green manure crop is raising and decomposing and the time period are essential for the green manure crop.

2. Selection of suitable soils



Livestock Penning

This is a traditional practice in which cattle, goats and sheep are flocked in the field during

the night. The soil gets enriched with the dung and urine of the animals.



3. Six Attributes in SRI method that help in achieving higher productivity

1. **Wide planting:**

With wide spacing each plant gets more space, air and sunlight. As a result each plant gives more tillers. The roots would grow healthily and extensively and take in more nutrients. As the plant is strong and healthy the number of tillers would be more. The panicle length would be more. The panicle has more number of grains and the grain weight would also be more.



2. **Less seed:**

As wide spacing is adopted the seed required would be less. This result in the advantages mentioned above. Further, it is easy to use and produce quality seeds.



3. **Transplanting young seedlings:**

The seedlings should be transplanted when it is in 2 leaf stage. When the seedling is transplanted carefully in this stage it grows healthily and generates more number of tillers. It can achieve the potential of giving higher yield.



4. **Less water:**

When the water is stagnating in the field the roots die due to lack of air. The dead roots are brown/ rusty in colour. The soil should have soil particles, air and moisture in equal proportions. The rice plant can survive even when there is standing water. But, for a healthy paddy plant water should not be in Stagnated situation in the field. When irrigation is provided intermittently the roots are aerated and grow healthily.



5. **Turning back the weeds into the soil:**

Instead of weeding and throwing the weeds outside the plot there are several advantages of turning the weeds into the soil by using a 'weeder'. These include soil aeration and then the decomposition of the weeds into the soil which will in turn add to the organic matter content into the soil leading to the healthy growth of the rice plant and subsequently leading to higher yields.

3. Six Attributes in SRI method that help in achieving higher productivity



6. *Use of organic manures:*

Organic matter is the food for life forms teeming in the soil. When organic matter is

added the microorganisms in the soil multiply manifold. The microorganisms bring nutrients into available form and are made available to them as and when they are needed.



4. Raising Nursery

In SRI method, utmost care should be taken in the preparation of nursery bed, as 8-12 days old seedlings are transplanted.



4.1 Bed Preparation

The bed should be 4 feet wide. The length can vary depending on the need and space available. Two kgs seed would be needed for transplanting in one acre. For raising this, a nursery bed of 400 sq.ft. would be required. Depending upon the convenience a single bed or several smaller beds (say, 4 beds of 4 x 25 feet) can be prepared. As the roots of 8-12 day old seedling would grow up to 3 inches, it is necessary to prepare raised beds of 5-6 inches. Nursery bed is prepared in this manner:

1st layer: 1 inch thick well decomposed FYM

2nd layer: 1 ½ inch soil

3rd layer: 1 inch thick well decomposed FYM

4th layer: 2 ½ inch soil

All these layers should be thoroughly mixed. Make a channel around the nursery bed to prevent the wet soil dropping down. The bed should be made secure on all sides with wooden planks, bamboos or any other suitable material.

4.2 Seed soaking and broadcasting

Using pre-soaked and germinated seeds is one of the methods in raising nursery. There are also other methods of raising nursery. Here let us learn about the process of pre-soaking and germinating seeds before sowing them in the nursery.



4.3 Germinating the seeds:

Soak the rice seed for 12 hours. Transfer the soaked seed into a gunny bag or make a heap and cover it with gunny cloth. Leave it for 24 hours. At this time the seed germinates. You can observe the white root or radicle emerges from the seed. This seed is used for sowing on the nursery bed. If sowing is delayed, the roots grow and get matted together making it difficult to sow the seeds with wider spacing.



Transporting the uprooted seedlings to the main field:

Transporting the young seedlings to the main field is a major problem in that this is done when the seedlings are between 8-12 days old. The means to overcome this problem are:

- * Take up nursery raising near to the main field.
- * For every acre have one nursery of 400 sq.ft. either in the centre or on one side of the field
- * Raise nursery in banana trunk or plastic trays
- * Raise nursery in 'mat' method

4. Raising Nursery

4.4 Broadcasting the seed:

To ensure uniform broadcasting, make the seed into 4 equal parts. Broadcast each part separately one after the other. Two seeds should be separated by a distance of length of one seed. It is better to broadcast the seeds in the evenings.

4.5 Covering the seed:

Cover the seed with a thin layer of well decomposed FYM or dry soil. Even paddy straw can be used for this purpose. The seed is protected from direct sun and rain by this layer. It also protects from being eaten away by birds and ants. When straw is used as a layer it should be removed after the appearance of the shoots.

4.6 Watering the beds:

Depending upon the need, water the bed daily in the morning and evening. The water should be gently sprinkled over the bed. One can use the garden rose can for this purpose. When pots are used for watering, use one hand to break the force of the water. The nursery can be watered by letting in water into the canal surrounding the nursery bed.



4.7 Community nurseries:

Having seedlings ready for transplantation by the time rains are received is an important issue. As less seed is needed and young seedlings of 8-12 days are planted one can plan for community nurseries. Nursery beds can be sown in a staggered manner with 2-3 days interval. This ensures that seedlings are available at different times. This might result in certain wastage of seedlings but the objective of timely transplantation would be achieved.

4.8 Nursery raising by 'mat' method

The nursery is raised on polythene sheet or empty fertiliser bags. A steel or wooden frame with four compartments is used. The dimensions of the frame are 1 x 0.5 metres. Each compartment would measure 0.125 sq. metres. The nursery bed of 4 cm thickness is prepared using well decomposed FYM and soil. Broadcast the seed on the bed and cover it with mud. After watering the nursery bed, the frame can be removed and reused. For the first 5 days the beds are watered using rose can 2-3 times, every day depending on the need.



5. Preparation of the Main Field

Preparation of the main field in SRI is the same as in conventional method. However it is ideal that the field is dry, ploughed and puddling by tractor is avoided. Particularly in black soils, the field should be ploughed and kept ready during summer itself. The field should be watered and transplanted. This way it would be easy to operate the weeder later. As puddling by tractor is not done the weeder would not get stuck and less energy would be sufficient to run the weeder. The field should be level and there should be no standing water while transplanting.



If the plots are small and levelled, water management becomes easy. If needed, canals should be prepared for irrigating and draining the SRI plots.

Wide spacing

Wide spacing is important in SRI method. The row to row distance and within a row plant to plant distance should be 16 x 16 inches (40 x 40 cm). With this spacing there would be 20 plants per square metre in SRI method. If there is any doubt regarding the survival of plant then two plants can be transplanted per hill. In the conventional method 33-40 hills are transplanted per square metre with 4-5 plants per hill.

What spacing to be followed

We have seen that with wider spacing the plant grows healthily and yields better. It was also recommended that 40 x 40 cm. spacing should be followed in SRI method. However, there are several farmers who have experimented with 50 x 50 cm. and 1 x 1 metre spacing and Obtained good yield

Use of Marker

There are several ways by which to transplant at 10 x 10 inches spacing. Take a rope and tie a knot or a stick at every 10 inches.

Using this rope as guide, transplant one row after the other. However, markers are available to help transplanting at 40 x 40 inches spacing. There are markers made out of wood as well as iron. There are bar markers which have to be drawn either way to form a grid and roller markers which would form grids at one go.

The rice seedling has to be transplanted where the vertical and horizontal lines meet. The roller marker gives 8 grids at a time.

For the rows to be straight it is ideal that a rope is tied along the length of the field and the marker is drawn along the rope. After pulling the marker once, i.e. for every 2 metres it is ideal to leave 12-13 inches path. Tie a rope as guide and draw the marker again along the rope.

Problems with markers

- * In roller marker, instead of the roller rotating it gets dragged on the field
- * Whenever there is an obstruction like stone, stubble or stem the roller marker jumps and the grids are not formed
- * After cultivating and incorporating the green manure crop it is difficult to form lines with a marker

5. Preparation of the Main Field

Different types of markers

Farmers have prepared different types of markers using rope, wood and iron. There are markers with 4 rows and super markers with 16 rows. Farmers have designed the roller marker. In the roller marker the horizontal and vertical lines are formed by pulling it, thus forming grids.



Wooden Marker



Roller Marker



Super Marker

Leaving pathways

Farmers are advised to leave paths for every 2 metres. Farmers have adopted this practice. However, the farmers first transplant the entire field. Paths are made later by tying a rope at ever 2 metres; the plants on both the sides are uprooted and retransplanted away from the path. These paths result in good aeration of the paddy fields. As a result the pest and disease intensity gets reduced. Normally we observe that the plants along the bunds and paths growing healthily. In rice fields the plants along these pathways also grow healthily. These paths are also useful for observation and intercultural operations. However, as wide spacing is used in SRI method some farmers are avoiding these paths.

For smooth transplantation, field operations like cleaning of bunds, levelling and marking should be completed a day before transplantation.

6. Transplantation

Young, 8-12 days old seedlings are transplanted in SRI method. The nursery should be raised with utmost care. Similarly, care should be taken in transplanting the seedlings without experiencing any 'shock'. The seedling should not be damaged either during uprooting or transplanting in the main field. The family members and farm labourers engaged in this activity should be educated in this regard.



In the conventional method, the practice is to pull the seedlings by holding the plant. But in SRI method the plants would be very small. So a hand trowel is pushed 10-15 cm below the nursery and lifted. This means that the seedlings along with the soil are taken on to the trowel. This can be transported to the main field on the hand trowel itself or transferred into a wicker basket. After uprooting the seedling transplantation should be completed as soon as possible, preferably within half an hour. This minimizes the trauma to the seedling.

When the nursery is raised in plastic trays or banana trunk leaves, they can be transported along with them. When the nursery is raised in 'mat' method, it would be easier to lift the nursery in

patches and transported to the main field.

It is important to see that peaceful atmosphere prevails during transplantation. Transplantation should be done with utmost care and concentration. Transplanting wouldn't be proper amidst shouts, quarrels and tension.



Method of Transplanting

In the conventional method, seedlings are transplanted by thrusting them into the soil using the middle and the pointing fingers. With this the root takes a 'U' turn. This means that the transplanting at the marker points using trays to lift the seedling roots are looking upwards. Thus the root takes time to turn downward again and get established in the soil. However, in SRI method the seedlings are transplanted shallow with the roots forming a 'L' shape. Start at 1 inch above the intersection of the horizontal and vertical lines and gently pull down using

6. Transplantation

the pointing finger. The seedling is taken along with the soil using the thumb and pointing finger. As a result the seedling establishes quickly and grows healthily. The field should be lightly irrigated either on the same day or the day after transplantation. Initially, SRI method requires 10-15 persons to transplant one acre. Once the farmers/labourers gain experience, it can be completed with fewer persons.



Transplanting at the marker point

Direct sowing

In certain regions there is the practice of direct sowing of paddy. The same system can be adopted in SRI method also. Direct sowing can be done at the spacing followed in SRI method. Some farmers are experimenting with forming paddy seed pellets with soil for directly sowing them. To reduce drudgery/labour experiments are being conducted to drop the seeds using a hollow iron rod/tube. The field should be prepared as in transplanting and marker should be used to form the grids. 3 days prior to this the required rice seed should be soaked and kept for germination as in nursery system. 1 to 3 germinated seeds should be dropped at the grid junctions. Another person should cover the seed using organic manure.

There is an advantage in transplanting the seedling as soon as possible after it is uprooted from the nursery. This helps the plant to put up extensive and healthy root system, resulting in the plant realizing its full yield potential.



Transplanting 11 days old seedlings at Mendesora Village, Koya Chiefdom. Portloko District



Transplanted Seedlings in the Field

Only a single seedling, instead of a hand full of seedlings gets transplanted in each hill.

7. Weed Management

As there is no standing water in SRI method, weeds would be more. Instead of weeding manually and throwing the weeds outside the plot there are several advantages of turning the weeds into the soil by using an implement called 'weeder'. Weeds are useful for the soil as organic manure. So the weeds should be allowed to grow and then turned into the soil intermittently. Use the weeder on the 10th and 20th day after transplantation. The weeding problem is addressed to a large extent with this effort. If the weeder is used on 30th and 40th day after transplantation, there will be more aeration to the plant roots resulting in their healthy growth. As the plant is strong and healthy, the number of tillers would be more. Weeder should be moved front and back between every two rows. Start using the weeder, when the weeds are small, i.e; on 10th day after transplantation. If the rice plant is tender or weeds are less, weeding should be done manually.

By using the weeder, the first advantage is the control of weeds and also adding organic matter to the soil. This gives the benefit of cultivating a green manure crop. Further, the soil gets aerated and the roots are exposed to air. This results in profuse growth of diverse soil micro organisms which make nutrients available to the plant.



Mandava Weeder

Under no circumstances, chemical herbicides be used in SRI method

While weeding with the weeder in one acre of crop, a person has to traverse a distance of 16 kilometres. So a weeder should be efficient in its function and easy to use so as to reduce the drudgery on labour.

Equipment Bank

To reduce the problems of farmers, either in terms of cost or availability, equipment bank is one way out. A village or a group of farmers should have certain number of weeders and markers which in turn can be used by the members as per their need.



7. Weed Management

Important Principles of Weeders

- * The space between two rice plants is wider after transplantation, which gets reduced with progressive tillering. Accordingly, the width of the weeder should be adjustable.
- * There should be arrangement to clean the mud that gets stuck to the teeth.
- * It should be of low cost and easy to be prepared locally.
- * It should be light and durable.
- * The design should be in such a way that it reduces the walking distance.
- * If the weeder is mechanized, the drudgery would be less



Cono Weeder



Mandava Weeder



Japan Weeder



Mechanised Weeder



Single Drum Weeder

The weeders that are available in the market are a bit costly. There are some problems with the design also. When these are being used in heavy soils, there are several problems. Different weeders were studied and by combining the advantages of each one, a new 'mandava' weeder has been designed. The weeder got its name after 'Chinna Mandava', a village in Khammam District in Andhra Pradesh, where it has been tested and fine tuned.

7. Weed Management

Low cost: *The weeder can be manufactured within a cost of Le 300,000-400,000/00*

Convenient Design: *It is of less weight and can be used in all types of soils.*

Technically Efficient: *It incorporates the weeds deep into soil.*

Operational Flexibility: *It is easy to operate without drudgery. It has flexible movement.*



8. Water Management

The farmers grow paddy under flooded conditions so as to control the weeds. In canal command areas as well as bore well irrigated areas, more water than is required is being used for paddy. What happens when the soil is flooded with water? The roots die due to lack of aeration. That is why the fields are not flooded under SRI method. Irrigation water is provided so as to wet the soil. The field should be irrigated again when the soil develops hairline cracks. Depending upon the soil and the environment conditions, the frequency of irrigation should be decided.



Rice plant can grow in water but it is not necessary that the Rice field be inundated with water.

As the soil is not flooded, the roots of the rice plant grow healthily, deeply in all directions. The root growth is extensive also due to the wide spacing. As the field is intermittently irrigated and dried, the micro organisms grow well which makes nutrients available to the plant.

A day before using the weeder, the field should be lightly irrigated. After the weeding, under no circumstances the water should be drained out of the field. If this water is drained, all the nutrients would be lost from the field.

After the panicle initiation stage until maturity, one inch of water should be maintained in the field.

The water can be removed after 70% of the grains get hardened. If the plot is uneven, water would be stagnating at low points and field dried up at high points. If irrigation water is to be used efficiently then the plots should be small and levelled.



8. Water Management



The SRI plots should have secured water resources so as to irrigate the field as and when required.

9. Pests and Diseases Management

The uniqueness of SRI method lies in not using the chemical pesticides and herbicides. Wider spacing and use of organic manures results in healthy growth of the plants and incidence of the pests and diseases is naturally low. The pests can be easily managed by using some organic concoctions either as a preventive measure or as and when needed. “Mapity Jalam” is one such concoction.



Preparation of “Mapity” Jalam

Required materials:

- Cow /Sow urine - one Litre
- Cow/Sow dung - One Kilo
- Jaggery/Neem (organic) - 250 grams
- Water (chlorine free) - 10 litres

Preparation and Use:

Mix all the above materials in a plastic container or an earthen pot. Let them ferment for 24 hours. Dilute this with water in



the ratio of 1:10. Filter the solution using a fine cloth. This can be used for spraying.

“Mapity” Jalam can be stored for a period of 30 days. However it has to be stirred daily. When urea is used, the plants grow succulently and or easily susceptible to pests and diseases. When “Mapity” Jalam is sprayed, it not only gives nitrogen to the plants but also repels harmful insects and micro organisms.

Harvesting

The grain matures even while the crop is green in colour. Hence farmers should be ready to undertake timely harvesting.

9. Pests and Diseases Management



Advantages of SRI

- ❖ Saving on seed cost as the seed requirement is less
- ❖ Saving on water as Irrigated – Dry method is followed
- ❖ Cost of external inputs gets reduced as chemical fertilizers and pesticides are not used
- ❖ Incidence of pests and diseases is low as the soil is allowed to dry intermittently
- ❖ More healthy and tasty rice as a result of organic farming practices
- ❖ Higher yields due to profuse tillering, increased panicle length and grain weight
- ❖ Seed multiplication with less quantity of parent seed
- ❖ Farmers can produce their own quality seed

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