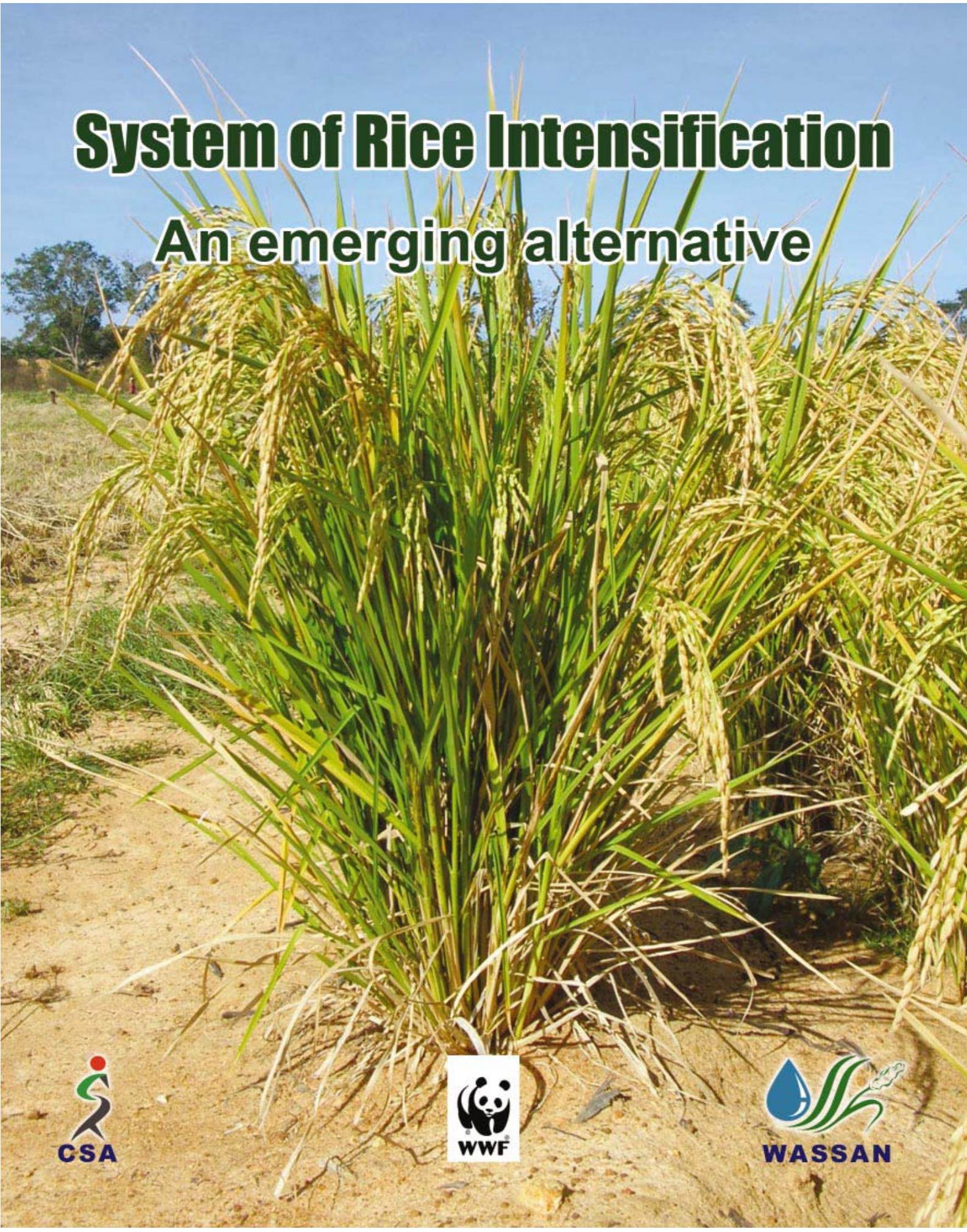
System of Rice Intensification
An emerging alternative
CSA
WWF
WASSAN

SRI - System of Rice Intensification

An emerging alternative

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This booklet was designed originally in Telugu to help farmers cultivate rice with SRI method. Publication of English version has two basic objectives : 1.To provide civil society organisations with basic information on SRI cultivation so that they will take up this in their operational area

2. To encourage farmers, who can read English, to practise SRI by using the information.

The booklet is organised in 9 sections…

...With less water, less seed, no fertilisers, no pesticides, more soil organic matter and more soil aeration, the productive potential of rice can be unleashed ... As a new way of looking at rice cultivation and solely driven by the innovative farmers, System of Rice Intensification (SRI) is emerging as an alternative to conventional water and chemical intensive rice cultivation...

Rice is promoted as a water intensive and high chemical input responsive crop. With intensive support from governments in terms of reallocating national water resources, subsidising chemical inputs and price support mechanisms, rice has become a preferred crop for farmers who have access to water. With such intensive support and changing food habits across the country, intensity or rice cultivation has even spread to areas with scarce water resources and is held responsible for the ever increasing water crisis. The crop is also one of the largest consumer of chemcial inputs-fertilisers and pesticides.

Increasing investments on external inputs and digging or deepening of borewells, forcing farmers into debt-traps. On the other hand, with more and more chemicals used, food is becoming more and more poisonous.

Farmers across the country are adopting System of Rice Intensification (SRI), as it gives equal or more produce than the conventional rice cultivation ; with less water, less seed and less chemicals. The net effect is a substantial reduction in the investments on external inputs. Conversley, increased labour needs for weeding and cultivation in saline lands are the two areas of major concern in SRI, on which innovations are forthcoming from various quarters. Farmers are leading the innovations and spreading that technology, while the scientific community is still to catch up with this emerging rice revolution.

WASSAN and CSA with support from the WWF-Dialogue Project are working with more than 1000 farmers across Andhra Pradesh and facilitating farmer-led innovations in SRI. Futher, the effort is to understand the scaling up issues in SRI, analyse the institutional and technology issues and to evolve appropriate policy options. ANGR Agriculture University, Hyderabad, has also promoted SRI in several districts in the state through its extension system. Innovative farmers across the state are leading process of informal diffusion of SRI and are contributing to the wealth of experience in the subject. Drawing from several such contributions by farmers, this booklet provides necessary information on the package of practices of SRI.

SRI is neither a new variety nor a hybrid... It is only a method of rice cultivation.

System of Rice Intensification

- less water
- less seed
- less chemical pesticides
- less chemical fertilisers
- equal or more yield in comparision to traditional cultivation

1. SRI Cultivation

SRI is an acronym for System of Rice Intensification. This improved method of rice cultivation was developed in 1983 in Madagaskar and has now spread to many parts of the world.

There is a notion that higher yields in rice come with high investments on seed, irrigation, high doses of fertilizers and pesticides. Contrary to this popular view, SRI method of cultivation produces higher yields with less seed and less water. SRI emphasizes on the need to shift from chemical fertilizers to organic manures.

Increased soil aeration and organic matter helps in improving soil biology and thus helps in better nutrient availability. Pest incidence also reduces due to increased spacing, drastically reducing the need for pesticides. Non-chemical approaches to pest management are also being practised by many farmers. Green manuring, *Panchagavya* (a formulation with cow urine based formulation) and other methods of fertility improvment are showing great potential in SRI.

SRI is not a new variety or a hybrid. It is only a method of cultivation. SRI is showing promising results in all rice varieties -local or improved. Marking the plot before transplantation to ensure proper rows and spacing, and weeding are necessitating development of appropriate implements.

SRI method is emerging as a potential alternative to traditional way of flooded rice cultivation and is showing great promise to address the problems of water scarcity, high energy usage, and chemicalisation. Government of Andhdra Pradesh has recently endorsed SRI and announced the state's policy of promoting and supporting SRI.

SRI practices outlined in this book are based on farmers' practices and their experiences in different parts of Andhra Pradesh. As innovation and local adaptation are the hall marks of SRI, farmers should further endeavour to optimise cultivation practices suitable to their local situations.

Important features of SRI

1.1 Low seed requirement

.... Since a single seedling is transplanted per hill at wider spacing, seed requirement is drastically reduced.

1.2 Low water requirement

.... As there is no need to maintain standing water.

1.3 Transplantation of tender/ young seedlings (8-12days)

.... Transplantation of young seedlings at shallow depth results in quick recovery and establishment and production of more tillers

1.4 Transplanting at wider spacing (10 x 10 inches or 25 x 25 cm)

.... Wider spacing allows enough sunlight to reach the leaves of each rice plant thus reducing competition for water, space and nutrients resulting in the spread of roots and healthy growth of plants (the distance can be increased depending on soil fertility)

1.5 Incorporating weeds into the soil while weeding

.... Weeding with a simple hoe helps in replenishing the nutrients in the form of green manure. Working with a hoe or weeder helps to aerate soil which in turn helps in vigorous root growth. (First weeding 10 days after transplating and a minimum 3 weedings at 10-12 day interval).

1.6 Organic manures in place of chemical fertilizers

.... Organic manures improve soil aeration and also microbial activity. This helps in decomposing organic matter into nutrients, essential for plant growth.

1.7 Pest management without chemicals

.... Normally, the incidence of pests and diseases is low as the plants are widely spaced and are healthier in SRI. In case of incidence of disease, biological control methods / natural control measures can be applied to keep them under check.

2. Suitable Soils

Unlike in the conventional method, saline or alkaline soils are not suitable for SRI cultivation. As water needs to be drained frequently in SRI, the salts come to surface , damaging seedlings or plants. It is therefore advisable to go for soil test before opting for SRI cultivation.

Undulation in the plot causes water to stagnate in some parts of the land. So land should be properlly levelled before transplantation to enable water to spread uniformly over the field. There should also be a provision to remove excess water i.e., drainage facility.

Tank silt application

Application of Farm yard Menure

3. Improving Soil Fertility

Yields in SRI respond well to organic manures than chemical fertilizers. This emphasizes the need to build up fertility through organic means from the beginning. There are some methods mentioned below to improve soil fertility. Atleast two such methods are to be followed:

3.1 Application of tank silt

Application of tank silt @ 15-20 cart loads per acre (40-50 tons / ha) improves water holding capacity and productivity. (This should be done atleast once in three years regularly)

Green manure

Sheep herd

3.2 Farm Yard Manure (FYM)

Application of well decomposed FYM (15 tons / ha or 3 tractor loads per acre) is quite beneficial for SRI cultivation. Vermicompost can also be used in place of FYM or in combination with FYM

Quality check for FYM heap

- Dark brown or black in colour
- Having no heat in the middle, or any where, of the heap
- Moist and friable but no oozing of water
- Homogenous and no visible traces of its former organic matter

3.3 Green Manure Crop

Green manures help in improving soil fertility to a great extent. Sunhemp and Sesbania are the commonly grown green manure crops that are incorporated into the soil at flowering time i.e., around 45 days, when the nitrogen fixation is at its maximum. It takes nearly 10 days for decomposition. If the rice seeds are sown in the nursery on the day of incorporation of green manure, the field will be ready by the time the seedling are ready for transplantation.

3.4 Penning Livestock

It's an age-old practice to leave cattle, sheep, goat etc in the field overnight. The soil gets enriched with their urine and dung.

Dabholkar method of green mauring

This method is gaining popularity in recent years. The usual method for obtaining green manure is to grow a leguminous crop. But in Dabholkar method, 20-25 kg of mixed seed from 5 categories (4 crops in each category i.e total 20-21 crops) mentioned below are sown and incorporated into the soil

1. Cereals (jowar, bajra, ragi, korra,sama)
2. Pulses (blackgram, greengram, chickpea, bean)
3. Oilseeds (sesame, groundnut, sunflower, castor)
4. Legumes (sesbania, sunhemp, horsegram, pillipesara)
5. Spices (mustard, coriander, methi, ajwain)

In this mix, pulses, oilseeds, cereals/millets, green manure crop seeds are added @ 6kg each where as spices are added @ ½ kg each. After 40-45 days of sowing, the entire biomass is incorporated into the soil. This way, the top soil gets replenished with all micro, macro nutrients and minerals in the form of humus. It is essential that enough moisture is ensured for the growth and decomposition of green manure crops

4. Raising Nursery

Seedbed : soil and fym alternately layered

Mixing soil and fym

Growing nursery

In SRI method, utmost care should be taken in the preparation of nursery bed, as 8-10 days old seedlings are transplanted.

2 kg of seed (5kg / ha) is required to transplant in one acre of land. The nursery bed can be raised in a 48 square yard (40 Sq. Meters) plot. Depending upon the situation, two beds can also be raised each measuring 24 sq. yards (20 Sq. Meters) per 1 kg seed. Seeds should be thinly spread to avoid crowding of seedlings. Care should be taken that no two seeds should touch each other.

4.1 Bed preparation

A bed with a width of 125cm or 4 feet is ideal. And length of the bed can be decided by the farmer depending on the ground situation. According to one's convenience either a single bed or several small beds (say, 4 beds measuring 4x28 feet or 1.25 X 8 meters each) can be prepared. As the roots of 8-12 day-old seedlings grow upto 3 inches (7.5cm) deep, it is necessary to prepare raised beds of 5-6 inches (12.5-15cm) height.

Nursery Bed Preparation

The nursery bed is prepared with application of farm yard manure (FYM) and soil alternately in 4 layers.

1st layer : 1 inch (2.54 cms) thick well decomposed FYM

2nd layer : 1 ½ inch (3.78 cms) soil

3rd layer : 1 inch (2.54 cms) thick well decomposed FYM

4th layer : 2 ½ inch (6.3 cms) soil

All these layers should be mixed well, as the FYM helps in easy penetration of roots. To prevent soil erosion, the bed on all sides should be made secure with wooden reapers / planks or paddy straw rope or anything of that sort. To drain excess water appropriate channels should be provided on all sides.

4.2 Seed preparation and broadcasting

Pre-soaking of seed and broadcasting of sprouted seed is the regular practice recommended for SRI. This process is as follows :

- Soak the seed for 12 hours in water. Then drain the water and transfer wet seed to a gunny bag. Leave it for 24 hours. By this time white root called radicle breaks open the outer coat and starts emerging out of the seed. At this stage the sprouted seed is taken to nursery bed for sowing.
- To ensure uniform broadcasting, divide the whole seed lot into 4 parts and broadcast four times (each part at a time) thinly spread over the bed. It is better to broadcast in the evenings.
- Spread well decomposed FYM or paddy straw (without its grains / seeds) over the sown seed thinly. The seeds are not to be directly exposed to sun. This would ensure protection from birds and ants. Straw can be removed once the seeds germinate. Depending on the requirement, watering should be done daily twice (morning and evening). Watering can be done slowly with pots by controlling the flow with hand. Care should be taken to see that the seeds do not come out while watering.
- The seed bed should be preferably in the center / corner of the plot and it should not be away from the main field, for quick / efficient transplantation. If the area is large, separate nursery bed for each acre is recommended.

Well soaked seed

Seed germination

Seed broadcasting

Application of a thin layer of soil and watering on seeds

8-10 days old seedling

Watering the bed layered with paddy straw

5. Preparation of Main Field

Preparation of the main field in SRI is the same as in conventional method. Field should be evenly levelled and there should not be standing water in the field during transplantation.

Well puddled and leveled field

In SRI method, seedlings are widely spaced (10 x10 inch or 25 x 25cm) and only one seedling is transplanted per hill (3-4 seedlings per hill in conventional system). SRI method can accommodate only 16 hills /sq. metre as against 33-40 hills/ square meter in conventional method. Uniform spacing is also required for easy weeding by implements.

To maintain uniform spacing, different methods can be employed. Small pegs can be tied to a rope at 25 cm or 10 inch distance and by using this rope, row after row transplantation can be done. Different types of 'Markers' are being developed for this purpose. These markers need to be run over the prepared field lengthwise and widthwise. Transplanting at the marked intersection gives the required 25 x 25 cm spacing.

Grid marks after marking


SRI field with pathways

Some of the newly developed markers draw 8 rows and columns simultaneously. These markers need to be pulled at an even pace for proper marking. To have the lines straight, it is advisable to tie a rope and pull the marker along side the rope.

For smooth transplantation, field operations like bunding, levelling and marking with marker should be completed a day before the transplantation.

There are many types of weeders and markers available in the market. Most of them are locally made. The markers and weeders developed by Acharya NG Ranga Agricultural University, Hyderabad are quite popular.

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Different markers in use


Grown up nursery ready for transplantation

Patch of saplings removed from nursery

Sapling being transplanted

6. Transplantation

Young, 8-12 days old seedlings are transplanted in SRI method. Care should be taken to see that the plant does not experience shock during transplanting. The farmers and farm labour need to be educated on this aspect. Care should be taken to prevent any harm to seedlings while pulling them from nursery or at the time of transplantion.

In the conventional method, the practice is to pull the seedling by holding the plant. In SRI method, a metal sheet is inserted 4-5 inches below the seed bed and the seedlings along with soil are lifted without any disturbance to their roots.

Transplanting should be done as quickly as possible, preferably within half an hour to minimise trauma to the roots. Transplanting should be done with utmost care and concentration.

6.1 Method of transplanting

In the conventional method, 30 day-old seedlings are thrust into the puddled soil and the roots take 'U' shape i.e the tips of roots face upward. Therefore the roots require time and energy to turn downward and establish in the soil.

In SRI method, young seedlings are planted shallow and therefore establish quickly. Single seedlings with seed and soil are trasplanted by using index finger and thumb and gently placing them at the intersection of markings. Light irrigation should be given on the next day of transplantion.

Initially, it requires 10-15 persons to transplant one acre. Once the farmers / workers get used to this practice, it can be managed with lesser number of persons.

Transplanting

Different methods of raising nursery

Transplanted field

Thinly watered field

Field with its top soil dry and developing hairline cracks

No need to inundate with standing water

7. Irrigation and Water Management

Because of some special anatomical features, rice can grow well even in standing water; but it does not require standing water as a rule. The practice of growing rice in inundated condition is mainly to control weed growth. But such conditions result in lack of aeration and consequent stunted root growth.

In SRI, irrigation is given to wet the soil, just enough to saturate the soil with moisture. Subsequent irrigation is suggested when the soil develops fine cracks. Irrigation interval depends on soil type and weather conditions. This method helps in better growth and spread of roots. Regular wetting and drying of soil results in increased microbial activity in the soil and easy availability of nutrients to plants.

For a smooth weeding operation, the field should be irrigated maintaining a thin film of water. After the completion of the weeding, water should never be let out of the field. Once the tillering process is complete, standing water of one inch / 2.5 cm height may be maintained.

Well tillered Rice plant

Strong and well spread roots

8. Weed Management

Absense of standing water provides a congenial environment for weeds to proliferate in SRI. If these weeds are incorporated into the soil, they serve as green manure.

Different models of manually operated weeders are being developed for effective weed management in SRI. The weeds in the vicinity of the hills that could not be reached by the weeder have to be removed by hand.

Incorporating weed into the soil with Mandava weeder

Weeds can be incorporated by moving the weeder between the rows. First weeding should be done 10-12 days after transplating. Later, depending on the need, weeding can be done once every 10 days.

Advantages of Weeder

- Controls weed
- Green manuring due to incorporation of weeds into soil
- Soil aeration
- Increased soil biological activity
- Increased nutrient availability and uptake

Cono weeder developed by Agricultural University

9. Management of Pests and Diseases

The incidence of pests and diseases is naturally low in SRI because of wider spacing and the usage of organic manures. Natural pest management methods and use of natural bio-pesticides are recommended whenever necessary to keep pests under control.

Harvesting

Farmers should be ready to harvest in time as the crop reaches maturity while it is still green.

Advantages of SRI

- Saving on seeds, as the seed requirement is less
- Saving of water, as the water requirement is less
- Withstands short gaps in water availability (like burning of transformers, delayed rains etc.)
- Saving on chemical fertilizers, pesticides
- More healthy and tasty rice due to organic farming practices
- Higher yields due to profuse tillering, increased panicle length and grain weight
- Easy and effective seed multiplication, as a small quantity is required as seed

SRI crop *Traditional crop*

Disadvantages

- Higher labour costs in the initial years
- Difficulties in acquiring the necessary skills

Implements and Innovations

A 'Dialogue' Workshop

Marking the transplantation cross points on the land and weeding are the two major challenges in SRI. Appropriate implements suitable to the varied conditions and soils are needed to be developed. Furthermore, these implements have to be affordable and within the reach of the small farmers. Keeping these considerations in mind, a workshop was organized by WASSAN and Centre for Sustainable Agriculture under the WWF-Dialogue Project. The idea was to bring the farmer-innovators, technical people from the university and the SRI practitioners together. Different markers and weeders that were developed and fabricated by the innovators were brought to the workshop. Based on the field trial of each of these implements and intensive discussions, the workshop has derived the requirements of a good Weeder or a Marker. These can serve as guiding principles (see pages 18&19) for those working on SRI implements.

Mandava Weeder

WASSAN has further worked on the recommendations made in the workshop. The float from the Cono-weeder, handle from Kollur Weeder and the mechanism to remove soil from the drum-plates in the Raichur weeder were integrated into the star weeder. This has resulted in the evolution of Mandava Weeder (named after the village of Kishan Rao, where this has been perfected). This new weeder costing about Rs. 550, is being tried at several SRI farms.

The marker prepared by Bommi Reddy Sudhakar Reddy was also improvised (named as Akiveedu Marker) in terms of adding more rows to it to minimize labour requirement. It is costing about Rs.600.

Akiveedu Marker

Cono Weeder

Single drum Weeder

Kollur Weeder

Japan Weeder

3-Row Raichur Weeder

Star Weeder

Weeders - Guiding principles

- Needs to have built-in width adjustability.
- Needs to have an arrangement to avoid mud getting stuck between the teeth / blades
- Needs to be fitted with a guard to protect rice plants while weeding
- Needs to be simple in design so that it can be manufactured locally and sold at an affordable price
- Needs to be all weather-proof and durable
- Needs to be available in multiple designs / models so that SRI farmers have options
- Need to develop a motorized version to lessen fatigue / workload on the operator.
- Need innovative designs in reducing the walking distance

Mechanised Weeder (under testing)

Mandava Weeder

Akiveedu Marker (16-Rows)

Super Marker (16-Rows)

Markers - Guiding principles

- Needs to have built-in adjustability to change the distance between the rows
- Needs to have an arrangement for direct sowing of seeds
- Needs to have an arrangement to mark both the pathways simultaneously
- Needs to be designed with a facility to add weight
- Needs to be amenable to working in the fields where green manure is applied

Koundinya Marker

Akiveedu Marker (9-Rows)

Roller Marker (8-Rows)

Wooden Marker

SRI... as a State Policy...

PRADESH THE HINDU 16 NOV 2005

YSR announces 4-cr. programme for popularising SRI method

World Wide Fund for Nature, ANGRAU take up pilot project

- 212 farmers implementing the method in 10 districts in the State
- It involves water and soil fertility management, planting of seed in a particular manner and weed control
- Discouraging farmers from growing paddy is meant for conserving water and not for restricting free power, says Chief Minister

BOWLED OVER: Chief Minister Y.S. Rajasekhara Reddy harvesting a 'hill' of System of Rice Intensification (SRI) paddy on a farm in Tarnakkipet on Ranga Reddy District on Tuesday. Ministers N. Raghuveera Reddy and Peethala Lakshmaiah are also seen. – PHOTO: G. GOPALAKRISHNAN

Plagued with serious short-fall in power generation and ever increasing demand for power for bore-well irrigation, Government of Andhra Pradesh has announced its decision to cut-off free power for rice cultivation in Rabi (2005-06) and allow it only for irrigated-dry crops.These measures triggered off an uproar from farmers and opposition parties as well.

Encouraged by the successes of the SRI farmers, the Chief Minister and the Agriculture Minister announced the government policy to exempt farmers growing rice in SRI method from cutting off free power and that their rice crops would be treated as irrigated dry crops. The announcement was made after a detailed interaction with SRI farmers in the multi-stakeholder dialogue organized by the WWF-Dialogue Project at the farm of an SRI farmer, Mr Nagaratnam Naidu near Hyderabad on November 15, 2005. The event was held to facilitate discussion on the viability of the SRI method among the rice farmers and policymakers. Scientists, Policymakers, NGOs and Media participated in the dialogue along with the farmers. The event was chaired by the Chief Minister and the Agriculture Minister.

The government also initiated a program to take up SRI demonstration plots in each village to train farmers. Implements such as weeders and markers would be supplied at 50% subsidy. Chief Minsister promised to gear up agricultural extension and the official machinery to promote SRI all over the state. The event received wide coverage in print and visual media at the national level.

It is a first sign of a promising future for scaling up of SRI.

Dialogue
ON WATER, FOOD AND ENVIRONMENT