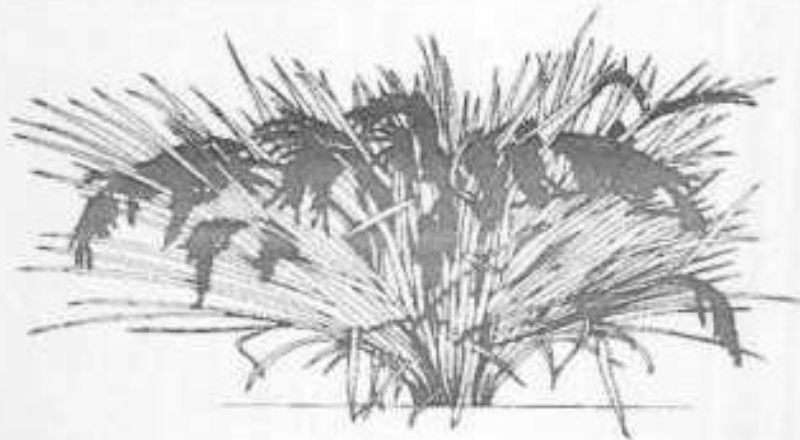


*Manual on*  
**"System of Rice Intensification" (SRI)**  
**A Revolutionary Method of Rice Cultivation**



**Acharya N.G. Ranga Agricultural University**  
Rajendranagar, Hyderabad - 500 030

# **"System of Rice Intensification" (SRI) A Revolutionary Method of Rice Cultivation**

*First edition*

*July 2004*



**Cultivate Rice Profitably**

*Manual on "SRI"*

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Drawings & Layout : Mr. M. Eswaraiah  
Inner cover : Mr. M.S. Johnson

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Authors : *Dr. A. Satyanarayana*, Director of Extension, ANGRAU, Rajendranagar  
*Dr. K. Sudhakar Babu*, Senior Scientist, Electronic Wing, ARI, Rajendranagar

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### *1. About the system :*



System of Rice Intensification (SRI) was first developed in Madagascar during the 1980's. It was not known outside Madagascar till about 1997. The potential benefits of SRI are being tested now in predominantly rice growing countries like China, Indonesia, Cambodia, Thailand, India, Cuba, Bangladesh and Sri Lanka.

SRI Technology uses less inputs. It uses less seed, water, chemical fertilisers & pesticides but uses more organic manures - Rice grown with SRI technology has large root volume, profuse and strong tillers with big panicles, more & well-filled spikelets with higher grain weight.

### *2. Is rice an aquatic plant?*

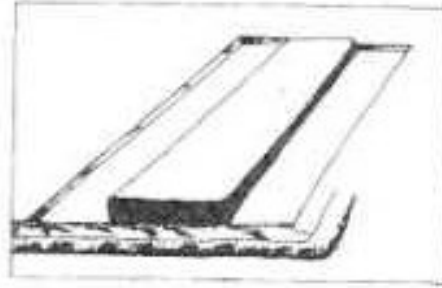
Scientists say rice is not an aquatic plant. It can only survive in water but does not thrive well under hypoxic conditions. Under continuous inundation, rice plant spends lot of energy to develop air pockets (aerenchyma tissue) as survival mechanism. Under SRI,



paddy fields are not flooded but only kept moist by alternate wetting and drying.

### 3. How to grow Nursery?

Prepare the land thoroughly when dry. Apply FYM and puddle well. Then, make beds of 1 metre width with convenient length. Remove the soil from either side of

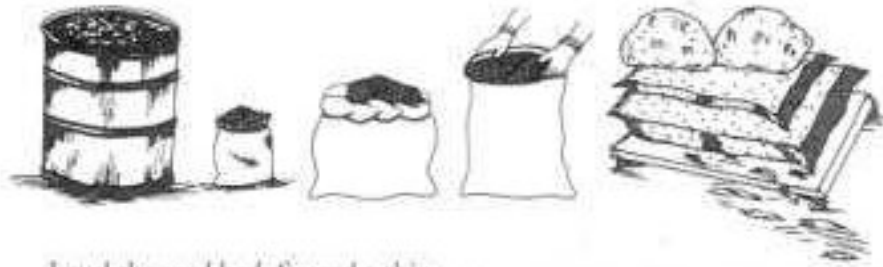


the bed, and put it on the bed. The bed automatically gets raised in height. Place wooden planks or bamboo slits all around the bed for support so that the soil will not loosen and get carried away with rain.

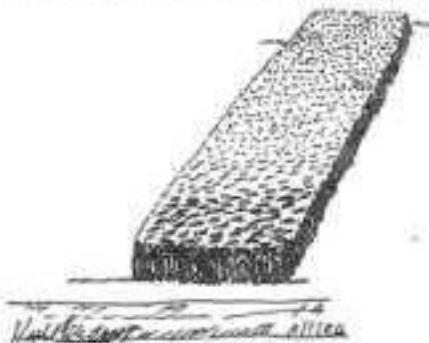
The seedbed should be prepared as closely as possible to the main field so as to minimize transport time between removal of seedlings from the bed and transplanting in the field.



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 2 kg seed is sown on 40 Sq.m area. Apply another layer of FYM to cover the seeds. Then mulch the bed neatly with paddy straw to prevent the seed



to come in direct contact with sun, rain, birds etc. Irrigate carefully with rose can every morning & evening. Do not apply any agro chemicals to the nursery bed. In 8 to 12 days, vigorous & healthy nursery is ready for transplanting.

The six basic Principles of SRI are

1. Use of young seedlings for transplanting

2. Careful transplanting
3. Planting at wider spacing
4. Weed control
5. Water Management
6. Organic manures

#### 4. *Early Transplanting :*

Eight to 12 day old seedlings with just two leaves have to be transplanted. This ensures more tillers and more root growth. While 30 tillers per plant are fairly easy to achieve, 50 tillers per plant are quite attainable.

#### 5. *Taking out Seedlings from the nursery :*

Take an Iron sheet of sufficient thickness measuring 18" by 15", push through this sheet into the nursery bed beneath the plants about 3 inches down from the surface. Then lift the sheet gently. Now the plants along



with the mud have come onto the metal sheet. Carry seedlings with the soil to the main field. With your right thumb and forefinger, take plant by

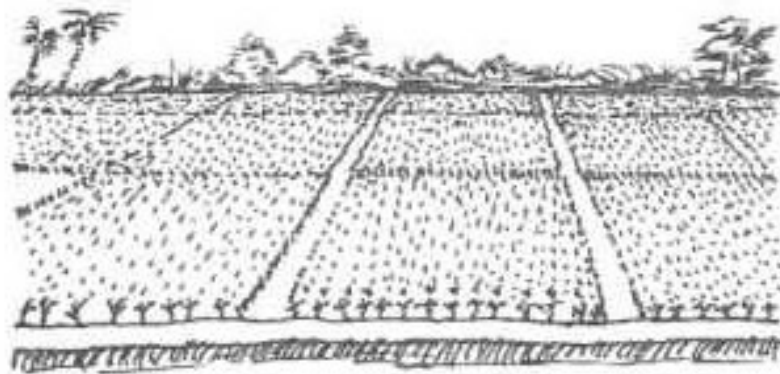


plant along with soil and place the plant along with mud and roots gently at the intersection of grid lines made for the purpose to plant at wider spacing in a square pattern.



### 6. Preparing the main field for transplanting :

The land preparation does not require special tips. Plough the land thoroughly. Puddle it as is done with the conventional method. At every two-meter interval make 30 cm wide channels. To make channels, place sticks at appropriate intervals (i.e. 2 m, 30 cm) along the edge of the field and stretch fine rope between them. Hold two ropes, at 30 cm apart. Remove the soil with in the two ropes and spread it on the adjacent beds thereby a channel is made. Level the field thoroughly.



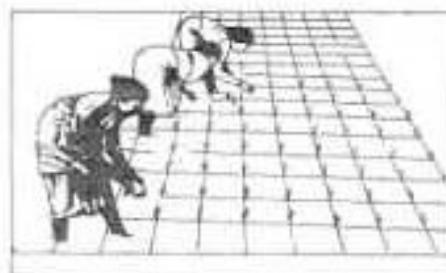
Then, take a "rake" that has teeth at 25 cm apart which can be constructed simply from wood. It is pulled across the surface of the prepared muddy field, marking lines on the surface at 25 cm intervals. Drawing the rake across the first set of lines perpendicularly (at a right-angle) to them creates the desired square pattern on which seedlings are planted at the intersections of lines. Farmers in AP have developed a roller marker which when rolled on the field mark the lines both ways in a single stroke.



In traditional method, a thin film of water is maintained at transplanting. But in SRI, there should not be standing water at the time of transplanting. Sixteen plants are transplanted per Sq.m in this method as against 33 hills per Sq.m in conventional method.

### 7. Careful Transplanting :

It is important to avoid 'shock' or 'trauma' while transplanting the seedlings. Remove seedlings from nursery with seed, soil and roots intact carefully and plant it in the field without plunging too deep into the soil. The seed should be attached



to the seedlings and transplanted as soon as possible after being removed from the nursery – with in half an hour and preferably with in 15 minutes to avoid desiccation and traumatization of the plant. -

Care is to be taken to ensure that when the seedlings are transplanted that their root tips are not inverted as usually happened during the hurried, rough transplanting done in the conventional method. If the root tip was turned upward - shaped like a J, rather than an L it could take a week or more for the tip to reorient itself downward and resume growth.

Hence, do not thrust seedlings downward into the soil. Rather, each seedling is slipped into the soil very 'gently' and close to the surface, so that its root lies horizontally in the moist soil. This makes the shape of the transplanted seedling more like 'L' than like 'J' and facilitates root growing quickly downward. Only single seedlings are to be planted at the intersection rather than in clumps of 2 or 3 or more.

#### 8. *Wider spacing :*

Rice plants can better realize their potential for tiller and root growth and for subsequent grain filling, if spaced widely rather than densely. Seedlings are to be planted in a square pattern at 25 x 25 cm wide. Leaving



wide spaces between each plant ensures that roots have adequate room to grow and the plants will be exposed to more sunlight, air and nutrients. The result is more root growth and more tillering. The square pattern also facilitates weeding in both directions. This means that individual plants have more room to spread.

### *9. Weeding and Aeration :*

As there is no standing water in rice fields under SRI method, weed growth is very high. Use simple mechanical rotary weeder to churn the soil for weed control.

Rotate the weeder at least 2 to 4 times. This incorporates the weeds into the soil. The first weeding should be done at 10-12 days after transplanting to eliminate weeds



when these were just germinating rather than wait for them to grow. Subsequent weeding is done at 10 days interval.

Working with rotary weeder helps in greater aeration which results in more root growth, reduced weed competition, more oxygen and nitrogen to roots. Weeds incorporated into the soil with each weeding can add-up to 1 ton green manure per hectare per weeding and also helps build up of large and diverse microbial population in the soil.

### 10. Can herbicides be used?

No. Herbicides are not recommended under SRI method. Instead, weeds have to be incorporated into the soil.



### 11. Water Management :

Rice has traditionally been grown under standing water continuously. Clearly, rice is able to tolerate standing water. However, standing water creates hypoxic soil conditions. Under such conditions three-fourths of their root system gets degenerated by the time of flowering. SRI practices, by contrast, nurture and sustain large and intact root system throughout the growth and reproductive stages of rice plant.

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. This avoids root degeneration, which usually happens under continuous flooding.

Unflooded conditions, combined with mechanical weeding, result in more air in the soil and greater root growth. Higher root growth provides access to more nutrients.



Irrigate the field on the previous evening before the periodic

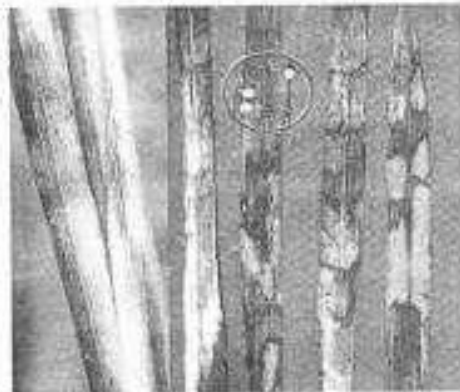
weedings. Drain out water in the morning to facilitate rotary weeder operation.

### 12. Compost :

Instead of chemical fertilizers, FYM or compost is applied @ 10 t/ha which 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 microorganisms.

### 13. Pest and Disease control :

Pest and disease problems appear to be less with SRI method, perhaps healthier and vigorous plants have more capacity to resist pest and disease attacks. Farmers across AP have reported fewer pest and disease



problems with this method, making use of Agro chemicals not necessary. It was observed by AP farmers that, sheath blight and BPH incidence is low under SRI method.

#### 14. Comparison of SRI with conventional method :

Conventional Method	SRI Method
1) 20 – 25 kg seed is used per acre	1) 2 Kg seed is sufficient for one acre
2) 25 to 30 day old seedlings are transplanted.	2) 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	3) Seedlings are treated very gently by scooping. No pulling, No washing, No bundling & No Stacking.
4) Planted at random	4) Planted in square pattern
5) 33 hills are planed per Sq.m	5) 16 hills are planted per Sq.m or less
6) 3 or more plants are planted in clumps	6) Only one plant is planted per hill.
7) Application of NPK, fertilizers as recommended.	7) Application organic manures only basal dose of fertilizers at present. No top dressing
8) Continuous flooding	8) Moist condition

### 15. Is it labour intensive?

Some farmers are hesitant at first to use SRI methods because they require more labour and skill and appear risky.

At first, SRI may take 50 to 100% more labour. Planting & weeding are initially the most labour intensive part of SRI. Since yields can be double or even tripled than with current practices, it justifies mobilization of labour for profit. But over time, this amount is reduced. Experienced SRI farmers in AP say, it requires even less labour once tools designed and techniques are mastered and confidence gained.

### 16. Results of SRI in AP:

The results with SRI method are remarkable. With SRI method, you can easily get 50 tillers on a single rice plant and some farmers have been able to get over 100 tillers from a single seedling, most of them productive with big panicle having well filled grains.

In Andhra Pradesh during kharif 2003, farmers using SRI averaged over 18.25 t/ha productivity. While the state average productivity is only 3.87 t/ha. In kharif 2003, in all 167 trials were conducted in A.P.

#### Performance of Rice under SRI *Kharif*, 2003 – 2004

Total demonstrations conducted	167
Average yields with SRI method (kg/ha)	8250
Average yields with conventional method (kg/ha)	5307
A.P. State average productivity (kg/ha)	3870

Similarly during Rabi 2003-04, the results obtained from 94 farmers field trials on SRI resulted in 9.9 t/ha yield advantage over conventional method.



Table : Performance of Rice under SRI during Rabi 2003-04.

No. of Farmers	94
Average yields in SRI method (kg/ha)	9910
Average yields in conventional method (kg/ha)	7720
Highest yields rewarded with SRI (kg/ha)	17250

### *17. Benefits of SRI*

- Higher grain & straw yields
- Reduction in duration by 10 days
- Lesser chemical inputs
- Less water requirement (About half that of conventional method)
- Less chaffy grain
- Grain weight increased without change in grain size
- Higher head rice recovery
- Withstood cyclonic gales.
- Soil health improves through biological activity
- Cold tolerance

\* \* \*



**Increased tillering of MTU 1071 at 50DAP under SRI**

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