Experiments with a Modified System of Rice Intensification in INDIA

T. M. Thiyagarajan, Tamil Nadu Agricultural University[1]

Rice is the staple food for 65% of the population in India. The crop accounts for about 22% (42 million ha) of the total cropped area, 34% of the area under food crops, and 42% of the area under cereals. India is the second largest rice-producing country in the world. The rice output of 82 million tons in 1994-95 amounted to approximately 46% of the country's cereal production and 42% of its total food grains. India needs to increase production by at least 2.5 million tons of milled rice every year to sustain the present level of self-sufficiency.

Tamil Nadu is the most southern state in India with a geographical area of 13 million ha and a cultivable area of 5.8 million ha. Rice is grown in about 2 million ha, mostly under irrigated conditions. The average productivity of rice in the state is the highest in the country, with an average yield of 5 t/ha.

The concepts of SRI came to be known at Tamil Nadu Agricultural University during 2000 through a communication from Dr. H. F. M. Ten Berge of Plant Research International in the Netherlands. The soil aeration aspect of SRI stimulated the conduct of an observation trial during 2000-2001. A detailed study involving SRI concepts was taken up during this past year through the water-saving rice production project funded by the Dutch government through the Plant Research International at Wageningen. At present, SRI is under evaluation only and has not reached any popularization stage.

Evaluations

Initial evaluation

The first observation trial was conducted with rice cultivar CO43. The treatments included two methods of crop establishment (wet seeding of sprouted seeds, and transplanting of 10-day-old seedlings) and five plant densities (4, 8, 16, 32 and 64 plants/m^2). The plots were irrigated in the evening and drained in the following morning. Though there were no spectacular yield differences, the study confirmed that flooding was not necessary to maintain yield.

Detailed study

This experiment was conducted during August 2001 to January 2002. Some of the components of SRI cultivation practices were compared with conventional practices for transplanted rice. Four factors were evaluated, with treatment combinations replicated four times.

For the *modified SRI practice:* (1) seedlings were raised in the 'dapog' manner,[2] and 14-day-old seedlings were placed on the surface of a puddled field; (2) up to the flowering stage, irrigation was given to a depth of 2.5 cm after surface cracks developed in the soil; after flowering, irrigation was similar to conventional practice; (3) all weeds were incorporated into the soil during weeding with a conoweeder, and prior to transplanting, green manure at 6.25 t/ha was incorporated into the soil.

For *conventional practice:* (1) 23-day-old seedlings were planted; (2) irrigation was given to a depth of 5 cm one day after the disappearance of surface water; and (3) weeds were manually removed.

In *both practices,* a plant density of 25/m^2 was used compared to a conventional plant density of 50/m^2 in order to permit use of the conoweeder. Also single seedlings were planted per hill with both practices. Since these are both essentially SRI practices, the evaluation

[2] *'Dapog' is a method developed in the Philippines, where seedlings are raised on a surface, like a banana leaf, so they can be easily transported to the field and transplanted at a young age.*

[1]*Director, Centre for Soil and Crop Management Studies, Tamil Nadu Agricultural University, Coimbattoir, Tamil Nadu, India; Email:tmthiyagarajan@yahoo.com*

was really of "modified" SRI, assessing the effects of only three of the six basic SRI practices. The "control" fertilization treatment was a conventional N, P, K plus Zn application, with the experimental treatment being this plus incorporation of green manure and an additional N application, which is not really an SRI practice.

Location: Wetland Farm, Tamil Nadu Agricultural University

Design : Strip plot

No. of replications: 4

Plot size: 6 x 4.4 m

Variety : CORH2 (hybrid)

Planting density: 20 x 20 cm (25/m^2)

Treatments

Planting P1: Conventional: standard nursery, 24 d old seedlings, 2-3 seedlings/hill

P2: Modified SRI: dapog nursery, 14 d old seedlings, single seedling/hill

Irrigation I1: Conventional: irrigating to 5 cm depth after disappearance of ponded water

I2: Modified SRI: irrigating to 2 cm depth after surface cracks develop up to flowering and thereafter as in I1

Weeding W1: Conventional: hand weeding at 18, 34 and 38 DAT

W2: Modified SRI: incorporating weeds and aerating soil with conoweeder at 15, 26, 36, 47 and 57 DAT

Nitrogen N1: Recommended applications of N, P, K and Zn

N2: Recommended N, P, K and Zn applications + *dhaincha* green manure (6.25 t/ha) prior to planting + 25 kg N/ha at tillering

Soil Characteristics

Clay: 470 g/kg	Organic carbon: 8.2 g/kg
Silt: 90 g/kg	$KmnO_4$: 232 kg/ha
Sand: 440 g/kg	Olsen-P: 32 kg/ha
Bulk density: 1.18 g/cc	NH_4Oac-K: 740 kg/ha
pH: 8.3	Elec. conductivity: 0.54 dS/m

Climate

The experiment was conducted during the northeast monsoon season. Weather conditions prevailing during the crop growth period are summarized in Table 1 below.

Results

Grain yields for the sixteen treatments varied from 5059 kg/ha to 7612 kg/ha. The results showed that by adopting the modified SRI irrigation practice, there was a water saving of 56% under conventional planting and 49.8% under modified SRI planting without any significant effect on grain yield when compared with conventional practice.

The maximum yield (7612 kg/ha) was obtained for the modified SRI practice with younger seedlings, restricted irrigation, addition of green manure, and incorporation of weeds with soil aeration.

With green manure application and conventional weeding, water-saving irrigation practices reduced yield compared with conventional irrigation practices, but not significantly. *In situ* incorporation of weeds of the modified SRI practice significantly increased the yield (6737 kg/ha) when compared to conventional weeding (6076 kg/ha).

Table 1. Weather conditions prevailing during the crop growth period

	Max. temperature (°C)		Min. temperature (°C)		Rainfall (mm)		Solar radiation (MJ/m)	
Crop growth period	P1	P2	P1	P2	P1	P2	P1	P2
TP-AT	31.9	31.6	22.6	22.5	98.6	203.1	14.9	14.4
AT-PI	30.9	30.4	22.0	22.0	284.7	178.9	13.8	14.6
PI-FL	29.8	28.9	21.9	21.1	129.1	91.4	14.9	15.1
FL-HT	28.3	28.5	19.0	19.0	23.6	14.8	16.2	16.3

Learning

- Irrigating fields up to the flowering stage to a depth of 2 cm after surface cracks developed, and thereafter irrigating conventionally, was found to give a similar yield compared to conventional irrigation, with a 50 to 56% saving of water.
- Incorporation of weeds is more beneficial for increasing the grain yield than removing them from the field, though part of this effect might be attributed to the soil aeration achieved with the conoweeder.
- Younger single seedlings per hill and 25 hills/m^2 produced yield similar to 3-week-old seedlings, 2-3 per hill, and 50 hills/m^2. This new practice could reduce farmers' seed cost, especially for hybrid seeds.

Prospects

Modified SRI methods offer scope for considerable reduction in the water requirement and in seed requirements, with an increase in yield attributable in large part to the incorporation of weeds in the soil and to soil aeration along with different plant management practices.