Adapting SRI in Tamil Nadu, India

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Tamil Nadu is India's southernmost state. About two million hectares of rice is grown, mostly under irrigation, with an average yield of 5 t/ha. Average rice productivity is the highest in the country. There is consensus, however, about the need to improve production, as water shortages are becoming increasingly severe, and overall production has stagnated in recent years.

The System of Rice Intensification, or SRI, was introduced only five years ago, and is currently the subject of much debate among agricultural scientists. But farmers are adopting it without bothering about the controversies raised. This is basically because of the visible results that SRI farmers achieve. By employing different principles which includes younger seedlings and wider spacing, SRI offers higher yields and incomes, lower cultivation costs, and other benefits. This article describes these principles on the basis of the experiences of farmers in this state.

Younger seedlings

In conventional rice production, farmers are recommended to transplant seedlings at between 25 and 30 days. In practice, seedlings are often transplanted later, depending on the availability of water or labour. When older seedlings are planted, the main tiller produces a poor early panicle, and the other tillers produce panicles later. This reduces crop growth and yields. SRI involves using younger seedlings. But, when advised to use 9-12 day old seedlings, farmers immediately become concerned, fearing that they may not be sufficiently strong to withstand being pulled out and transplanted. However, experience shows that not only are these young seedlings strong enough to withstand transplanting, they are also in a better condition to do so.

Nursery

Farmers in Tamil Nadu usually have a specific field earmarked for a nursery, which receives more manure. Sprouted seeds are broadcast in a well puddled and levelled nursery field. While seed rates of 20 kg per hectare are commonly recommended, farmers often use seed rates which are 3 to 5 times higher. This means that the seedlings are densely spaced, and as a result, less healthy. SRI practitioners recommend a 20 x 20 cm spacing and only one seedling per hill (see below), so only 25 seedlings are required per m^2, instead of 150 to 200. The wider spacing and single seedling per hill drastically reduces the seed requirements in the nursery, with only 7.5 kg of seed required per hectare instead of 20 kg. As a result, the nursery size can be reduced from 800 m^2 to 100 m^2.

In conventional cultivation, seedlings are uprooted, washed, bundled and transported to the main field. Quite often, the main fields are far away, so there is a long time gap between uprooting and planting. SRI practitioners try to avoid any establishment delays, and/or to remove the seedlings with the base medium, thus minimising any root damage and possible transplanting shock. This might appear to require more time and energy, but in fact it does not, as farmers use far fewer seedlings. Another positive aspect is that it is possible to have the nursery in one corner of the main field so that transfer time can be minimised. The experience of Tamil Nadu farmers has shown that these apparently small changes have a large impact on the final outcome.

Plant density

In Tamil Nadu planting distances of 15 x 10 cm and of 20 x 10 cm are conventionally recommended for short and long duration rice respectively. These recommendations suggest a density of two or three seedlings per hill, although farmers generally plant 4 to 6 seedlings. By contrast, SRI farmers leave wider spaces between the hills, and plant a single seedling in each. Farmers are apprehensive about whether there will be enough panicles per unit area, but rice has a self-adjusting mechanism with regard to tillering: closer planting reduces the tillering of individual plants and wider spacing enables higher tillering rates (depending in both cases on the fertility of the soil).

Photo: Edwin van der Maden

Nurseries can be smaller as less seedlings are needed under SRI practices.

Rice plants have a growth stage referred to as "time of the last productive tiller", which means that only tillers present at that time will become productive. This occurs between 20 and 35 days after planting in conventional cultivation. The goal then is to obtain the desired number of tillers before this time. When single seedlings of less than 14 days are planted at a wider spacing, each has nearly 10 days more for tillering. The wider spacing also gives the seedlings a larger zone from which to draw their nutrients. A spacing wider than 20 x 20 cm is appropriate if soil fertility is good. Some experiments in Tamil Nadu have shown spacings of 25 x 25cm to be better, and similar distances are recommended in Andhra Pradesh.

Transplanting

One of the major hurdles in the adoption of SRI lies in the transplanting process. In contrast to conventional rice production, transplanting in SRI needs to facilitate later weeding. So seedlings need to be placed in rows, preferably following what is known as "square planting": a model which allows weeders to pass in both directions. Farmers in Tamil Nadu do this in different ways, the simplest of which is to use nylon ropes to mark the correct spacing. Matchsticks or small pieces of coloured cloth are inserted in the nylon rope at the desired spacing, facilitating an even spacing along the row. Wooden rods with markings at the desired spacing are fixed at either end of the field to shift the lines.

The Acharya N.G. Ranga Agricultural University in Andhra Pradesh has worked with farmers to develop a hand-drawn marker used to make marks in a square pattern every 25 cm. The marker is now very popular in this state. But while this can save some labour and time compared to line sowing, its effectiveness depends on the field conditions. If the soil is too wet, the marker will sink and not mark the spaces corrrectly. This reduces the effectiveness of using the weeder. The marker is best used a few days after puddling, when the soil has settled and moisture levels are not too high. Efforts are currently being made to develop a floating arrangement to avoid the marker sinking.

Weeder use

Different evaluations have shown that weeding is one of the most important factors in SRI. This represents a major change in rice cultivation, and has a noticeable effect on the growth of the plants. Farmers in Tamil Nadu use two types of weeders. One is the rotary weeder, which is light (2 kg) and can therefore be used by women labourers. It can be used in plant spacings of 20 x 20 cm or wider, and is very useful for small scale and marginal farmers who can do the weeding without having to hire labourers. The other model, the cono-weeder, is used with wider spacings. It weighs approximately 7 kg and is mostly suitable for use by men. It has two cones which stir the soil thoroughly. Large farms have also introduced motorised weeders, though these are only successful if the square planting and lines are perfect.

Existing weeds are incorporated into the soil when the weeders are used every 10 days. This results in a considerable incorporation of biomass (more than 700 kg/ha according to different studies) and, more importantly, the maintenance of nutrients within the soil. Studies have also shown that weeder use causes an "earthing up" action which helps new roots to be formed. Further studies are required to analyse common farming practices, such as allowing animal grazing during fallow periods in fields where weed infestation is low, and the advantages and possibilities of green manure.

Shallow and intermittent irrigation

In Tamil Nadu, rice is grown in many different conditions, with water availability dictated by the monsoon rains. The north east monsoon season (between October and December) is the main rice season in both irrigated and rainfed environments. Farmers adopting SRI initially considered irrigating the fields in the evenings and draining the excess water the following morning. This, however, proved to be time consuming and labour intensive. At the same time, water scarcity led scientists to focus on other ways of saving water in agriculture, looking in particular at the possibilities of "improving" SRI.

In conventional rice production in Tamil Nadu it is generally recommended to flood the field with a layer of water up to 5 cm deep, one day after the disappearance of flood water. However, adoption of this recommendation by farmers is poor, due mainly to problems associated with water availability. No definite recommendation is given for irrigation under SRI, except that the soil should remain as aerobic as possible. Current practice among SRI farmers is to provide a water layer of up to 2.5 cm after cracks develop in the surface of the soil up to the panicle initiation stage. After that they provide the same depth one day after the surface water has disappeared. Development of surface cracks does not imply that the soil is dry or that the cracks will be deep enough to cause nutrient losses. Rather, it happens due to the formation of small hairline cracks in soil which is still moist but has no standing water. The soil is not allowed to dry out. This approach requires regular monitoring of the field, which is especially important in cascade irrigation areas and during the monsoon.

A comparative evaluation

The positive effects of SRI on rice production and water saving has prompted the submission of a policy note to the Government of Tamil Nadu. In a swift decision making process, the State Government sanctioned 25 million rupees to evaluate SRI in two major rice growing areas of the state: the Cauvery Delta and the Tamiraparani river basin in south Tamil Nadu. This was carried out through 100 Adaptive Research Trials in selected farmers' fields during the wet season of 2003-2004.

The trials compared SRI with conventional cultivation on 1000 m^2 plots without replication. All participating farmers were supplied with the required inputs and a weeder, and were asked to follow the different component parts of SRI. Grain yields were recorded carefully by collecting all the panicles from five randomly selected 1 m^2 areas from both the SRI and the conventional plots, and recording the grain weight after threshing and cleaning. The yield was reported at a 14% moisture level.

In the Tamiraparani basin, the grain yields recorded under SRI ranged from 4214 to 10 655 kg/ha and those from conventional cultivation between 3887 to 8730 kg/ha. Average results showed a yield advantage of 1570 kg/ha under SRI. Thirty-one farmers recorded yields of more than 8 t/ha under SRI, while only three farmers obtained those yields using conventional cultivation. Yield increase was associated with an increased number of panicles per m^2 and an increased number of filled grains per panicle. Of the 10 varieties used by the farmers, three were found to perform very well under SRI. Square planting was the only constraint faced by the farmers as they found that their former practice of random planting was much quicker.

Results in the Cauvery Delta area were similar. The additional yield advantage from SRI ranged from 500 to 1500 kg/ha. Increased grain yield under SRI was mainly attributed to a greater number of lengthy and productive tillers with an increased number of filled grains per panicle, and to fewer unfilled grains. Between 300 to 400 mm of water was reported to be saved through intermittent irrigation.

Adoption of SRI by farmers

SRI is attractive to small and marginal farmers because of the higher yields, the lower seed requirement and the relative ease of weed management. Results obtained by farmers throughout the state have convinced the Tamil Nadu State Department of Agriculture to actively promote SRI through its extension service. They set up demonstration trials in major rice producing areas of the state in the 2004, 2005 and 2006 rice seasons. Extension has helped spread SRI to farmers, as have the more informal farmer-to-farmer exchanges. The benefits of using younger seedlings, wider spacing and weeder use are best demonstrated by the visible results, which once seen by farmers lead to high uptake. Many NGOs are also taking a keen interest in this approach. ■

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