

What is the System of Rice Intensification?

The System of Rice Intensification — in French, *le Système de Riziculture Intensive*, referred to as SRI in English and French and as SICA in Spanish — is quite literally a “system” rather than a “technology” because it is not a fixed set of practices. While a number of specific *practices* are basically associated with SRI, these should always be tested and varied according to local conditions rather than simply adopted.

With good use of these practices, it is usually possible to increase rice yields by 50 to 100%, and increases of 200 to 300% have been achieved where the initial level of production was low. Such increases can be attained without requiring farmers to change varieties or to use any purchased inputs. Only about half as much water is needed with SRI, so there can be substantial water savings from this method of production.

The *principles* that underlie SRI practices are more important than the practices themselves, and thus these principles should be considered first. The practices that follow from these principles differ dramatically from those that irrigated rice farmers have used around the world for decades, centuries and even millennia.

SRI grew out of insights gained by Fr. Henri de Laulanié from his three decades of work with rice and rice-growing farmers in Madagascar. He sought to learn how the best possible growing environment can be provided to rice plants. SRI practices were crystallized in 1983, but were not evaluated or disseminated very much for a decade.

Indeed, SRI methods were even not tried outside of Madagascar until 1999, first at Nanjing Agricultural University in China, and then by the Agency for Agricultural Research and Development in Indonesia. Since 2000, the evaluation and dissemination of SRI has spread to a dozen more countries, usually with good results and sometimes with spectacular results. There is thus growing interest around the world in this system for rice production.

The objective of SRI is not to *maximize yields* but rather to achieve *higher productivity* from the factors of

production devoted to rice — land, labor, capital and water. Increases in productivity should be achieved in ways that benefit both farmers and consumers, especially poorer ones, and that are environmentally friendly if an innovation is to contribute to equity and sustainability.

The productivity of these four factors of production can be raised all at the same time with SRI practices, without tradeoffs among them. The exact yields obtained with the methods will vary considerably, since yields depend on the *skill* with which the practices are used as well as upon the *soil* and other growing conditions for the rice. So far, SRI methods have been able to raise the yields of any and all varieties used, both traditional and improved cultivars.

Principles

SRI practices derive from the following observations that come from the work and writings of Fr. de Laulanié:

- 1. Rice is not an aquatic plant.** Although rice can *survive* when growing under flooded, i.e., hypoxic, oxygen-less, conditions, it does not really *thrive* in such a soil environment. Under continuous submergence, most of the rice plant’s roots remain in the top 6 cm of soil, and most degenerate by the plant’s reproductive phase.
- 2. Rice seedlings lose much of their growth potential if they are transplanted more than about 15 days after they emerge in their nursery.** This potential can be preserved by early transplanting, before the start of the fourth phyllochron of growth, in conjunction with the other SRI practices.
- 3. During transplanting, trauma to seedlings and especially to their roots should be minimized.** Stress, such as from the drying out of roots, delays the resumption of plant growth after transplanting and reduces subsequent tillering and rooting. This principle does not mean that one can get good SRI

results *only* with transplanting; it means that transplanting when done should be done very carefully. *Direct seeding* can also be used with SRI practices as it avoids root trauma entirely.

4. **Wide spacing of plants will lead to greater root growth and accompanying tillering**, provided that other favorable conditions for growth such as soil aeration are provided.
5. **Soil aeration and organic matter create beneficial conditions for plant root growth** and for consequent plant vigor and health. This appears to be the result of having greater abundance and diversity of microbial life in the soil, which helps plants resist damage from pests and diseases.

Practices

To give effect to these principles, SRI is communicated in terms of a set of practices or techniques. These should be understood as *starting points* for experimentation and for fitting SRI to local conditions.

1. **Start by transplanting young seedlings**, preferably 8-12 days old and not more than 15 days, when the plant still has just two small leaves and the seed sac is still attached to the root. The nursery from which the seedlings are taken should have been cultivated like a garden, not kept submerged in standing water.
2. **Transplant seedlings quickly and carefully**, allowing only 15-30 minutes between uprooting from the nursery and planting in the field
 - a. Seedlings should be put 1-2 cm deep into soil that is muddy but not flooded.
 - b. They should be laid into the soil with care, with roots lying horizontally so that their root tips are not pointing upward.
3. **Plant the seedlings far apart**, with
 - a. One seedling per hill and
 - b. Relatively few plants per m².

In some soils, 2 plants per hill may give more tillers per m² but certainly more plants in a hill will create inhibitions on root growth due to competition.

4. **Plant in a square pattern to facilitate weeding**. The most common SRI spacing is 25x25 cm spacing, but with good soil conditions, the hills can be up to 50x50 cm apart. With a square pattern, weeding can be done in perpendicular rows.
5. **Keep the soil well drained rather than continuously flooded during the vegetative growth period**. Then, after panicle initiation, keep only a thin layer of water on the field (1-2 cm) until 10-15 days

before harvest, when the field should be drained. During the vegetative growth period of tillering, one can either:

- a. Apply *small amounts of water daily* — just as much as needed to keep the soil moist but never saturated, with no standing water. During tillering, the field should be left to dry out for several short periods (2-6 days), to the point of surface cracking; or
- b. *Flood and dry the field* for alternating periods of 3-6 days each throughout the period of vegetative growth. With either method, the objective is to avoid sustained hypoxic soil conditions that will cause the roots to form air pockets (aerenchyma) and begin to degenerate.

6. **To control weeds, there should be early and frequent weeding**. This is best done with a simple mechanical hand weeder often called a ‘rotating hoe,’ starting about 10 days after transplanting. Then weed about every 10 days, at least once more and if possible 2 or 3 times more, until canopy closure makes weeding difficult and no longer necessary. The purpose of any later weedings is more to *aerate the soil* than to remove weeds.

7. **Add nutrients to the soil, preferably in organic form such as compost or mulch**. This is optional since the above practices will increase yield in almost any soil, at least for several years. The best results with SRI come from soil that is rich in organic matter and microbial activity. SRI farmers often apply their compost to a preceding crop, such as potatoes or beans, rather than to the rice crop itself, to give more time for decomposition and microbial multiplication. Chemical fertilizers used with SRI practices raise yield, but they do not contribute as much over time to soil quality, which is a key factor in best SRI performance.

Approach

SRI is characterized as a methodology rather than as a technology because it is not to be presented to farmers as a set of practices to be simply *adopted*. The principles behind SRI should be explained so that farmers understand the reasons for the practices. Farmers should be encouraged to test, vary and evaluate the practices, *adapting* them to their own field conditions and taking factors like their labor constraints into account.

SRI was seen by Fr. de Laulanié as a strategy not just to increase rice production, but also to promote **human resource development**. Farmers, as a result of working with SRI, are encouraged to take more responsibility and more initiative for their own develop-

ment. They see that traditional practices or even introduced modern ones do not necessarily give the highest yields.

Experimenting with spacing, water applications, weeding, etc. and making their own evaluations of what can work best for them encourages critical and independent thinking. SRI is thus intended to be more than just an agricultural innovation. NGOs working with SRI have found that it can be very motivating for farmers.

Tefy Saina — the name of the NGO that Fr. de Laulanié and a number of Malagasy friends established in 1990 to promote SRI as part of overall rural development in their country — means “to develop the mind” in the Malagasy language. Thus in any efforts to extend SRI, farmers should become **engaged as partners** in the evaluation of its practices and become **involved in farmer-to-farmer dissemination** of the opportunities that SRI can open up.

For many farmers, **the first year of SRI practice is difficult**, especially doing the careful transplanting of tiny, young seedlings. More labor time per hectare is required when first using SRI methods. But as farmers become familiar and skillful with the practices, they find that SRI can take less time. Eventually, the whole SRI

operation can require less labor per hectare than do conventional methods. Changes in the human factor are as important as technical changes.

Also, farmers who are practicing SRI for the first time should be warned that for the first month and even up to 5 or 6 weeks, their field will look disappointing. There will be little green color to be seen as plants are small and sparse; and there will be no reflection of blue sky from standing water. One will see mostly mud. But once the exponential increase in tillering begins as a consequence of SRI’s plant, soil, water and nutrient management practices, the field will fill rapidly with impressive green growth. The flag leaf usually remains green and upright up to harvesting. There is little senescence of the rice plant above — or below — ground.

SRI farmers often get asked: What is the new variety that you have planted this year? The answer: It is the same variety as last year, only new management practices are being used to bring out the plants’ natural growth potential. This is the challenge of SRI, to achieve the full potential of rice by creating a growing environment for plants that is most conducive for vigor and production.

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