Farmers develop new hand weeders in Sri Lanka to make SRI less labour intensive. Photo: Norman Uphoff

System of Rice Intensification gains momentum

Norman Uphoff and Erick Fernandes

Since 1999, the System of Rice Intensification (SRI), developed in Madagascar by Fr. Henri de Laulanié in association with the NGO Association Tefy Saina (ATS) and many small farmers in the 1980s, is spreading to many countries. Various articles and presentations on SRI at national and international fora, especially those by Dr. Norman Uphoff, Director of the Cornell International Institute for Food, Agriculture and Development (CIIFAD) at Cornell University in USA, have motivated many people to experiment with the approach and evaluate it for themselves.

SRI is a 'system' rather than a 'technology'. It is based on the insights that rice has the potential to produce more tillers and grains than now observed, and that early transplanting and optimal growth conditions (spacing, humidity, biologically active and healthy soil, and aerobic soil conditions during the vegetative phase) can fulfil this potential. These principles are translated into a set of 'baseline' practices: transplanting of young seedlings, carefully one per hill, with wide spacing; no standing water during the vegetative growth phase; application of compost; and early and frequent weeding (see e.g. LEISA Magazine Vol.15, No.3/4, pp.48-49; Vol.16, No.4, p.12; Vol.17, No.4, pp.14-16). Practitioners of SRI are encouraged to vary and improve these practices, to see which can best give effect to the SRI principles in their specific situation.

The SRI approach has been tried in at least 17 countries under a range of climatic and other conditions. Farmers have worked with many different varieties (traditional, high yielding and hybrids) and soil fertility practices (organic, chemical, and a combination of both) and have developed several variants and improvements of the 'baseline' practices.

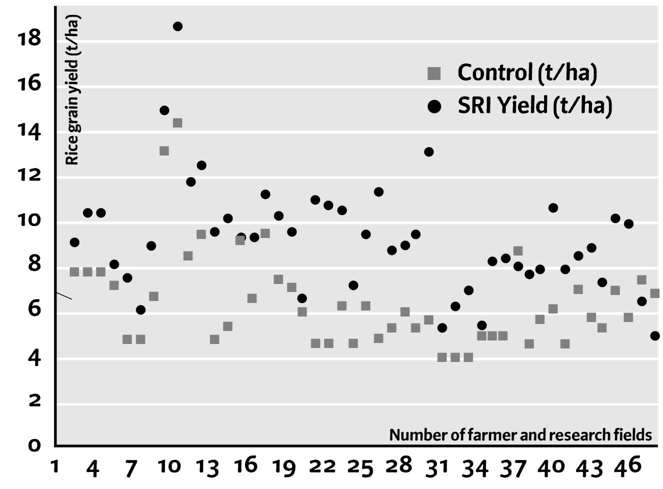

Figure 1: Comparative rice yields reported from cases where data were available on both actual SRI yield and comparison/control yield

First International Conference

As scientific validations of farmer and researcher experimentation have become available, it was timely to hold an international conference on the System of Rice Intensification. This was organised by CIIFAD and the China National Hybrid Rice Research and Development Centre, with co-sponsorship by ATS and the China National Rice Research Institute. It took place in Sanya, China, April 1-4, 2002. The objective was to better understand the variations in practices and the results that have emerged, and to establish means for communication that would facilitate evaluation of innovations from various sources and share them widely, so that farmers in many countries would have a longer "menu" of SRI practices to choose from.

Reports from China, Indonesia, Philippines, Cambodia, Laos, Thailand, Myanmar, Bangladesh, Sri Lanka, India, Nepal, The Gambia, Madagascar, Sierra Leone, Cuba, Peru, and the U.S.A. were presented at the conference. This article is a compilation of the main findings and comments.

Advantages

Numerous benefits associated with SRI practices were reported in the conference papers, the most important being an increase in

total factor productivity. Specific advantages included:

- **Higher yields:** increases of 50-200 %, with yields of 4-8 tons/ha common, but also yields above 10 tons/ha frequently reported (see Figure 1).
- **Increased returns to labour** with more production per day invested.
- **Water saving**: up to 50%, with higher productivity per unit of water applied.
- **Improvement of soil quality** and **increased efficiency of fertilisers**, both organic and chemical.
- **Reduced requirement of seed**: 5-10 kg/ha of seed is used, 5-10 times less than the quantity with the regular practice; this makes the use of improved and hybrid seeds much cheaper for farmers.
- **Less requirement of purchased inputs - water, fertiliser, seed and pesticides**, and lower costs of production contribute to **higher income** for farmers.
- **Higher seed quality:** SRI methods make it possible to increase considerably the yields for traditional rice varieties grown organically for which higher prices can be obtained; also, multiplication of 'breeder seed' can be faster as many more grains can be produced from a single seed.
- **Diversification of production**: less land is needed to produce the same amount of rice, freeing up land for producing green manure or crops with higher value.
- **Environmental benefits**, resulting from reduced demands for water and less or no use of agrochemicals.

The disadvantages reported included:

- **Requirement of good water control**, to be able to apply small amounts of water as and when needed to maintain soil moisture without saturation, rather than flooding fields continuously. Farmers who do not have such control or reliable access to water will get less or little benefit from SRI practices.
- **Requirement of more labour**, at least in the first year or two, as skills are learned for using the SRI practices quickly and confidently (see Box 1). This can be a barrier to adoption, even for poor households which are relatively more endowed with labour, if they need immediate returns from their labour to meet subsistence needs. At the present stage of development, SRI is mainly of interest to small farmers who have sufficient household labour. The challenge is to develop practices that make SRI suitable for situations where labour is more expensive and for larger-scale mechanised farming.
- **Drastic change of farmer practices** which is often not accepted by farmers, their communities, researchers and/or governments.
- **Requirement of greater skill** on the part of farmers, expecting them to adapt SRI practices to their own conditions based on their own trials and evaluations. This can, of course, contribute to human resource development, which is a benefit and not just a cost.

Box 1. Gender division of labour in SRI

We do not know how much SRI affects the gender division of labour within households, so this should be evaluated as a matter of some priority. Since SRI requires more labour per ha., at least initially, there is concern that this could increase the labour burden on women, who usually do the transplanting operation. Labour savings in terms of time spent on nursery construction and management with SRI would accrue usually to men.

However, conversations with women doing SRI transplanting in Sri Lanka indicated that they found SRI methods easier and quicker after the first year, once they became comfortable with handling tiny seedlings. Because lighter and fewer seedlings are transplanted, they reported that SRI transplanting had become quicker for them, and they found the technique more comfortable ("less backache").

In Madagascar, there are still complaints about the method taking extra time and effort, but the spacing for transplanting is still marked with ropes stretched across fields, rather than with a simple wooden rake that scores the surface of the fields with lines. With increased yield, women's burden at harvest time is probably increased, though a larger harvest helps maintain household food security, which is a major responsibility and burden for women.

Field experiences and observations

Using young seedlings. This is probably the single most important practice in SRI according to the factorial trial results in Madagascar, adding about 2.5 t/ha in this situation, other conditions being equal (Table 1). Some farmers have tried seedlings as young as 5 days; others have preferred older seedlings (3-4 weeks), e.g., because of slower growth in colder climate. Two evaluations in Madagascar have shown definite benefits from using younger seedlings. The advice to start by using 8 to 12 day-old seedlings remains sound, but decisions about seedling age need to match varietal and climatic differences.

Effective tillering. There is wide variation in tillering and the effectiveness of tillers. Sometimes there are up to 50% **unproductive tillers**, which cannot be explained very well. More often effective tillering is in the range of 60-80%, with some plots attaining 80-90%. How to optimise effective tillering is an important research question.

Quick and careful transplanting. Farmers have not found it difficult to transplant seedlings within 30 minutes, or preferably

Table 1. Factorial trial results, comparing yield responses on clay and loamy soils, Anjomakely, Madagascar, 2001

	CONTINUOUS FLOODING				SRI WATER MANAGEMENT			
	20-day plants		8-day plants		20-day plants		8-day plants	
	3 per hill	1 per hill	3 per hill	1 per hill	3 per hill	1 per hill	3 per hill	1 per hill
CLAY SOIL								
No Fertilizer	2.26	2.78	3.09	3.75	4.82	5.42	5.65	6.25
NPK	<u>3.00</u>	5.04	5.08	6.07	7.16	8.13	8.15	8.77
Compost	3.71	4.50	6.72	7.45	6.86	7.70	9.32	**10.35**
LOAM SOIL								
NPK	<u>2.04</u>	2.78	2.60	3.15	3.89	4.36	4.44	5.00
Compost	2.03	2.44	3.41	4.10	3.61	4.07	5.17	**6.39**

The yield figures reported (tons/ha) are each averages from 6 replicated trial plots. The average yield with conventional practices is <u>underlined</u>; that with all-SRI practices is **bold faced.** A traditional variety (riz rouge) was used for all trials, with soil type as one of the variables evaluated. These trials (N=240) were conducted in a village 18 km south of Antananarivo on the high plateau. More complete data from factorial trials conducted by Rajaonarison in 2000 and Andriankaja in 2001 are reported in the conference proceedings.

15 minutes or less, if they establish their nursery near the field. Farmers have found that using a trowel or other implement helps minimise trauma to the tender seedlings when they are uprooted from the nursery. Seedlings are sometimes planted in wooden or bamboo frames that can be kept in or near the house for protection and then carried to the field, so that seedlings are uprooted only at the time of transplanting.

Trauma during transplanting can be reduced by paying attention to the soil mixes used in the nursery and by appropriate water management practices. In Sri Lanka, for example, a nursery mixture of one-third soil, one-third sand, and one-third (chicken) manure has given very good results.

Traditional, improved or hybrid varieties. All varieties used so far have given higher yields with SRI practices, though not surprisingly, some varieties respond better than others, e.g., producing more tillers or giving better grain filling. It was observed that 120-140 day varieties responded most productively, but more evaluation is needed on this. The best SRI yields (up to 16 tons/hectare and higher) have been obtained with high-yielding or hybrid varieties, although traditional varieties, considered low-yielding, have also shown great yield increases. Since the latter are commonly preferred for taste and other qualities, and command a higher market price, they may regain popularity with SRI methods that increase yields up to 6-10 t/ha.

Seedlings per hill. 1 or 2 seedlings per hill can give good results depending on local conditions. Where soils are poor it may be better to use 2 seedlings per hill until soil quality is improved. There is enough evidence that 3 or more seedlings per hill retards growth due to plant competition below and above ground, and therefore does not need further experimentation. On good soil, single seedlings have been giving the best results.

Wide spacing. Some of the highest yields observed with SRI have come with very wide spacing, 50 x 50 cm, when soil quality is excellent. But spacing between plants is something to be optimised, not maximised, since one wants the largest number of grain-bearing tillers per sq. metre. This number is influenced by various factors (soil quality, variety) as well as by SRI practices, of which spacing is one. Most farmers are advised to start with 25 x 25 cm. Often 35 x 35 cm spacing has given the best results but on very poor soils 20 x 20 cm may be better.

Techniques of spacing. Instead of using strings to achieve desired and exact spacing, some farmers in Madagascar and Sri Lanka are now using wooden rakes with teeth (pegs) spaced at 25 cm, or wider, intervals to mark square grid lines on the muddy surface of their paddies. Farmers find that this speeds up the transplanting considerably (see Box 2).

Water management. There is plenty of evidence that in many conditions keeping the soil moist but unsaturated during the vegetative growth period is best. The SRI recommendation has been to add small amounts of water to the field daily, preferably in the late afternoon or evening (unless there has been rain during the day), and draining any excess (standing) water in the morning. This opens the soil to aeration and warming during the day. However, a large number of farmers, seeking to reduce their labour requirements, follow an irrigation schedule of alternate flooding and drying of their field instead of careful watering but not flooding during the vegetative growth period. It is not clear if this gives a higher yield but it does economise on labour. Certainly different practices are needed for clay vs. other kinds of soil. Further research is also needed to understand the implications of such changes at large-scale for water distribution and the environment.

Weeding. When fields are not kept continuously flooded to combat weeds, farmers have to use other practices. With SRI, early and frequent weeding is also important to aerate the surface of

Box 2. Adaptation and innovation of SRI practices in Sri Lanka

One of the reasons for fast dissemination of SRI in Sri Lanka is the enthusiasm and creativity of farmers to adapt and innovate SRI practices to resolve their field problems. The following are highlights:

- Various soil-enrichment practices have become part of the system including green manure (e.g. sunhemp), rice straw, chicken dung, and mixtures of certain green leaf extracts with cow dung. In this way farmers are improving soils degraded by conventional rice production practices without needing to transport huge quantities of compost to their paddy fields.
- Practical problems encountered in using the rotary weeder have resulted in alternative weeder designs to suit the specific conditions of different fields. Weeders are manufactured and sold by several farmer companies and private sector entrepreneurs. A motorised weeder is at the design stage in three locations and will be tested soon.
- To make transplanting easier, a rake was produced to draw lines in a square grid pattern on the ground. Seedlings are planted at the intersections of lines.
- A transplanter that can do careful planting of one seedling per hill in 6 rows at a time with required spacing has been developed.
- A seeder, which can drop one or two germinated seeds at the desired spacing has also been developed and is now in use.
- A foot-pedal water pump with sprinklers is being experimented with to ensure required moisture during the growth period and after panicle initiation. This is especially useful in drought periods when surface water is scarce, and also to ensure production of high-value organic rice for the export market.
- Many farmers are using different combinations of plant extracts, with or without 'effective micro-organisms' (EM), to avoid the use of chemical pesticides. They experiment with different plants available in highlands around the paddy fields. Some plant extracts are used not only as insect repellents but also as a source of nutrients.
- Farmers have stopped plastering their bunds and leave the grass cover on the bunds to protect the habitat of rice-pest predators. In this way they support biological pest control and microbial activity in the soil to improve soil health and biodiversity in the paddy fields. This saves money for plastering and pesticides and thus reduces production costs.
- SRI farmers experiment with different spacing and direct seeding. They also do careful time planning to prevent flowering during the full moon phase. They find that this reduces damage by insect pests.

The benefits achieved by farmers from SRI and other improved practices are attractive. Farmers have been able to at least double the yield they got from conventional practices while also reducing their production costs, often by half. They have become producers of quality rice earning a slightly higher income from sale as seed paddy. Biocide-free SRI rice fetches a higher price in the market, and the demand is increasing. Production of organic and traditional rice for export is increasing with one farmers' group already obtaining certification for production of organic rice. In this way SRI is becoming a viable alternative for farmers cultivating small plots obtaining average yields of 8.5 tons/ha, achieving higher returns from reduced inputs, while increasing the productivity of land, water, labour and capital. Besides, SRI farmers produce clean and healthy rice through eco-friendly practices.

More information on the experiences in Sri Lanka can be found in Box 4 and in the Proceedings of the International Conference on SRI

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Training material used in Madagascar showing the steps involved in planting SRI rice.

the soil. SRI farmers could use hoes or weed by hand, but 'rotary hoes' or 'cono-weeders' are recommended. Access to mechanical hoes can be a bottleneck. Labour required for hand weeding can be as much as 20 – 25 days for one ha in Madagascar. Recently, SRI practitioners in Sri Lanka have developed a new design for a push weeder (see Box 2 and photo on p.24) which makes it possible to weed 1 ha in 3 to 5 days.

Soil and nutrient management. With SRI, the highest yields have been obtained with organic soil amendments, particularly compost. Research in Madagascar has shown that compost gives a considerable increase in yield compared to NPK fertiliser, especially for traditional varieties (Table 1). But it was also reported that most farmers are using neither compost nor NPK on their crop, and still getting yields with SRI methods that are twice as high as with standard methods. Participants wondered how this is possible, and for how long farmers can continue with such nutrient-depleting practices. At some point there may be soil nutrient constraints, e.g., P, that have to be alleviated by adding sufficient soil amendments. Often there are not enough organic nutrients available and chemical fertilisers are too inefficient to be profitable.

Better understanding of soil life and biological soil processes are needed to develop effective, efficient and sustainable soil fertility management strategies for SRI. There seems to be much scope for Integrated Soil Fertility Management (ISFM) practices. Green manure, composted rice straw, micro-nutrients and sprays of soil micro-organisms and plant extracts seem to be organic practices with good potential. Incorporation of a green manure crop either before rice (e.g., *Sesbania rostrata*, mung bean or bush bean) or after rice (e.g., jackbean) could work well with SRI. Researchers at the Tamil Nadu Agriculture University in India have good experience with sowing of green manure (*S.*

Box 3. SRI adaptation and diversification in Cambodia

After farmers gain confidence in SRI, they become interested in refining the ways of increasing rice production and diversifying rice-based farming systems. The following trends have been observed:

- Farmers modify the way that they transplant depending on their specific conditions, especially the age of seedlings and spacing. They are keen to assess appropriate practices in plant management for themselves through experimentation.
- It is much easier to talk to SRI farmers about integrating green manure after and before the rice crop, and they are more ready to invest in growing green manure.
- Some farmers are developing simple tools for weeding, like small hoes and harrows. The concept of soil aeration through weeding, which contributes to improved root growth, is now well understood by SRI farmers.
- This year, two farmers started with zero-tillage, and there are more farmers becoming interested in the practice. Zero-tillage is possible since SRI makes the cultivation of traditional rice varieties that produce a lot of biomass for mulching attractive again. So far, we observe that rice growing under zero-tillage is doing well, even better than the normal practices.
- When farmers see that their rice yield is increasing, they are willing to use part of their rice fields for growing other crops and for raising fish. We call this a multi-purpose rice field, or the System of Intensification and Diversification (SID) of rice production. Earlier, they would not consider diversification, as growing less of the staple food, rice, was unaffordable.
- Some SRI farmers return to practices of mutual help in transplanting, because those they would normally hire do not have the skills to transplant as required by SRI. By pooling their labour they find they can get good and quick results.

Based on our experiences, the SRI approach contributes significantly to increasing farmers' innovative capacity, community learning and cooperation. Now, we see that ecological intensification of rice production through the small farmer group approach is a very good entry point to sustainable agriculture and rural development in Cambodia.

More information on the experiences in Cambodia can be found in the conference proceedings.

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rostrata) within rows of rice plants and incorporating it into the soil with a cono-weeder, 30 days later. They have developed a special drum-seeder for this purpose.

With wide spacing of plants in SRI, broadcasting of fertiliser is less efficient. Application of chemical fertiliser granules (as successfully used in Bangladesh) or compost near the plants can be more efficient. Flooding and adding chemicals can have a strong negative impact on soil life and may affect crop production, but a lot remains to be understood. More ecological learning is needed to find the best soil management practices. Research presented to the conference from Madagascar indicated that crop responses to compost are non-linear, i.e., there may not be greater benefits from applying 4 or 6 t/ha compared to 1 or 2 t/ha, as the smaller amounts appear sufficient to "incite" the biological life of the soil and give good crop results.

Prof. L.P. Yuan of the Chinese National Hybrid Rice Research and Development Centre explaining his experiments on SRI using super hybrid rice varieties and inorganic fertilisers. Yields of 12 to 16 tonnes are expected. Photo: Coen Reijntjes

***Land preparation*.** Good land levelling is important for getting best results from applying small amounts of water. At the same time, a proper drainage system for the field should be established so that alternate wetting and drying of the soil can be done effectively. With SRI, land preparation (puddling) does not differ from standard practices. There could be considerable saving of labour and energy by combining zero-tillage with SRI practice (both follow similar agroecological principles), but experimentation and evaluation on this remains to be done.

Raised beds, zero-tillage and direct seeding. One of the most promising adaptations of SRI appears to be the use of raised beds as being experimented with under the Rice-Wheat Cropping Systems Consortium in India and Pakistan (see LEISA Magazine Vol.16, No.4, pp.8-10). These beds are elevated 10-15 cm above the bottom of furrows in which irrigation water is intermittently issued. This can give water savings of 25-30%, with positive effects on yield due to soil aeration.

Some SRI farmers who have compared direct seeding with early transplanting found no difference in yield, but some saving of labour. Zero-tillage with mulching and direct seeding is practised with very positive results by farmers in, for example, Japan (Fukuoka), Sri Lanka (Nava Kekulama, LEISA Magazine Vol.13, No.3, pp.20-21), Nepal (LEISA Magazine Vol.16, No.4, pp.11), and Cambodia (Box 2). SRI was developed for irrigated lowland production, but some of its principles and practices could be extrapolated to rainfed areas. Some experiments in Madagascar, of direct seeding instead of transplanting, and using leguminous shrub cuttings as a mulch instead of mechanised hand weeding, have given good results (4 t/ha) in upland rainfed cultivation. This is a new direction for SRI research.

Ratooning. Some farmers in Madagascar let their SRI rice regrow after harvest for a second crop. The yields are not as high as the first crop, 60-70%, but this is profitable since it saves labour otherwise required for land preparation, sowing and transplanting. In Thailand, some farmers do a second ratooning.

Pest management. With SRI, rice plants are well developed and healthy due to organic soil management, high soil quality and deep rooting, which makes them more resistant to pest and disease attack and drought. Other traditional, organic or Integrated Pest Management (IPM) practices could help to make SRI rice production even more pest and disease resistant.

Diversification, from monocropping to integrated rice-based farming. Some SRI farmers who have discovered that they can produce the same amount of rice on less land have started to diversify their rice farming systems by growing green manure or higher-value crops and trees on the land no longer needed for rice production. This provides a higher income and has some advantages for pest and weed control and for soil fertility management. Integration of fodder crops and improvement of animal production can be a next step. In fact, SRI can be an important entry point for developing integrated rice-based farming systems that combine high production and profitability with high resilience and ecological sustainability.

Adaptation and diffusion

SRI is a complex system, which implies many drastic changes of current farmer practices. To train farmers in SRI is not so difficult, but there could be various difficulties in practising it. It is not just a matter of diffusing a few standard practices but rather of spreading a more holistic understanding of how rice plants can be grown more effectively. As adaptation to local conditions is needed, **farmer experimentation** is an essential part of any strategy for the dissemination of SRI.

From a scientific perspective, precise and well-documented comparisons are needed, both to convince scientists and to gain a better understanding of the potentials and limitations of SRI. Standard systems of evaluation and statistical analyses are necessary for scientific credibility. As this does not always combine well with a process of group-based farmer experimentation, effective **methodologies for participatory technology development and assessment** can be very helpful (see for example LEISA Magazine Vol.15, No.1/2).

Adaptation and diffusion of SRI is a very strategic process. It is important to convince **top-level government people** of the efficacy of these new methods and where possible to get policy-level promotion. **Political backing** for SRI will probably be gained most quickly and strongly where there are enthusiastic farmers who support the methods based on their personal experience and who are able and willing to lobby on its behalf. Successful SRI farmers will certainly be more effective in talking to politicians than researchers.

There should be special strategies to convince **professionals** in agriculture, who often find it hard to accept this new methodology. The mention of super-yields attained with SRI (e.g., 21 tons/ha in Madagascar) is seldom believed by researchers even when yield component information is provided, so it may be best to *stress average yields*, not those that can be attained with best SRI practices.

As long as governments do not accept SRI, there is a need for **alternative strategies** of dissemination. Even where there is government acceptance, multiple avenues for evaluation and dissemination can be complementary. So far, **NGOs** have been most active in taking advantage of SRI potentials, particularly attracted to SRI for its pro-poor, environmentally-friendly features. **Farmer groups** often are very interested in experimenting with SRI and in providing farmer-to farmer training to their colleagues.

SRI could be combined well with **Community IPM** and **Farmer Field School** (FFS) programmes on rice as the philosophy of experimentation and human resource development is common. **Credit facilities** may be needed for purchasing tools, in particular weeders. These can be very cheap, but for poor farmers even small expenditures like this may be a barrier. This, in fact, is the only area in which SRI requires credit.

Conclusions still provisional, further information on internet

As most of the knowledge about SRI is quite recent, conclusions about it must remain provisional for now, pending more years of experience and wider utilisation of SRI in a greater variety of circumstances. Much research is still needed to understand the ecological processes involved and to develop a variety of best practices. More insight is also needed in the applicability and limitations of the approach and the possible risks involved. The initial results are, however, mostly very positive and give reason to suggest that more countries and more farmers should have an opportunity to evaluate SRI for themselves.

The proceedings of the First International Conference on SRI, including all papers, contact addresses, training materials and illustrations are accessible on an SRI internet homepage: **http://ciifad.cornell.edu/sri/** Printed and CD-ROM copies are also available on request. The internet will also be used for follow-up information and discussions. Please send experiences, both good and bad, and comments too!! SRI networks have been established already in Bangladesh, Indonesia and Philippines and are being set up in China, Sri Lanka and elsewhere.

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Box 4. Experiences with diffusion of SRI

Several participants reported on how the process of diffusion has proceeded so far in their countries. These experiences differed considerably from one country to the next:

- In **Madagascar**, SRI was introduced first by an NGO, Association Tefy Saina, through training and farmer-to-farmer extension, supplemented by booklets and radio. Subsequently there was also some involvement from the university and government. But most farmers have still been hesitant to try these radically new production methods, and the spread has been slow. No exact statistics are available on the number of farmers using SRI methods. This is at least 20,000, but the Ministry of Agriculture has estimated the number could be as high as 100,000 (10% of rice cultivators). Use is accelerating now that a larger and better-equipped NGO, Catholic Relief Services, is involved in SRI dissemination, with donor support.
- In **Indonesia**, dissemination is just starting after three years of evaluation by government researchers. SRI methods have been incorporated into a new official strategy for raising rice production (Integrated Crop Management) that is being supported on a national basis, expecting to make appropriate local adaptations. This country's IPM programme is also starting to work with SRI as this is very consistent with the agroecological approach and dissemination strategy used in its Farmer Field Schools.
- In **Sri Lanka**, SRI is reported to be spreading fast. Dissemination started with an article on SRI experiences in Madagascar printed in the Ministry of Agriculture's extension magazine in 2000 (30,000 copies were distributed). A researcher from Madagascar, Joeli Barison, had visited Sri Lanka to share his knowledge on SRI in January the same year. Agricultural officers and extension workers who tried SRI on their own accord got good results. TV and radio became interested, creating a process of dissemination that could not be stopped any more. Rotary weeders, since long forgotten, have been reintroduced, with fabrication instructions spread among local blacksmiths. One ecological rice farmer, Mr. H.M. Premaratna, became the leading SRI farmer, trainer and promoter, transforming his farm into a training ground (Nature Farming Centre) where more than 4,000 farmers have been trained. Unfortunately, some researchers in Sri Lanka have remained opposed to SRI, and official endorsement for dissemination has not been obtained yet from the Ministry of Agriculture. The previous Deputy Minister has been very supportive and has used SRI very successfully on his own farm (up to 17 t/ha yield). The present Minister has declared SRI to be an important cultivation practice especially suited for small farmers. A green light from the government is expected once there is more research results to confirm existing findings. Opportunities to export organically-grown rice that uses SRI methods have also helped to raise interest in SRI among farmers.
- In **Cambodia**, the NGO CEDAC has been working with farmers to disseminate and innovate the SRI approach since 1999. CEDAC helps farmers to understand the principles of SRI and to analyse the practices that keep rice from achieving its full potential. Now there are at least 2,000 farmers actively experimenting with SRI.
- In **Laos**, some small-scale NGO experimentation and evaluation with farmers has begun. The International Rice Research Institute (IRRI) programme in Laos has now taken the initiative to launch a national evaluation starting in June 2002. It expects to do three seasons of testing before making recommendations, but some farmers are likely to start using it more quickly if the initial results are good.
- In **Cuba**, some top-level officials became convinced about SRI at an early stage as it meets the country's needs to raise rice production without reliance on petrochemical inputs. Dissemination can go very fast here because of farmers' literacy and their need to find ways of raising rice production without expensive inputs. The first sugar cooperative to try SRI methods on one ha of land got a yield of 9.5 t/ha as opposed to the usual of 6.6 t. The next season, it got 11.2 t/ha from its SRI field, and is fully persuaded of SRI's merits, even though it was not yet using young seedlings or doing any weeding to aerate the soil. Just changing the regime of water management and using wider spacing with single seedlings made a big difference. In the current season, when 12-day-old seedlings were tried on a small plot, their superior growth after 40 days has persuaded farmers to start utilising the full system next season.
- In **China**, SRI evaluations have been done at various rice research stations. Chinese rice scientists are very interested in SRI methods as they can increase the already very high yields of super hybrid rice varieties. They have concluded that SRI is a good way to improve rice production in China, especially given the need to reduce water demands. But certain adaptations will be needed to suit Chinese conditions, where labour costs are high and organic fertiliser material is in short supply. A next step will be to encourage farmers to try SRI methods for themselves. In Sichuan province, researchers have taken SRI already to six different locations (agroecological zones). Many innovations being made in rice production, e.g. triangular planting system, seed inoculation, paper frames for transplanting, intercropping with glutinous varieties for pest control, could be useful outside China as well.