

REPORT FROM S.R.I. VISIT TO CAMBODIA - January 14-18, 2003 - Norman Uphoff

Summary: Below is a narrative report on a five-day visit to Cambodia to participate in a national workshop on SRI held in Prey Veng, a provincial center in the eastern part of the country. It provides some "flavor" as well as facts and figures. What was learned during this visit can be summarized thus:

- SRI is being evaluated and promoted by a **diverse set** of farmer, NGO, government and donor efforts. These have been spearheaded by CEDAC (the Cambodian Center for Study and Development of Agriculture), working in cooperation with the PRASAC II project, GTZ and NGOs supported by OXFAM-UK. Provincial and district officials are getting increasingly interested in SRI, but most of all, the level of farmer acceptance and even enthusiasm is growing.
- The workshop documented the **spread of farmer use** of SRI, from 28 in 2000 to over 2,600 in 2002. Average yields with conventional rice-growing methods in Cambodia are in the 1.5-2.5 t/ha range, even with fertilizer and improved varieties in many cases. With SRI, most yields averaged around 4 t/ha, at least 50% higher than comparison yields, with some SRI yields in the 8-12 t/ha range. The national average yield for rice in Cambodia is 1.8 t/ha.
- **Adoption of certain practices** is proceeding rapidly and smoothly: transplanting single seedlings, wider spaced, reduced water applications, increased use of compost, and frequent weeding. However, transplanting really young seedlings, 8-12 days old, has not been widely taken up, even though there is evidence from farmers and researchers that shows its benefits. The average age of seedlings used with SRI is 21-25 days, well beyond the fourth phyllochron.
- Since factorial trials have shown that the **use of young seedlings** is the largest single factor contributing to higher SRI yields, Cambodian SRI yields can probably be raised considerably higher, by at least 1-2 t/ha, by adoption of this practice.
- Also, there is still more scope for improving **water management** with SRI, which could raise yields still more. Flooding in the rainy season is presently the main constraint to achieving the full potential of SRI. Infrastructure investment and social organization to control water better, e.g., using groundwater, could further enhance SRI yields.
- The most surprising finding from the workshop was farmers' insistence that they find there is **no increase in labor requirements** with SRI. Indeed, many maintained that SRI **reduces their labor requirements**. If this becomes a general consequence of SRI, it will further increase the benefits of this system and speed the rate of its adoption. (Farmers associated with Indonesia's IPM farmer field schools reported the same conclusion in January evaluation workshops.)
- Further, women SRI farmers reported that SRI **reduces women's labor input** in growing rice. This has not been reported before. It may reflect the skill with which Cambodian women rice farmers have mastered the techniques, but it could prove to be more general.
- Interesting experiments have begun using **green manures** or **zero tillage** with SRI practices. The results are quite encouraging for the first year, about 4.5 t/ha. There are reasons to believe that these results will improve over time as the new practices improve soil fertility.

Farmers are certainly interested in -- and motivated ones are quite able to grasp -- many of the scientific **explanations** that we can suggest for superior SRI performance, such as phyllochron analysis, root exudation, mycorrhizal associations, and phosphorus solubilization. More efforts should be made to develop good materials for communicating effectively on these subjects since this could help farmers better understand and adapt SRI practices.

The workshop, organized by CEDAC with support from PRASAC II and OXFAM-UK, was held January 15-17. It was attended by 50 farmer representatives from seven provinces and by representatives of NGOs, government programs, and donor agencies. The Prey Veng PRASAC office provided logistical support for the workshop and funded travel for participants as did OXFAM. (PRASAC is the Support Programme for the Agricultural Sector in Cambodia project, funded by the European Union, working in Prey Veng, Takeo, Kampong Speu, Kampong Chhnang, Kampong Cham and Svay Rieng provinces.)

Opening Session: The governor of the province opened the workshop with a very strong endorsement of SRI. Next, I gave an overview of SRI, its principles, its origins, and its diffusion internationally. CEDAC's director, **Koma Yang Saing**, then reported on the diffusion of SRI in Cambodia. In 1999, after reading about SRI in the ILEIA magazine, Koma had tried the methods himself, to be sure that they could give better results before his NGO began promoting them. In 2000, there were the first field trials directly with farmers and other organizations. That year, 28 farmers in 18 villages in 3 provinces tried SRI. This past year, 2002, the number of farmers using SRI with CEDAC assistance has grown to 1,006 in 124 villages in 7 provinces.

Other organizations have also gotten involved with SRI in cooperation with CEDAC. PRASAC II started by supporting SRI extension in Prey Veng province in 2001, with 200 farmers cultivating 8 hectare of SRI. This year, 2002, there are 1182 farmers in four provinces using SRI on 130 hectares, with an average yield of 3.26 t/ha (the highest yield was 8 t/ha). GTZ is working with SRI promotion in Kampong Thom and Kampot, while eight Cambodian NGOs are working on SRI in 6 provinces. Overall, more than 2,600 farmers in 10 provinces are using SRI.

A PRASAC staff member working in Prey Veng reported on a survey of farmer practices with SRI and conventional methods. Of most interest, 90% of farmers said that SRI involved the same or less labor, while only 6% said it required more. (Some gave no opinion.) Most of the farmers who knew about SRI but had not started using it said that they did not have enough organic matter or were "waiting to see."

A farmer from Prey Veng commented that he had received training from PRASAC Prey Veng in 2001 and started SRI with two varieties, one an IR variety and one traditional. He followed the recommendations and got 7.2 t/ha from 100 m², which amounts to 7.2 t/ha from the improved variety; he got 5.2 t/ha yield from the local one. The third time he used SRI methods there was a lack of water and he got 4 t/ha from the IR variety with little water control. Other farmers got much lower yields. He said he would continue with SRI in the future because he didn't have much capital and it doesn't require fertilizer or chemicals. "I can make my own compost, and I want to expand the area," he said in conclusion.

To close the morning session, the Deputy Director of the Provincial Agriculture Department spoke at some length. He started by saying that Prey Veng had already benefited a lot from SRI, adding that he saw "a lot of potential" for SRI in his province. After recounting a number of benefits attainable with SRI, the deputy director admonished farmers to "have courage" to try the system, repeating my comment that "SRI appears crazy" because the idea that "less can produce more" goes against logic and experience. "At first, I myself didn't believe that it could work," he said. "When I went to the field with some high officials, I couldn't see the seedlings, and I wondered how the people were going to get enough rice to eat from this crop. But after two weeks, when the seedlings started to grow, the farmers started to get interested and could see that it is a good system."

He confirmed the governor's statement that SRI has given good results in Prey Veng and urged farmers to do much experimentation with SRI, testing and comparing results. He had worked with the IPM program, which uses farmer field school methods, and liked this approach. "You don't need a formal agricultural education like I have to do experiments." He also said that "SRI is based on natural principles" and talked about the value of maintaining balance in the biological activity in the soil. "We haven't thought enough about the life in the soil, which becomes clearer with this new way of thinking."

He expressed satisfaction that SRI is spreading fast and said he will recommend to his Department that all farmers in the country learn about it. He welcomed the workshop as an opportunity for farmers to share experience and develop SRI methods through their practice. He concluded with a comment that there is a growing demand for "good quality products," clarifying this to mean "grown without chemical inputs."

"We need to develop agriculture that is good for health," a statement that would please CIIFAD's Food Systems for Improved Health group. As he had received a telex from the Ministry directing him to attend another meeting that morning he said he could not stay for the reports, so excused himself wishing everyone success.

After a break, there were farmer reports on SRI, starting with an elderly, somewhat wizened farmer, **Mey Som** from Kandal Province, who was introduced by Koma as "the first SRI farmer in Cambodia." Mey has become known among farmers as "the professor" because of his knowledge and earnestness when talking about SRI.

Som said that he had started working on agricultural innovations with CEDAC in 1997. When he first learned about SRI from Koma in 2000, he didn't believe that it could succeed. "The old men in the village said this could not work." Even when he first tried it himself, he didn't really believe it would be successful, but he did it as an experiment.

With conventional methods, he usually used 36 kg of seed on his half hectare of land. He used just 4 kg of seed (8 kg/ha), planting an unflooded nursery, with quick and careful transplanting, and got a yield of 3 t/ha. He didn't say what his usual yield was, but he considered this result a significant improvement. At first, people came and laughed at him, and criticized him, he said.

In fact, he commented, he himself wasn't convinced of the value of young seedlings. He tried this because of CEDAC's encouragement. Instead of transplanting seedlings at 10-12 days, he tried three ages -- 12 days, 15 days and 18 days. The 12-day-old seedlings were definitely the best. His paddy land is low lying, near a lake. Planting early, in June, well before the monsoon flooding, he said is a very good time, getting a lot of tillering and good resistance to pests and diseases. He has tried several varieties but now uses just one, a traditional variety that responds well to SRI practices.

SRI gives him now yields of 3.5-4 t/ha. He raises his seedlings in small seedbeds near the house, on banana leaves that can be easily carried to the field. He can protect them better this way, and transport is no problem. He uses organic fertilizer, including cow dung and urine. His soil is sandy so he needs to add organic fertilizer, and he also adds some ash from fires.

SRI is a good system, he said. With less seed, you can get higher yield. It is a complex system, at first somewhat difficult, but now it is easy. If there is enough water to get the plants started early in the season, before the flooding, he recommended this practice. Good land preparation is also important, he said. He said that he can get a high yield even if part of the field is affected by drought. He gets 30 to 65 tillers per plant.

The next year, 19 families in his community used SRI; now there are 180 families. Other villages are also taking an interest. Farmers have come and asked him for some of his seed, thinking that his high yields are due to new seed. He explains that this is not true, that the yields come just from new practices. "But some do not believe me and have come and taken some of my seeds when I was not in my field." After some questions and answers, the rest of the afternoon was devoted to reports from various provinces.

Kompong Thom: The representative of the CBRD/GTZ program in this province reported on SRI experience there. SRI work started in 2000 with 12 farmers on 1.7 ha, having CEDAC support and using a farmer promoter. Yields the first year ranged between 3.8 and 6.6 t/ha using several different varieties. The highest yield, interestingly, was with a local variety. In 2001, the number of farmers using SRI increased to 20, and in 2002, to 66. Yields with conventional methods averaged 2.84 t/ha; with SRI they averaged 4.12 t/ha.

Each village in the program now has at least 20 farmers using SRI. With conventional practices, farmers use 69 kg of seed/ha while those practicing SRI use 43 kg/ha (still 5-6 times more than recommended for SRI). The average age of seedlings used is 21 days (at least a week older than recommended). Use of chemical fertilizer has been reduced, with farmers putting about 14.5 t/ha of compost on their plots. They have observed increases in production using organic fertilizer. Koma added, when the report was finished, that farmer-to-farmer extension of SRI is increasing in this province.

Kampot: A GTZ staff member from this province reported that 104 farmers in three pilot villages there are practicing SRI on 10.7 ha. Their seed use on SRI plots is 21 kg/ha compared with 28 kg for conventional practice. (The first figure is too high, while the second seems rather low.) SRI farmers are applying 30 kg/ha of chemical fertilizer, compared with 120 kg/ha conventionally. SRI farmers apply 4.5 t/ha of compost while conventional plots receive none. The age of seedling is 21 days (too old) compared to 42 days otherwise. Seedlings are planted singly with SRI, and 5 per hill on average in conventional plots. Conventional yields averaged 2.07 t/ha (minimum 1.75, and maximum 2.26 t/ha), while SRI yields averaged 3.1 t/ha (minimum 2.15, and maximum 7.0 t/ha).

Farmer evaluations have indicated that they can save labor with SRI, up to 25%. (This is surprising, since we have usually considered SRI to be more labor-intensive, at least in the first year or two.) They get higher yield and see that their soil fertility is improved with SRI. Costs of production are lower, which is a real advantage. But still many farmers are waiting before trying SRI for themselves. They want to see continued high performance of SRI, or to have more instruction. GTZ is emphasizing farmer-to-farmer dissemination in its program.

A farmer from Kampot then discussed his experience. He was willing to try it first so that others could see and learn from him, he said. During the experimentation, there were some objections, e.g., some farmers said that their ancestors would be "worried." But he was successful and is now publicizing SRI in other villages. It is important that villagers start this with proper education about SRI. He enjoys spending time discussing the techniques. Diffusion is taking place, he says.

How can farmers save labor with SRI methods? I asked, wanting clarification on this point. The farmer said that SRI is very different for them. They used to hire labor to uproot and transport seedlings. These sometimes laid around for 2-3 days. With SRI, they do not hire anyone to do this any more. They can do the uprooting, transport and transporting themselves very easily and quickly. The first year, compost making was more difficult, but now they do not find it a problem. Now they are learning the techniques to control weeds, and work is going more easily. The farmer was asked about his yield. He has three plots, 0.24, 0.20 and 0.20 ha, and he got 3.4 t/ha yield from them. He used 14-day, 20-day and 30-day seedlings and found that the youngest were best.

Takeo: SRI work started here in 2001 according to the PRASAC staff member reporting. It has expanded from 5 villages the first year to 40 villages in 2002, in 5 districts. The first year, 9 farmers got a 4.7 t/ha average yield on 0.26 ha. The next season, 20 farmers got 4.07 t/ha yield on 1.04 ha. This past season, 215 farmers in 40 villages got 5.07 t/ha average yield on 8 ha.

The seed used with SRI cultivation is 12 kg/ha compared to 111.3 kg/ha conventionally. Fertilizer use is 35 kg/ha vs. 190 kg/ha, while compost is 5 t/ha compared to less than 1 t/ha. Seedling age averages 24 days (too old for good SRI practice) vs. 45 days conventionally. Number of seedlings per hill is 1-2 vs. 5. Spacing is 30 cm vs. 20 cm. Weeding is 2 times vs. 1 time. Water management is reduced water, 5 cm usually (too much) vs. continuous flooding.

Conventional yields the past season for participating farmers were 3.78 t/ha (minimum 3.27; maximum 3.91 t/ha). SRI yields were 5.16 t/ha average (minimum 3.5; maximum 7.5 t/ha). The usual yield in Takeo province is 3.1 t/ha.

Farmer evaluations are that there is no increase in labor requirements, and they can get about doubled yield. Soil fertility increases with SRI methods, probably due to the compost. They have reduced chemical fertilizer use by about 180 kg/ha. Reasons for non-adoption are often that they learned about SRI too late to change their methods. Also drought is cited as a reason. Some say that their soil fertility is too low, while others say it is hard to divide their fields into smaller paddies (to have better leveling and more water control). But many plan in the future to do such field reconstruction. Farmers say that they will increase their area under SRI, and the project will facilitate this, e.g., with group training in seed selection. In this province there are connections with neighboring Vietnam, where agricultural tools are produced. A good new machine for planting in rows that can save on seed costs about \$20-25.

A Takeo farmer then reported on his experience with SRI. At first he used only .05 ha, planting IR66 and doing good seed selection, land preparation and leveling. He used 1 kg of seed (a rate of 20 kg/ha). He transplanted 2 seedlings/hill, and his children helped with the uprooting since this was quite easy. He planted at low density, but with 18-20-day seedlings. He used little chemical fertilizer and stopped use of pesticides. His yield was 5 t/ha compared with the 2-3 t/ha he got previously.

He thought that extension should be easy because the system is simple to explain, however what is difficult is changing people's habits. "We need to start work step-by-step." In his village, they started with 4 SRI farmers, and there are 31 now. In the rainy season they have gotten 5.7 t/ha.

A woman farmer asked: how do you deal with conflict within the family over SRI? The Takeo farmer responded (assuming that the man would be interested in the new methods but the woman not) that it may take some time for the husband to persuade his wife to do SRI, a few weeks. "But after the SRI plants begin to grow, there is no more problem." The woman explained to the group that in her case, it was her husband who had resisted using SRI; but he was willing to follow her lead and there was no conflict. (After the meeting, the Oxfam-UK representative told me of a family in Battambang where the couple had separated for two weeks due to their disagreement over using SRI; once the plants started tillering profusely, they reconciled.)

Kompong Speu: The PRASAC staff member from this province said that they started only in 2002, working in 4 districts and 22 villages; 72 farmers cooperated in this drought-prone province. The average land size is 1.31 ha (minimum 0.35 ha, maximum 3 ha). Farmers used 22 different varieties, most of them local, but frequently IR66. The average area planted with SRI was 0.08 ha, with a total of 2.34 ha. The average conventional yield in 2002 was 1.8 t/ha (minimum 0.24 t/ha and maximum 5.2 t/ha). With SRI, the average was 6.18 t/ha (3.4 times more), with minimum of 2.5 t/ha and maximum of 11.4 t/ha. This year, 2003, 156 farmers are using SRI.

Farmer evaluations say that they get higher yield with less seed. There is no need to buy chemical fertilizer, which they appreciate. Soil fertility increases, and labor is not a problem. Children are also participating in uprooting the seedlings and transplanting with SRI methods. The PRASAC staff member then invited a woman farmer from Kompong Speu to report on her experience. She was slow coming up to the microphone, explaining that she felt "shy" about speaking before such a large group.

Once she started talking, she became animated and fluent. She said that even her children had been surprised by SRI when she tried it. Why do you use only one seedling? they asked. She used 16-day seedlings on 0.16 ha. The children helped her choose seedlings. Unfortunately they preferred to weaker seedlings, perhaps feeling sorry for them. Afterwards, though, they saw that this was not a good decision.

At first the tiny plants struggled, but she told the children to be patient. One week later, when the rains came, the seedlings "stood up," and then they started tillering, and the children could see the difference. Her soil is not good, she said, but she got a good yield, 351 kg compared to her usual yield of about 90 kg. This calculates to be a yield of about 5.5 t/ha, a four-fold increase.

What will she do in the future? she was asked. Normally she has had to spend more on inputs to do rice production, but SRI saves her costs. She will increase her land area under SRI, and 2 or 3 neighbor farmers will follow her. Two others are still hesitating. They come and count the tillers in her field during her absence, not quite believing the results. Now all members of the family assist in collecting organic matter to make compost to "feed the field."

Kompong Chhnang: The PRASAC representative said that SRI efforts in this province started only in 2002, in 17 villages with 40 farmers (out of the 429 who went through training). The SRI farmers used 13.9 t/ha of compost compared to 1.45 t/ha for those using conventional methods. The latter used 91 kg/ha of chemical fertilizer, while the former used none. The SRI yields averaged 4.43 t/ha compared to 2 t/ha with conventional methods.

Farmers in Kompong Chhnang were reported to be very interested, with high yields resulting and strong rice stands. The plants are taller and more vigorous. In 2003, at least 121 farmers are planning to use SRI methods on 4.52 ha. "SRI is a very appropriate technology" for Kompong Chhnang, is their conclusion. People can save labor and capital, with lower external inputs.

Then a farmer representative from the province was invited to speak. He expressed gratitude and pride in being able to participate in the workshop and to get experiences from different provinces. He said that nothing like SRI has been seen before in his community: "it is like magic." However, he went on to emphasize that farmers should take a self-reliant approach. "If we need help, we should help ourselves first... There are many obstacles when trying to achieve something like SRI... It is difficult to change habits." But if they can produce good results with SRI, he continued, there will be no need for advertising on TV or radio. SRI will spread farmer-to-farmer. "Farmers are usually more willing to come for handouts than for training. But if charity organizations give out rice or tools, this is only a one-time benefit, and we are still poor," reiterating his advocacy of self-reliance.

There are now 40 farmers using SRI in his village, and he was chosen as their representative to become a farmer-trainer. "People think they cannot feed their family using just single seedlings. But we have to challenge them to try SRI." He started with a 100 m² plot alongside a main road, "where many could see." He didn't flood the plot but started with dry sowing, transplanting the seedlings into a muddy field, having improved the soil with compost, leaves and manure.

At first, his children were unhappy, telling him that they were embarrassed by their father's behavior. Villagers were saying that these tiny transplanted seedlings could not survive. However, 16 days later, the plants had 12-17 tillers, and everyone's attitude changed. At harvest, the number of grains per panicle averaged 199, with a maximum of 270. The average yield in his field was 6 t/ha (0.6 kg/m²), with a range of 5 to 7 tons. The taste of the SRI rice, he added, was very sweet, with good smell and nice texture. He plans to increase his SRI plot to 1,000 m² in the next season. On this positive note, the first day's session ended.

NGO Reports: The next morning, a panel of NGO representatives shared their experiences. An NGO from Battambang province, Aphiwat Satrey (**Women's Development**), reported that 11 farmers in 4 villages there got an average yield of 5 t/ha with SRI methods in 2002. The NGO started with just one woman farmer in 2001 and is involved in disseminating SRI techniques to other villages.

The agricultural advisor for **Rural Development Association (RDA)** said that her NGO started its SRI work in July 2002, working with 8 villages and with 4 families in each. They had problems with flooding that limited yield increase, but there is definite interest in continuing with the methods.

Krom Aphiwat Phum an NGO established in 1993, works in Battambang province. It started SRI work in 2001, with CEDAC training of its staff. The first year, only one farmer tried SRI, on 12 m². He got a 5 t/ha yield, which compares favorably with a 3.5 t/ha average in the area. The next year, 53 farmers in 24 villages cultivated 10.3 ha of SRI, with an average of 5.5 t/ha, and a minimum of 3.7 t/ha and a maximum of 7.2 t/ha. That year, the average conventional yield in the area was only 2.5 t/ha. Farmers tried seedlings 15, 20 and 30 days old, and the youngest seedlings were "really good."

This NGO is doing extension work in the province through workshops, a newsletter, and farmer exchanges. It has less support from the provincial and local government than in Prey Veng; there is a lot of skepticism among officials in Battambang. SRI is important because small farmers have little access to chemical fertilizer anyway, so it is good if they can benefit from compost. The representative concluded with some personal comments: "I had the idea that we needed a large land area to produce enough food, but I have changed this idea. Even a small area can give a high yield with SRI. This system is easy. The most difficult part is water management."

Next, **CCK** (Cham Roeun Cheat Khmer) from Takeo province reported. It works in villages close to the border with Vietnam. CEDAC has helped it with training and dissemination. In 2001, 12 farmers used SRI and got 4 to 8 t/ha, with tillering in the 60-70/plant range. In 2002, 20 farmers used SRI and got 3 to 8.3 t/ha yields. The farmers' conclusion was the SRI is "a very good system for farmers." They can save seed and get a high yield. While SRI methods are difficult to use in the area because of flooding, farmer interest is growing.

Chethor (Mind + Dharma) started its SRI activities in 2001. It does extension work in 22 villages. Initially only 7 farmers in 4 village were willing to try SRI on 0.05 to 0.10 ha each. They got harvests of 0.48 to 0.61 kg/m² (4.8 to 6.1 t/ha). "When this work started, there was much skepticism. Farmers became interested only when they saw the rapid tillering." Another 10 joined in 2002. Now the 17 farmers are committed to each disseminating SRI to 5 more farmers, aiming to have 85 users in this next season.

The representative from **NAS** (Community Development Worker) active in Kompong Chan said this NGO's work with SRI started in 2001-2002 in 5 villages in 2 districts. It disseminated information to 21 farmers, 7 of them women. SRI farmers increased their average yield from 1.45 t/ha to 6 t/ha.

There followed various questions and answers. One of the main points agreed on was that "farmers can best learn and practice after seeing." This argues for organizing farmer exchanges and farmer-to-farmer communication networks. At first there will be resistance or disinterest. One PRASAC staff member said that 429 farmers attended the initial meetings on SRI in his province, and 89 expressed interest in SRI afterwards. But only 40 farmers actually tried the methods the first year. However, after that, acceptance has increased rapidly, after seeing results.

A JICA staff member asked how farmers can solve the problem of flooding, which seems to recur in many parts of Cambodia. A farmer from Battambang, Chhaeng, said that his area has much problem with flooding. There is need to form farmer associations first to discuss this problem, he said, to find solutions appropriate for their area. In his area, they are planting floating rice in June, well before the flooding that starts in September. The single seeds, widely spaced, grow very well and are able then to survive in the flood and give a good yield. But these strategies need to be work out and tested locally. There were other questions and discussions before the group adjourned for lunch.

Research Reports: After lunch, a CEDAC staff member reported results of a survey done on the practices and performance of 108 SRI farmers compared with 112 conventional farmers. The samples were randomly drawn, with standardized interviews to make comparisons easier. The average yields reported were 3.72 t/ha with SRI and 1.32 t/ha with conventional methods.

The most interesting data concerned chemical fertilizer use and yield with the two sets of practices, raising questions about the productivity and profitability of using chemical fertilizer. With conventional management practices, the returns appear to be marginal or even negative, though economic analysis remains to be done (and will be). More details on this survey will be provided in the workshop's proceedings. The following data are from the powerpoint presentation. Unfortunately, there was no multivariate analysis considering inputs of organic fertilizer:

SRI Practices	Fertilizer (kg/ha)	Yield (t/ha)
	Less than 50	2.78
	51-100	2.52
	101-150	2.19
	151-200	2.94
	201-250	4.20
	251-300	3.22
Conventional Practice	Less than 50	0.93
	51-100	1.10
	101-150	1.34
	151-200	1.75
	201-250	1.57
	251-300	1.81

Data on yield associated with different numbers of (mechanical) weedings when SRI practices are used were also interesting, though as noted above, the age of seedling and water management are often not meeting SRI recommendations, so even better results should be possible in the future with fuller use of SRI principles and practices:

Weedings	Yield
1	3.02
2	3.40
3	3.50
4	3.60
5	3.40
6	8.00

The number of farmers in each category (total N = 108) was not reported, and probably the last result may represent a very small number of farmers. I was surprised not to see more increase between 2 and 5 weedings, as has been documented in Madagascar. Water control was not as systematic as recommended for best SRI results, and possibly soil organic dynamics are different. I encouraged farmers in my closing remarks to experiment on their own fields with additional weedings to see if they can get a profitable increase.

Next, Sarun, a student at the Royal University of Agriculture reported on his thesis research on SRI. He measured yield, panicle number and size, grains per panicle, and grain weight associated with seedling

age. Plots were 25m² with three replications of the four treatments. Correlations of (young) age with yield, number of panicles, panicle length, and % of filled grains were statistically significant:

	Yield (t/ha)	Panicle Size No.	cm.	Grains/ Panicle	Weight (gr/1000)
8-day seedlings	5.76	29	24.2	152	20.81
12-day seedlings	7.77	31	24.4	172	20.72
16-day seedlings	6.76	26	24.5	155	20.88
45-day seedlings	5.80	25	24.5	161	20.58

The value of younger seedlings was supported overall, though experience elsewhere would lead me to expect considerably better performance from 8-day seedlings. Also, we have usually seen increased grain weight with younger seedlings. This is the kind of research that should be done many times, on different soils, with different varieties, etc., to establish overall patterns and any significant exceptions to any generalization.

Zero Tillage (ZT) and Green Manures (GM): Next **Prak Chres** reported on his experiment with no-till SRI. He said that people have always considered it very difficult to plant without plowing, thinking that there would be no yield. In 2000 he began training with CEDAC. At first he was quite worried about zero-tillage. But this method, together with SRI, he said, involves "working with nature." He added a lot of organic matter to the soil and got the fields properly "organized" to begin, with canals, dikes, drainage ditches, etc. "This was a big investment for me."

He had cultivated the plot with SRI methods in 2001, so there was a good supply of soil organic matter in 2002 when he started with ZT on 0.07 ha. His family did not agree with him. "I had to do this alone, with no help." He didn't get angry, he said, but just went ahead with the land preparation, the leveling, seedbed formation, etc. After the dry season harvest, he just put rice straw on the field and let it rot. He saw lots of earthworms, which was good, and he could see a lot of roots in the soil left over from the SRI crop.

The method was easy, he said, as no plowing was required. He just put seedlings into holes through the mulch, though in holes different from those of the previous season's rice plants. He didn't work any additional organic matter into the soil. His yield was 340 kg from the 0.07 ha, which works out to be a yield of 4.85t /ha. It is anticipated that this yield will go up in subsequent years as soil quality improves without the tilling.

Phorn from Kompong Thom then described his experience with ZT. He identified plots and measured them, 8 of them each 72 m² it. Then he used just a hoe and organic matter (straw and weeds) for mulch, planting the rice through the mulch. Crickets came and ate up the crop, so he "almost gave up hope," he reported. "At first I wanted to spray with pesticide, but I knew the dangers of this, so I refrained." He flooded the field to flush out the insects, and this was successful. About 7-10 days after flooding the young seedlings started growing very well. The top soil he could see was very good, and the rice plants took up nutrients easily. He considered the experiment very successful, with a yield of 4.33 t/ha.

Then a farmer working with CEDAC in Takeo province spoke about his efforts to improve soil through use of green manures. He first used soy as a GM on 0.048 ha in 2001 and then on 0.16 ha in 2002. Within one month, he could get 12 t/ha of organic matter from the soy. He has concluded that while compost is good, GM are better. He gets 7 t/ha with compost (and SRI methods) but 9 t/ha with GM.

A Prey Veng farmer then reported on his GM experimentation, started in 2001 after he had visited the farmer who had just spoken. He was trying to figure out how to diversify his farming operation at the same time he intensified production. If he could get more yield from SRI methods, he could put less of his

land into rice production and could grow more of other crops. He was willing to sacrifice some land area in the process. When planting 250 cashew trees and 32 mango trees, he gave up 0.12 ha of his 0.45 ha for canals, etc. His neighbors did not believe he would do something like this.

In fact, his wife was very angry with him at first. However, once she observed the SRI plants in their rapid tillering stage, she became more agreeable to this innovation. After the harvest when they got 4 tons of rice from their 0.33 ha, a yield of 12 t/ha, "she came to me and smiled at me."

The farmer discussed his land preparation and leveling efforts. He said that within one month he could observe the nitrogen fixation by rhizobia in the nodules of the cowpea crop that he had planted as GM. (It was wonderful to hear a small farmer talking about rhizobia.) This was ploughed into the soil 10 days before transplanting. By the time of transplanting, the organic matter was already decomposed in the soil. Neighboring farmers were so impressed that they came to get seed from him, and some even took it without permission. His yield was only around 2 t/ha, but he was satisfied with this as a first experiment. (The yield could have been more than 3 tons, but neighbors, including his brother, came and stole panicles from his plots, never having seen long, nice panicles like his, and they wanted to use the rice for seed next year.) He wants to continue using GM, to try to build up the soil further.

Koma asked one woman farmer, **An Meng**, who had also experimented with ZT to share her experience. She said, "I tried this because Koma had trained me. I had promised him I would try it, so I had to do it, though inside I was very hesitant. Getting started was not easy. But my husband and I love each other. So when I asked him that we try SRI with transplanting just single seedlings, he agreed. We started with a 5 are plot (0.05 hectare). Now I find that SRI really saves labor and it gives us more time to go to the market, to care for vegetables, and even to watch TV."

Someone asked her to explain how she put organic fertilizer into the soil. She said they work green manure and compost into the soil and transplant then 15 days later. "In my village, I would say there is a lot of organic matter available. Industrious farmers can collect it, even from the hills around the village. Two years ago when I started SRI, I had to go out collecting organic matter by myself." She put on about 100 kg on 5 ares of land, an application rate of 2 t/ha. "The rice grows very well."

Koma invited another farmer, **Sinhao**, to take the microphone. He said that he had practiced SRI on a small plot, only 0.02 ha, planting 12-day seedlings with 20x20 cm spacing. "People called me a crazy man. But one week later, there were lots of tillers." He collected a lot of organic matter, e.g., tree leaves, to mulch the soil. His soil is fairly good anyway because it is alluvium, and he was getting already 6 t/ha before. With SRI methods and mulch, he got a yield of 12 t/ha.

Technical Explanations: After a tea break, I made a powerpoint presentation to the group, presenting various reasons why we think that SRI methods give the good results that farmers had been reporting to the workshop over two days. With Koma translating the presentation into Khmer, I discussed the importance of practices that increase rice root growth: use of young seedlings, wider spacing, and soil aeration, also with improved soil structure due to increased organic matter and earthworm activity. I discussed also how beneficial soil microbial activity can increase due to greater root exudation along with soil aeration.

I said that we have evidence from our own experience and/or from the literature that with SRI practices there is biological nitrogen fixation, phosphorus solubilization, increased uptake of micronutrients, and other processes that enhance plant performance. I discussed phyllochrons, showing why transplanting young seedlings (before the 4th phyllochron) leads more tiller and root growth. I talked also mycorrhizal fungi which increase the volume of soil accessed by roots.

The terminology used was simple, but the presentation was a serious discussion of plant physiology, nutrition and soil ecology. The farmers and others present were very interested, taking in as much as possible. When finished, I asked for questions. A farmer came forward to say that he was feeling very good after this discussion, which had been to him like the song of a famous pop singer in Cambodia (I couldn't recognize the name) which was remembered long after the singer had passed away.

After a discussion of problems ranging from pest control to dealing with flooding (soil inundation), Koma divided the participants into five working groups -- three of farmers, one of extension personnel, and one of project managers and donor representatives. The rest of the afternoon was spent in these groups, some of which kept their discussion going until 6.

Group Reports: The next morning, everyone was assembled by 8 to resume the workshop. The farmers' reports were not yet combined into one presentation, so those from the extensionists and managers were given first. Both were very positive, but longer and less "farmer-centered" than I would have liked. There was clearly strong interest and a personal commitment from these groups of professionals to make SRI opportunities more widely and effectively available within Cambodia.

The farmer report was rather brief. **Ear Sophorn** from Kompong Thom started with an enumeration of the farmer group conclusions about the advantages of SRI:

- SRI requires less seed
- SRI requires less labor, with less time for ploughing and for planting
- Weeding is easier because rice is planted in rows (squares)
- Less money is needed for fertilizer and pesticides
- Soil quality improves over time; also good insects (microbes) are increased
- Water use is reduced
- Farmers become more involved in their agriculture, visiting their fields daily
- Yields are increased
- Agriculture becomes more sustainable

Disadvantages are:

- With less water application, weeds grow more easily. Solutions: do early weeding; flood fields at appropriate times; do good land preparation before planting; and use mulch such as rice straw or tree leaves to suppress weeds.
- Young seedlings are quite vulnerable. Solutions: protect the roots during transplanting; and plant carefully and in lines so weeding is easier. (He said that transplanting goes very fast.)

Next **An Meng** from Prey Veng spoke briefly, and emotionally. "I will remember this day all my life." She talked about the benefits of the workshop, being able to share experience with many people from other provinces. Then she admonished all of the men attending the workshop: "Please tell their wives how to implement SRI. Don't keep it to yourselves." She said that from her experience with SRI, it cuts down the labor for women, giving them more time for other things, "like going to the market, or planting trees." (An Meng had previously reported on her experience with ZT on the previous page.)

Srai Ken from Kompong Speu, the "hesitant" woman farmer reported on above, was even briefer. She spoke of her pleasure and surprise that so many people from so many provinces had come together to share experiences. She said she will continue to use SRI in her village and will work to extend it to other farmers. I think everyone was disappointed that the three farmer spokespersons did not take as long as the extensionist and manager did to present their ideas. But the written reports of the farmer groups will be presented in full in the proceedings.

The representative from Oxfam- GB questioned An Meng and Srai Ken. Does SRI really cut down on women's work? Yes, they responded. SRI requires less capital and less labor. And it gives them more rice, so they have some for sale as well as for home consumption.

I was then given the floor to present a number of questions that I thought farmers in Cambodia could help get answers to, to make SRI a more productive and sustainable system. The day before I had told them what I know about SRI; now I would tell them what I don't know and would like to know, going through a list of things regarding water management, seedbed preparation, transplanting, weeding, varieties, etc. that farmers could assess for themselves to determine what practices, timings, implements, cultivars, etc. are most beneficial under different circumstances.

There was good discussion after this, with farmers expressing their interest in undertaking efforts to evaluate SRI components and to share conclusions so that all could benefit from such learning. I stressed that SRI is not a system just for increasing rice production, but also for supporting human resource development. The name of the NGO promoting SRI in Madagascar, Association Tefy Saina means "to improve the mind," not "to grow more rice."

One new subject that came up was the use of groundwater, from pumps or wells, for SRI. This seems more advantageous with SRI than conventional surface water irrigation because there are incentives to cut costs by reducing water use. Also farmers have more control over water application and can apply it more sparingly, on an as-needed basis.

Concluding Session: After a tea break, the Deputy Governor of Prey Veng province arrived, standing in for the Governor who had been called that morning to a high-level meeting in Phnom Penh. Koma started the closing session with a short summary of SRI progress. In 2000, SRI work began in 3 provinces and 10 villages with 28 farmers. This past year, 2002, the work had spread to 10 provinces and 340 villages, with more than 2,600 farmers. (I calculated quickly that these were 3.3, 34 and 93-fold increases in two years).

The Deputy Governor pledged the provincial government's cooperation with NGOs and farmers to take advantage of SRI potentials. He said that SRI could help with poverty reduction and food security, two goals of the government. He thanked everyone and especially thanked the farmers for their participation in the workshop.

Then the Deputy Director for the Department of Rural Development and co-zonal advisor for PRASAC, **Um Bunleng**, who had hosted the workshop closed with thanks to everyone. He added apologies for Prey Veng being a less developed province than other parts of Cambodia, with a less developed provincial center. He was concerned that participants would not have had very good restaurants or comfortable places to stay. This was an unnecessary comment because I don't think anyone had come to Prey Veng for food or comfort. The participants had come with great seriousness and enthusiasm about SRI, and their "appetites" for knowledge and ideas had surely been satisfied during the two and a half days. The Deputy Director invited everyone to go downstairs outside for a group photograph of "the SRI family," as he put it, a nice thought.

As we went downstairs for the picture, I went over to An Meng and congratulated her on "becoming 16 years old again." She was surprised, as it took her a while to understand what I was referring to, even with good translation in Khmer from one of the CEDAC staff. I was referring to an exchange that Koma had told me about -- between him and An Meng when he first introduced SRI to her village.

An Meng had been incredulous when Koma explained SRI methods and results to her and her neighbors. She challenged him in front of everyone, saying: "If you can get those results, I can be a 16-year old girl again." In two years' time, she had gone from being an outspoken skeptic about SRI to being, as we had

just heard from her in the farmer group reports, one of its most ardent advocates. Because my knowledge of Khmer was even less than her knowledge of English, we could not communicate much by words, only through our smiles and strongly clasped hands. But it was gratifying beyond words to know that SRI has such a strong proponent in rural Cambodia.

After lunch, Koma and I met with representatives of the provincial government, PRASAC and Oxfam-UK to discuss follow-up efforts, which will surely be important for SRI dissemination. Among the farmers attending the workshop there are probably many others with An Meng's capability and conviction. With appropriate NGO, government and donor support of their efforts, SRI can surely spread. Indeed, if farmers in other countries find SRI to be labor-saving as the Cambodian farmers were insisting it is or can become, SRI will surely spread rapidly in many other countries as well.

SUMMARY OF CAMBODIAN SRI YIELD DATA, from reports to National Workshop

Report	Season	N	Area	SRI Yield	Comparison	Maximum
*PRASAC Prey Veng	2002	855	110	3.26		8.0
Farmer Rpt	2001-2	1		5.3		7.2
Provincial Reports						
KANDAL (May Som)	2000-2	1		3.75		
KOMPONG THOM	2000	12	1.7	5.2		6.6
"	2002	66		4.12	2.84	
*KAMPOT	2002	104	10.7	3.1	2.07	7.0
Farmer Rpt	2002	1		3.4		
TAKEO	2001	9	0.26	4.7		
"	2001-2	20	1.04	4.07		
* "	2002	215	8.0	5.16	3.78	7.5
Farmer Rpt	2002	31		5.7		
KOMPONG SPEU	2002	72	2.34	6.18	1.8	11.4
KOMPONG CHHNANG	2002	40		4.43	2.0	
Farmer Rpt	2002	1		6.0		7.0
NGO Reports						
Women's Developmt	2002	11		5.0		
Krom Aphiwat Phum	2001	1	0.12	5.0	3.5	
"	2002	53	10.3	5.5	2.5	7.2
CCK	2001	12		6.0		8.0
"	2002	20		5.8		8.3
Chitor	2001	7		5.5		6.1
NAS	2002	21		6.0	1.45	
*CEDAC Survey	2002	108		3.72	1.32	
Green Manure Experiments						
Phom	2002	1		4.33		
Takeo	2002	1	0.16	9.0		
Prey Veng	2002	1	0.33	12.0		
Sinhao	2002	1	0.02	12.0	6.0	
AVERAGE*				4.1*	2.7	7.7
All reports				(5.8)		

* Four largest data sets