

REPORT FROM FIELD VISIT TO FARMERS PRACTICING S.R.I. AROUND LAC ALAOTRA, MADAGASCAR - June 6, 2001 - Norman Uphoff

We get an early start in the morning, leaving the Ambatondrazaka project office of the Landscape Development Interventions project (LDI) at 7. This town located on the southeastern side of Lac Alaotra -- Madagascar's largest inland body of water -- is the commercial center for the region. The low-lying areas around the lake are considered as the country's "rice basket," having large stretches of suitable rice land. However, the lake as well as the rivers and streams that flow into it are rapidly silting up due to deforestation and resulting soil erosion in the lake's watersheds, especially to the east where Zahamena National Park is located with one of the largest expanses of remaining rain forest in Madagascar.

The accompanying loss of biodiversity in the lake's marshes and in the rain forests to the east has drawn LDI, a project funded by USAID, to the region, seeking to halt, and if possible reverse, the environmental degradation. SRI, a system of rice intensification, developed in the 1980s in Madagascar, by raising rice yields significantly, could take some of the pressures of agricultural expansion off the watersheds, areas around the lake, and the marshes on the edge of the lake itself.

With me are **Joelibarison** and **Oloro** McHugh, both Cornell students doing master's thesis research in Madagascar respectively on agronomic and water management aspects of SRI; also **Haja** Rakotomalala and **Noelison** Randriamampianina, their field assistants, and **Hery** Rakotondratsima, LDI supervisor for the region around Lac Alaotra. We have breakfast on the way at a small restaurant that LDI staff frequent.

AMBANDRIKA: It takes only about 15 minutes to reach this village north of Ambatondrazaka on the east side of the lake. Haja and Noel direct us to a small shop where we meet **Roland** Randrianjafy, who has been cooperating with them in their evaluation of SRI for Cornell and LDI. Roland is a farmer who also operates a fertilizer and agrochemical supply store. I recognize the Malagasy word for insects ("bibikely," meaning baby or little animals) on the signboard, which advertises Sevin and other insecticides along with NPK and urea.

It is perhaps impolitic to begin with this question, but it come strongly to mind as I look at the signboard. Is Roland possibly worried that the success and spread of SRI might reduce the demand for fertilizer and insecticides? [Thereby undermining his business, I do not add]. He is not worried, he says, because some farmers are using NPK with SRI practices and get better yields. This is certainly possible, as chemical fertilizer usually will enhance SRI yields, even though the best yields from traditional varieties are achieved by using compost rather than NPK. How about insecticides? I ask. Some farmers are also using chemicals with SRI, he answers, noting that "Sherpa" is particularly effective for controlling *tsingalambilona*, a leaf-eating insect.

I comment that in a number of countries, as well as in Madagascar, farmers have reported that SRI methods produce plants that are more resistant to pest and disease attacks, so

they find chemical use less necessary or not necessary. He says that since many farmers are still cultivating with traditional methods, there are still a lot of insects growing on their fields, and these can also invade SRI fields. So he is not worried.

I ask Roland how long he has been using SRI methods? Three years. How did he learn about it? From other farmers. Have his yields gone up or down over the three years? He can't remember what his yield was the first year, but it was good, he says. Last year he got 1,680 kg from 25 ares (one-quarter of a hectare). This amounts to about 6.5 tons per hectare. Before we can calculate the yield for this year, Noel informs us, looking at his log book, that it is 9.24 t/ha. What were Roland's yields before he tried SRI? About 3.2 t/ha. So he got a doubling in his second year, and almost a tripling in the third.

Farmers in this area using fertilizer and agrochemicals can get about 5 t/ha, Noel says. So SRI definitely can give higher yield. Why does he think that SRI works better? Because it produces more tillers. Noel says, again consulting his log book, that Roland had 20-25 fertile tillers per plant, with a maximum of 27 and a minimum of 10. I say that with best use of SRI practices, there can be considerably higher tillering. Joeli tells Noel about visiting the field of a woman farmer near Fianarantsoa this season who had 94 fertile tillers on one plant. Her yield was probably around 18 t/ha. I tell him of one farmer whom I visited who had 140 tillers on one plant, with an average of 70, and got 21 t/ha by using SRI methods very carefully.

Roland says that because he has a business to operate, he cannot devote enough time to use the SRI methods very intensively -- a reasonable consideration and tradeoff. I comment that the farmer who got 21 t/ha has only 13 ares (one-eighth of a hectare) of paddy land to cultivate, plus some upland, so he has to get the most possible yield from what little land he has.

I ask Roland what he considers to be the most difficult part of SRI? The weeding. He does not have one of the simple mechanical push-weeders (*sarcleuse*) recommended for SRI cultivation, so he has to borrow one. How much does a *sarcleuse* cost? 90,000-100,000 FMG (\$14-16). Why doesn't he sell them in his store? He says he hasn't enough capital to stock them. Where are they made? There was a factory in Ambatondrazaka that made them, but it is now closed.

Perhaps his store could rent out *sarcleuses*, I suggest. Maybe, he says. We have been told that the toothed wheels of these weeders often break, and that it is difficult to get them repaired, so I suggest that he might consider stocking the wheels to sell. He nods but makes no commitment. One of the things that would make the spread of SRI easier would be to ensure that weeders are locally available and operational.

I ask about transplanting: is it more difficult? No, he says, **it is much easier than the traditional method.** "Even small kids can do it," he adds, to our surprise. We have not heard such an assessment before. He says he uses the planting system where ropes are strung across the rice field at even intervals to get precise spacing between plants, for example, 25 by 25 cm in all directions, which facilitates the weeding process.

We explain that it might be quicker and easier to use a special "rake" (*rayonneur*) that has "teeth" widely spaced, e.g., 25 cm apart. When it is pulled across the field at right angles, this marks a "grid" onto the surface. Transplanters can then plant seedlings at all the intersections quickly and easily. An added advantage with using a *rayonneur* is that farmers can tell whether the field is dry enough for good SRI transplanting -- if it is too wet, the lines in the mud will disappear. Roland is very interested in this method, and soon Joeli is squatting on the ground, drawing lines with his fingers, and Roland is crouching down with him.

During this conversation, an elderly farmer with a wispy beard is listening quietly, the hood of his faded denim jacket pulled up over his head, anticipating the day's rain. Now a young farmer joins us. We later found out that his name is **Arsene** Rinath. He has a calculated "tough-guy" look, with a decorative gold-plated razor-blade on a chain around his neck, and a toothpick in his mouth. His gaze is a "hard" one, but he listens intently as we discuss SRI. The front of his cap has in bold letters: "*The Eliminator*," with "National Hot Rod Association," "30th Annual MacTools Gaternational," and "Gainesville, FL" embroidered on the sides and back in small letters.

We discuss with Roland how much additional labor SRI requires. He says 38 extra days for 25 ares of land. This works out to be 152 days per hectare, about twice the usual labor required for growing rice, and considerably more than is usually reported for doing SRI. However, if Roland can get a tripled yield, even this much additional labor is a good investment. (We are doubtful about his figure for labor requirements with SRI, but do not want to argue with him; Joeli and Oloro are gathering detailed data from more than 100 farmers who use SRI in four different locations in Madagascar; so they will soon be able to give us reliable information on labor requirements and other variables.)

Roland says that he knows that **doing more weeding gives more yield**. In fact, I was just about to tell him this, based on our experience and analyses, so he has anticipated me. It is good to know that his observations are consistent with ours. We discuss how additional weeding can improve the soil, apparently by aerating it and promoting the growth of microorganisms in the root zone.

Joeli explains in Malagasy how bacteria can make minerals such as phosphorus available which are otherwise unavailable in their present form, and how microorganisms can also contribute nutrients such as phosphorus directly to the plant in organic forms when they die, such as from the rewetting of dried soil. (We have just come across some research showing this in a recent issue of the magazine *Nature*).

Roland asks, does this mean that the use of insecticides can kill these beneficial microbes? An excellent question. I do not want to make a categorical statement, so simply that some insecticides can have a bad effect on soil microorganisms. I say that this is an area where research is just starting to be done, and we are learning more all the time about how microorganisms contribute to plant growth and health.

Roland asks about compost, and Joeli discusses this with him, emphasizing that the content of compost is important as well as the quantity used. A number of plants such as wild ginger (*longoza*) and tithonia (*mangidy*) can contribute phosphorus to compost, while banana leaves can add potassium; leguminous plants enrich compost with nitrogen. We discuss also how growing vegetable crops in the off-season (*contre-saison*) improves soil quality. Most SRI farmers now put their compost on this crop rather than on their rice crop, letting the latter benefit from the slow decomposition of compost in the soil.

I ask whether either the young farmer or the old farmer who are listening to us are themselves using SRI? Arsene says that he is, adding that the problem farmers here have with SRI is that it requires a lot of capital, which most farmers don't have. What do they need money for? For soil preparation, he says; it takes more labor to prepare soil for SRI.

This is something I have not heard before; most farmers say that land preparation is the same for both methods. Arsene says that his soil requires three diskings to break up the clods enough for planting young seedlings. Also, leveling takes more time because it has to be done more carefully with SRI, to be sure that there are no depressions in the soil where water would gather and possibly drown the young seedlings.

Water control can also be a problem, Arsene adds. Given the way the irrigation system here is constructed, it is necessary for farmers to take turns getting water, and this can be a constraint on practicing SRI. We discuss what it would take to reconstruct the system so that farmers would have individual access to water. Probably a little land would have to be given up to put in individual field channels. Once farmers see that they can double or triple yields, however, they should be willing to make such an investment. Roland comments that it is also necessary sometimes to put in drains so that the field does not remain saturated.

An old man with a grizzled beard and bare feet, wearing a nicely woven reed hat and a tattered sweater, joins the group. He is introduced as one of the village elders. He says that the main problem here is not enough water. The springs from which their water supply comes are not adequate. They have prepared a proposal and budget for rehabilitating the existing irrigation system (apparently submitted to LDI), but they have not had any approval yet.

Rehabilitation by itself will not increase their water supply if the source is inadequate. I comment that SRI methods should reduce the amount of water required to grow rice by one-third to one-half. Roland says that they know this. I ask how he manages water for SRI cultivation. After transplanting he does daily irrigation (each night) and then switches to flooding his field for 2 days and then letting it drain and dry out for 3 days, alternating this pattern for a month; he then lengthens this pattern up to the time of panicle initiation (with 3 days of flooding and 4 days drying). When the rice plants begin their grain filling, he keeps some water on the field continuously. This schedule of alternating flooding and drying saves labor and may enhance yield as much as the recommended schedule of daily water management.

Arsene says that after transplanting, he alternates one-day-flooded/one-day-dry for two weeks, and then keeps the soil flooded for 3 days and dry for 2 days, up to panicle initiation. He says he has himself observed that **rice plants produce fewer tillers when they are grown in continuously standing water.** (This is one of the key insights with SRI.)

I tell Roland and Arsene that their experience confirms that SRI is not to be regarded as a set of fixed practices but rather as a set of *principles*, which we want farmers to experiment with. They should draw their own conclusions about what works best for them under their particular conditions. We want farmers to be experimenters, and our task as scientists is to try to understand and explain in scientific terms what is happening.

I ask the old farmer whether he uses SRI? He laughs and says that he is too old for farming now, describing himself in Malagasy as "*papa*," meaning grandfather. Does anyone in his family practice SRI? Yes, one member does. He has used SRI on 15 ares and got a yield of 600 kg, which figures out to be about 5 t/ha.

Are they happy with this yield, and is this enough increase to repay their extra labor? Yes, they are very happy with SRI, he says. They also planted beans (*tsaramaso*) as an off-season crop, alternating with SRI, and got a very good yield from these, 103 kg from the 15 ares. I comment that growing off-season crops is not only good to enhance their SRI rice yields but also to improve people's nutrition.

I suggest to Noel and Haja that they organize a small local workshop on water management methods with SRI. I am impressed that several different methods are being used. It would be good for farmers to share their experience, to inform each other, and in the process to contribute farmer knowledge to LDI and to the research of Oloro and Joeli.

At this point, as we are about to leave, a stout man in a shiny leather jacket joins us. He is introduced as the Ministry of Agriculture's extension agent in the area. Noel later tells us that he has been supportive of SRI. He is just in time to stand with the others for a group photograph.

As Joeli steps back away from us to take the picture of the group, he has to back up all the way to the other side of the street as a herd of cattle is driven along it, some of them having impressively large horns. When they have passed and the dust settles, Joeli takes our picture. We shake hands all the way round and get back in the LDI vehicle to drive on to our next meeting.

AMBODIVOARA: Ten minutes further up the lakeside we come to the large regional research station of FoFiFa, the government's agency for agricultural research. Behind it is a village that reminds me very much of the kind of rural villages I have visited in Ghana, quite a contrast from the small town we have just come from. The abundance of livestock is evident from their sounds and droppings.

We drive into the compound of **Soloarivonjy**, a farmer who has been cooperating in Joeli's and Oloro's study of SRI. His wife, **Jeanette**, says he is in his rice field, and she leads us several hundred meters through a succession of paths and gardens to Solo's swampy field near the edge of the marsh. I am impressed to find amaranth being intercropped with maize in several gardens.

Solo joins us on the edge of his field. This is his first year doing SRI, though he says he did some experiments previously. What attracted him to try SRI? The expected high yield, and the saving in seed required. He says that the costs of production are about the same. He uses only 8 kg of seed per hectare with SRI, compared to 100 kg per hectare conventionally, so this saving offsets other labor costs.

I am surprised to find that some of the SRI rice has lodged, something I have never seen before, and something that farmers say rarely happens with SRI because plants have stronger root systems and tillers. Solo and Noel estimate that the yield will be 7 to 8 tons per hectare, even with the lodging. There is an area in front of us that looks less productive. This is also SRI rice, Solo says, but it is the area where he had the nursery, and he planted it later in the season. It will probably yield only at a rate of about 4 tons per hectare. The usual yields in this area are about 2 tons per hectare.

Solo plants variety 1285 because it is known to be drought-resistant. I am surprised this would be a consideration here because the water table is very high. There is a small pond next to the SRI plots. But Solo says that this past season there was some water stress when the rains did not come as expected.

What is the most difficult part of practicing SRI? The leveling of the fields, so they are quite even. Jeanette, who has been listening quietly thus far, adds her agreement. This part of the process takes about three times as much effort as usual, to be sure that the young plants can be kept alive and not drowned.

Both Jeanette and Solo agree that for them, SRI weeding and transplanting requirements do not present problems. Having more space between plants makes the weeding easier, she says. I press a bit on their statement that the transplanting is easier, because this is not a common farmer opinion. But they insist that it presents no problem, even using the ropes to get even spacing in both directions.

We ask if they know about using a *rayonneur* to speed up transplanting? No, but they would like to know more about this. As Joeli starts to explain, Jeanette comes closer to listen and watches carefully. Solo says that they use something like this already for spacing their planting of upland maize. He is very interested to try it with rice.

I ask about difficulties with water management, given that their field is so low-lying. It may be hard to have well-aerated soil. I see the unwelcome reddish film of dissolved iron on water in the field and the adjoining pond. Solo says that water management is not easy, but he has worked out a way to drain water from the field into the pond. He jumps into the pond and digs out some plants and mud to show us his handiwork.

The sprinkle of rain that has been coming down now turns into rain, so we retreat to a place under some trees beside the field. Do they use compost here? No, and not fertilizer either. Solo leaves the rice straw on the field to decompose, and he also tramples weeds into the soil to decompose. This is enough, he thinks.

Have any farmers shown an interest in learning from him about SRI? There is one farmer, he says, but also he has been visited by a student from neighboring Reunion (a small island country in the Indian Ocean) who has asked him about SRI. What is the most difficult thing for farmers to manage if they adopt SRI? Water control. This, he says, is the main barrier to adoption.

I ask Jeanette if the women talk about SRI among themselves? Yes, she says. What do they say? She has a friend in a neighboring village who is interested. They have talked about the benefits of SRI. What are these? Seed saving is an immediate one. I comment that one can save 100 kg per hectare by using less seed, but yield can go up 1,000 kg or more per hectare with SRI. Isn't this more significant? Solo says of course. He can get double or triple the yield without investing much more labor.

Solo now tells us something in very dramatic Malagasy, with Jeanette chuckling as he talks. After he finishes, Joeli explains that Solo said he was not originally a farmer. He studied at the university in Tana, getting a General Education degree. While working in the city, he learned about SRI and was interested in trying it, but he couldn't then because he wasn't farming. Later when he took up farming, his wife was opposed to trying it.

She finally agreed to his using SRI on a small area, and he got a much greater grain yield, which persuaded her that it is worth practicing. But she still was not happy about the wide spacing, Solo says. "She was afraid we would lose yield that way." He finally convinced her that this is a good idea by telling her that it is like a meal in the house: if the available food is divided up among many people, each gets only one plate of food and is not as well nourished as if just one person does all the eating. "SRI is like the one plant having many plates of food." He says Jeanette is satisfied now with SRI, and she agrees.

How did Solo learn about SRI? From a newspaper article. When he read it, he had recently visited the home of a well-to-do person whose flowers were large and beautiful. The obvious reason was that they were well cared for. He had thought to himself: why not take similar good care of rice plants as well? That is why when he read the article it made a lot of sense to him. He says that "being a farmer is like passing through a learning process." For example, he has had to learn how to benefit from selecting his own seed carefully, or the advantages of getting improved seed from the input supply center.

We talk about the problem of lodging. He asks us if we know a better variety for his conditions that will not lodge. Noel suggests that he consider 1632, though this must be experimented with to make sure it is better. Solo says that he has 4 hectares of land down closer to the marsh, where water control is a big problem. He is thinking about getting a pump to be able to pump water up from there to this field near us.

I suggest that he could not make his field by the marsh drier this way because the water table in this area is so high. But he says he was thinking only of seasonal use, pumping water from there to this field when it runs dry, and from the marsh to the lower-lying field when it gets dry. He also wants to do fish cultivation in his paddies. I say this may not work with SRI, which does not keep rice paddies flooded. But he says he was thinking of having small ponds of the edge of the paddies, something that some other farmers have done with SRI. Solo is obviously an innovator who looks for a variety of ways to improve his production.

He asks our opinion about increasing animal production. I ask whether there is enough available fodder to support a larger population. Noting the very nice-looking vegetable garden he has next to the rice field, I suggest that horticulture might be more profitable if he can improve the soil to get top yields. He says he is getting involved with this, but there are times when all farmers' crops mature at the same time and their price in Ambatondrazaka falls sharply. We discuss the need for farmers to work backwards from market opportunities to what they can grow, rather than grow things and then seek a market. Also there can be more efficiency and bargaining power in marketing if farmers are cooperating in this process. He agrees.

We talk about soil improvement, and the contribution which (phosphorus-rich) wild ginger and tithonia can make to compose. He says that he knows of their advantages already. We start to close the discussion, but Solo wants to talk more about vegetable production. Do we have any ideas for insect control, for example, without chemicals? Joeli discusses some possibilities.

Solo says that this rice land he inherited from his parents in 1986. Because he was working in the city, he did nothing with it, but when once he visited it, he saw that others were cultivating it, so he decided to take up agriculture. This was very difficult at first, but he has learned many things, and particularly the need to diversify. He grows rice, maize, legumes and other crops and also raises cattle. Now he is getting involved with SRI.

He says that he has a total of 35 hectares (which makes him a richer farmer than we imagined from his house and his hands-on, "barefoot" approach to agriculture). He is only cultivating 2 hectares himself this year, and rents the rest out. Some of the land is in fallow to help the soil regenerate, he adds. He does not rent out most of his land because he has found that most tenant-farmers do not take care of the soil to maintain its fertility.

Previously he has cultivated 15 hectares, but now he prefers to exploit a smaller area aiming for higher yield. He asks (rhetorically), if I can earn the same amount of money, say 1 million FMG (about \$150), from 15 hectares or from 2 hectares, why not concentrate my efforts on the latter? We certainly would not disagree with this choice, which is the essence of "intensification," the central objective of LDI as a strategy for reducing destructive pressures on natural resources.

We thank Solo and Jeanette for their time and the experience that they have shared with us. We walk back to their house along a path with large stands of tithonia on either side, the yellow flowers in full bloom. I note that Solo's and Jeanette's house is indeed a very modest one -- though it also has one of the most well-built latrines I have seen in any village, a sign of their educational attainment.

While Solo goes into the house to change clothes (and put on shoes) to come with us for the rest of the day to have some farmer-to-farmer exchange of ideas, I ask Noel how much education he thinks Jeanette has? Probably high school education, which is not common for women here. This is obviously a very progressive couple, living and working close to the land, and being successful at it. We say good-bye to Jeanette and to her daughter, a high school student we are told, who has come out of the house to wish her father a safe journey.

As we drive back through the village toward the main road, I am struck by how many of the children appear to have poor nutrition (unshiny hair, pallid skin, listless demeanor), here next to an agricultural research station. Joeli says that FoFiFa currently is functioning at about 30% of capacity, for lack of funds and for loss of personnel. The government gives it little support, and most donors have given up on it. FoFiFa has followed a conventional scientific approach of seeking to discover agricultural improvements by itself, with these then transmitted to farmers through an extension service for adoption. Its scientists have been more concerned with publications and promotion than adoption, which has been limited for many reasons, among them the lack of fit between what is proposed and what farmers consider their real needs and resource capabilities. This is not unique to Madagascar, to be sure, but it is particularly acute here, which is why our Cornell program has been trying to promote "farmer-centered research and extension" in its activities here.

As we drive along, I ask Solo about the amaranth that we saw in his garden. I comment that its grain and also its leaves are quite high in protein and thus good for human nutrition. He says that he uses it as green manure because it has high nitrogen content and decomposes quickly. However, the poorer families in the village eat its grain during the "*soudure*." (This is the hunger season in Madagascar, the time between when people's previous crop harvest is consumed and the next harvest time arrives, known in French as the "make-shift" or "make-do" time, when people must weld or solder together whatever it takes to survive.)

I ask Solo what kind of yield he gets from his maize? 3 to 5 tons per hectare, depending on the weather. Is growing maize easier and less risky than growing rice? Yes. Joeli and Solo discuss composting and other subjects. The rain grows stronger as we proceed north along the lake, and the road gets poorer. Our driver stops to turn the front-wheel hubs so that the vehicle can utilize its four-wheel drive. We will need it soon.

Joeli and I start to talk about the role of soil microbial ecology. Solo says that he knows about this already. Formerly he slashed-and-burned his fields, but then he learned that this kills the microbes in the soil that are valuable for crop production. Where did he

learn this? At a school in Antsirabe, operated by an NGO consortium for agricultural education, Formagri (*formation agriculture*); it is called Rova and gets support from the European Union. Solo says he now doesn't like to rent out any of his land to any tenants who will burn it before planting. How many other farmers know about the contribution of microbes to agriculture? Not many, he replies, but he is trying to teach others about this.

We get to the town of Imerinamandroso at exactly 12:30 and pull up in front of the one eating place in town which LDI staff always patronize, Hotely Maminjatovo. I talk with Joeli and Oloro about their study. They have 140 farmers in their sample. How many are as enthusiastic about SRI as Solo is? About 25%. Solo is one of the best-educated farmers in their study, they say, with perhaps the largest landholding; but there are many small and uneducated farmers in it as well.

We try to figure out with Solo's help the costs of production compared to yield and income for SRI and standard cultivation methods. The latter require about 1 million FMG per hectare, not counting family labor, for a yield of 2 to 3 tons, which yields 1.5 to 2.25 million FMG at harvest time. The costs of production with SRI come to about 1.5 million FMG -- 50% more -- for 6 to 8 tons yield, earning 4.5 to 6 million FMG. The net is 0.5 to 1.25 million FMG compared to 3 to 4.5 million FMG, a 3 to 4-fold increase.

I say that we are not seeking to double or triple rice production in Madagascar with SRI. This would plunge rice prices exceedingly low. Rather we are aiming to raise the *productivity* of land, labor and water, so that Madagascar can meet its rice requirements with less of these factors of production. Along with *intensification* we would like to see *diversification* of production, though we know that this will require a much better, more efficient and competitive marketing system than now exists.

Solo agrees, saying that the collectors (rice buyers) at present are able to monopolize purchase of the crop, keeping the price at harvest time very low; they then sell the rice for several times more during the *soudure* (hunger period). What is the price differential? It goes from 750 FMG per kg at harvest time to 2,500 FMG per kg just 3 or 4 months later.

We also discuss Solo's experimentation with direct-seeding of rice, to save the labor required for transplanting. He did not get better results, so he thinks transplanting is still a better method, especially since he does not find SRI methods of transplanting difficult. I ask for the bill, which comes to 28,000 FMG (\$4.20) for the eight of us, including the driver. We have each consumed large plates of rice with beans, beef, chicken or fish. This reflects the low price for rice, but that in turn the low purchasing power of Malagasy. That they consume so much rice is a reflection of their overall poverty.

ANKASINA: We drive eastward from Imerinamandroso, toward Antanandava and the Zahamena National Park, stopping at this village. While Noel goes off to see if the farmer whom we want to talk with is at home, I look at a notice tacked up on the little store where we have parked. It advertises, in Malagasy, a series of videos, shown twice a week in Imerimandroso. Two that are titled *Sexe: Delicacé ou Disastre?* and *L'Amour sans*

Regrette catch my eye. But since the videos are being shown in a FJKM church, they must be for sex education, nothing prurient.

The farmer whom we are hoping to meet is not there, so we get back into the vehicle and head north again, driving around the top of the lake. Solo is talking almost non-stop, and Joeli who is in the back seat with him has no time to translate for me.

ANDREBAKELY: This is a larger town than Ankasina, though definitely still rural in nature. Cattle pens are seen behind many of the houses outside the central market area. The farmer whom we are hoping to meet here, **Augustine** Rabendrina, is also not at home. Friends say that he is at his field, so with Noel guiding us we drive another 20 minutes over small roads (not much worse than the Route National 44 we have traversed to get to Ambatondrazaka). We finally come to a threshing floor -- woven mats laid out in the middle of a rice field. Fifteen persons, two-thirds of them children, are busily winnowing, filling bags, sweeping, piling straw, shooing cattle away. There are already eight huge bags full of rice.

We talk to the eldest male there, who comes forward to meet us. His name is **Hubert** Randrianarisoa. When asked, he says he has used SRI methods on another plot of land, but not on this one where we are standing. The other plot is smaller and has better soil. How did he learn about SRI? From a technician from the Ministry of Agriculture. (This is good to hear.) After they discussed the potential benefits, he decided to try SRI. He is still experimenting with it, he says.

Hubert thinks that it requires better soil to get good yields (correct, though it can help get better yields on poor soil too). The soil here is not very good, he adds (something that I commented to Joeli on when we walked across the field to the threshing floor -- its light, gray color and its compacted structure.) Does the farmer know that he can make the soil better? Yes, he knows. He and Joeli talk about the application of compost and the contribution of microorganisms to increased fertility.

How many farmers in this area are using SRI now? About 10 farmers who live in Andrebakely. Why not more? They are still experimenting with it. What problems does he encounter with the methods? Hubert laughs as he tamps down the rice in the bag they are filling. Weeding is the hardest part. How many days does it take for a hectare? About 30 days. This is more than usual. Is it difficult to get a *sarcleuse*? He does not own one. How much does it cost to rent one? 5,000 FMG per day. This is expensive. How much does it cost to buy one? 90,000 FMG (the same price we have heard before).

Is it difficult to make compost for improving the soil? Hubert says he uses animal manure rather than compost. Here farmers have enough grazing area to maintain cattle, though transporting manure all the way from Andrebakely where he corrals his cattle at night is surely very difficult. Composting biomass from the area around his fields would probably be easier.

Does the farmer have any questions for us? I cast my eye around the area. I see cooking pots where the women have cooked a noonday meal. Several children are playing games. One woman whacks a large zebu that has started eating at a pile of threshed rice. A young fellow wearing an "Endless Love" T-shirt is stitching up a filled bag.

Since Hubert is not coming up with a question, Solo asks us about land preparation: the article that he read about SRI said the land should be prepared 8 days in advance of transplanting. It is possible to plough and level the land earlier, he asks, and let it stand for some time before planting? We say yes, though the more freshly prepared a field is, the better it will be for the seedlings to resume their growth.

Another farmer comes up to join us. This is Augustine, whom we came to see and who has heard that we have arrived. As we shake hands, we break out laughing because he is wearing a lilac colored sweatshirt with "CORNELL" across the chest in big red letters. These are in exactly the same style that our university uses. We explain to Augustine that Joeli, Oloro and I are from Cornell University in America. Where and how did he get this shirt? He bought it in the market in Ambatondrazaka some time ago, he says. Joeli takes some pictures of Augustine with us that we can show back at Cornell.

How long has Augustine been practicing SRI? For four years. Have his yields with SRI gone up or down during that time? Up each year. Why? Because he is able to practice SRI with more care each year. How did he learn about SRI? From an extension agent.

What have his yields been? Now up to 6 tons per hectare. What problems has he encountered? There are some problems with insects. Which ones? Locusts (which no plants can withstand, no matter how they are grown). Also there are some crawling insects (perhaps borers) that have affected his crop. He says that the very young plants are more sensitive to these. What did he do about them? He was unable to use insecticide because it was too expensive, so there was some reduction in yield.

Has he had any problems with lodging? (I am thinking of Solo's field.) No. What variety does he use? MK 34, the variety recommended for this area by the Ministry of Agriculture. It is a long-cycle, photosensitive variety. What are the advantages that he finds from using SRI? Seed saving, he says quickly. He uses 15 kg of seed per hectare, compared to the 150 kg he used to use previously. That saves 100 kg per hectare.

How long does weeding take for him? He says 16 days per hectare (half what Hubert reported). The labor costs 5,000 FMG per day, so this makes 80,000 FMG (about \$12.50 per hectare). We have seen that each weeding can add about a ton of yield, worth over \$100, so the return to labor is very good. He says that the second and third weedings (which enhance yield more than the first one) go more quickly.

Does he own his own *sarcleuse*? Yes, but only one. He needs more, he says. Do the teeth break on his *sarcleuse*? We have heard that this is a problem. No, not in four years. How much does a *sarcleuse* cost? He paid 45,000 FMG for his four years ago (about the same price as now, adjusting for inflation).

Has he heard of Association Tefy Saina? From his puzzled expression, it is clear he has not. We tell him about the work of this NGO to promote SRI. Joeli tells also about the work of Father Henri de Laulanié with farmers to develop this methodology. Why doesn't SRI spread more quickly? I ask. Augustine says that he thinks it will now spread very quickly, because farmers have very limited land, and they know they have to get higher yields to stay in farming. "Farmers are seeing that they can improve their yields with SRI, and many are trying it out."

How large an area is he cultivating with SRI methods? One hectare out of his 6 hectares. Why doesn't he use SRI for his whole area? He doesn't have enough labor to do the weeding required. He would use SRI methods more extensively if he could. What yield does he get on his other rice land? 3.8 tons per hectare. He says that he has been able to do more SRI cultivation each year as he has learned the techniques better. He will have to get additional *sarcleuses*, though.

Is he using compost? No. (A yield of 6 tons per hectare is pretty good if he is not adding any nutrients, organic or inorganic, to the soil.) Solo explains to Augustine that he can improve the texture of his soil by adding compost, a farmer-to-farmer suggestion.

We excuse ourselves to go back to Andrebakely to look at the field of another farmer practicing SRI. Augustine will come back with us in the vehicle. As I am leaving, a young farmer asks if he can have my address so he can write to me. I say that my French is not very good, but I will be glad to have a letter if I can respond in English. They like this idea, so I write out my CIIFAD address on a notebook page and give it to him.

Back in Andrebakely, we park near a large cattle pen and walk to the field of **Martial** Ratokojanahary. We have to cross a small stream and to enable us to not to have to take off our shoes and wade across, he fetches a home-made ladder which he places across the stream as a makeshift bridge. With careful balance but little gracefulness we make our way across.

This is not as impressive a field as we have seen elsewhere. Martial explains that he has had a pest attack, indeed two attacks of a kind of borer affecting part of the field. He has planted in rows rather than in a square pattern, so this is a modified use of SRI. Also there is currently water flowing into the field. We do not know how much water control he has practiced.

This is his second year with SRI, and has planted three varieties in this small field, the high-yield variety X265, a traditional variety known locally as Boeing, and a third he doesn't know the name of. It is short-stalked so probably an improved variety. He did not apply any fertilization, but he expects to get 500 kg from his 9 ares, which amounts to 5.5 tons per hectare, a respectable yield. His jacket is tattered, but his knowledge is quite precise.

What is the most difficult part of SRI? Weeding. He finds the pushing a *sarcleuse* hard work. He still needs to do some hand weeding to supplement the mechanical weeding. Augustine, who is with us, says that he needs to do this also. We find quite a range of opinions on how difficult weeding is, as we do also for transplanting. Are other farmers becoming interested in SRI? About 10 are practicing SRI methods in this village (the same answer Hubert gave). Others are observing their fields and becoming more interested.

I ask Martial, what do you say to other farmers to try to persuade them to try SRI for themselves? I tell them first about the higher yield, and then about the seed saving. He has reduced his seeding rate from 150 kg per hectare to 15 kg (the same rate as Augustine uses).

Pests are an obvious problem for Martial, as about one-sixth of this field has been set back by damage. What did he do to prevent this? Nothing. He observed the attack too late to use insecticides to stop it. What was his experience the first year he tried SRI? He got a good yield, he says. Early transplanting is a good idea, he adds.

How much variation is there in the price of rice, between harvest time and the *soudure*? The price goes from 750 FMG per kg to 1,500 FMG, a doubling rather than the tripling that Solo reported prevailed in his area. Do they have Kolo Harenas here? (These are the farmer organizations that LDI has been helping to set up in the region around Lac Alaotra.) No. Would they be interested in having farmer organizations? Yes, both Martial and Augustine respond.

What other problems do they have? Rats. I suggest that they need more cats, and everyone laughs. But this is a serious suggestion. There are a number of kids who have climbed up into the tree above us, and they giggle at the idea.

As we walk back toward the vehicle, and across the stream on the ladder, through Joeli I ask Martial about his system of water management with SRI. For the first month, he applies water to the field for 2 days and then lets it dry for 2 days; thereafter he applies water for one week, and then dries it out for 2 days. Yet another pattern for irrigating SRI rice.

I ask Augustine what his water management practice is, and he says that he alternates application and drying daily for the first 2 months, putting on some water in the evening and then draining any water remaining on the field in the morning. This is what Tefy Saina recommends. Then he keeps water standing on the field, at a depth of one-third of the height of the plants until two weeks before harvest.

In the vehicle as we drive back toward Ankasina, Joeli, Oloro and I discuss how one could evaluate water management optimization, with farmer data and evaluations. There are obviously tradeoffs to be considered. The water management system that is best in agronomic terms might require more labor than is worthwhile economically considering the

yield increment it can give compared to a less labor-intensive method. One wants to know:

1. **the best water management practices** -- those which give the highest yields in biophysical terms But then these need to be modified (adjusted, simplified, reduced) according to
2. **the total amount of labor time required** for farmers to manage water -- if their rice fields are far from their houses, they may manage water less intensively and accept a lower yield as economically justified, and
3. **farmers' opportunity costs** -- what will be given up if more labor is invested in water management (if they have few alternative income-earning opportunities, they may efficiently invest more labor in managing water). One needs to consider also
4. **the actual price for rice that will be received.** The higher this price is expected to be, the more investment of labor can be justified to manage water carefully during the season. Farmers make such calculations and tradeoffs, at least implicitly. What is "best" for any particular farmer is a relative matter.

ANKASINA AGAIN: When we pull up to the small store where we stopped before, Haja gets out of the care to see whether the farmer, **Claude** Rabemahaso, is home. He is and comes out to welcome us and invite us into his house. Haja introduces everyone as we sit down on chairs or benches in the low-ceilinged room. Claude sits on his bed, which has a large mosquito net overhead. I thank him for receiving us and explain that we are trying to understand better farmers' experience with SRI, and to know why it is not spreading more quickly, to be better able to make it available to farmers.

How many years has he used SRI? This is his first year. How did he learn about it? From the LDI field agent, Fely. Why was he willing to try it? First, the seed saving possibility was attractive, and second, the prospect of higher grain yield. Has he had a good harvest from SRI? Yes.

How large an area did he plant? 40 ares, Hadja answers, from his field notebook. What was the yield? 7 tons per hectare. What was his yield before? 3 tons per hectare. This is a very good start, I say, commenting that with more experience and with mastery of the management techniques, he should be able to raise this still further.

What is the most difficult part of SRI? Weeding. He says it takes him 18 days to weed his field, which works out to 45 days per hectare. This is higher than the norm. He doesn't have a *sarcleuse*, so he rents one from the NGO that is helping SRI to popularize SRI in this area, BRL. It costs only 1,000 FMG per day, one-fifth of what Hubert reported paying. (Hubert also only took 30 days per hectare for a weeding.) How much does it cost to buy a *sarcleuse*? 100,000 FMG. Where are they available? In Imerimandroso, not very far from Ankasina. Who sells them? BRL.

How many other farmers in the area are using SRI? Four others in this village. Do all rent *sarcleuses*? No, some have their own already. Do the teeth break on these weeders? This

is not a problem, Claude says. Does he have water management problems? No, he responds, to our surprise. He is the first farmer to say this. Why not? Because he gets water from the barrage (dam) that LDI has built (with cyclone relief funds).

What water management system does he use? There is a lot of discussion back and forth with Joeli. From the date of transplanting to panicle initiation, one day on, three days off. This is quite different from any system we have been told today, but it must not be a bad one because he has gotten very good yield results. I suggest again that Oloro and Joeli hold workshops with farmers to exchange information on water management methods.

Can most of the farmers here accept SRI or will it be limited to a few? Claude says that this depends on the farmers. If they are very interested in yield, they will take it up. They will not be put off by the higher cost. He says that SRI methods do pay off in his experience.

He estimates that the additional cost per hectare is about 200,000 FMG, which can be covered by selling 250 more kilograms of rice per hectare, a fraction of the increment possible with SRI. The traditional system costs about 400,000 FMG per hectare, plus the cost of plowing and puddling. This cost he says is the same for both systems of cultivation, a different evaluation than given by Arsene in Ambandrika this morning. Claude is not counting family labor with either system of cultivation.

Leveling fields does take more work (as several other farmers have told us). Does he do any fertilization? Yes, on all of his fields. He once left one small part of his fields unfertilized and could see a difference in yield. So he puts some NPK on before the first weeding, and then some urea on at panicle initiation. This might account for the higher yield he reports.

Has he considered using compost? At present he does not have enough time. Might he try using compost in the future? Yes. Has he started preparing a pit for this? Not yet; he has just received advice from the field agent on how to do this. Does he cultivate a contra-saison crop? No, but he plans to do so this coming year, having heard that it can benefit the rice crop.

What variety of rice does he plant? MK 34, which is photosensitive; its success is conditioned by the weather. He is thinking about using 4012 now because it is being recommended by the government extension agent. Is he a member of a Kolo Harena? No. Hery explains that LDI has not started a process of social organization here yet. They have been working more to the east, closer to Zahamena National Park. About 15 associations have been established there, covering about half the Antanandava area in which Ankasina is located. The project's social organizers will start organizational efforts here this coming year.

I say to Claude that I am glad he has tried SRI and has had good experience with it. We have found from other farmers that yields from SRI can improve year by year as the methods are better understood and practiced, so possibly he can get still higher

production in the future. Much will depend on how he improves his soil. Joeli talks with him about compost and the role of soil organic matter in nurturing active populations of microorganisms. Hery says that one of the farmers in this area got 14 tons per hectare this past season -- double what Claude produced -- so farmers here know that higher yields are possible.

Does Claude have any questions for us? He says that he encountered some problem with a particular fungus he names. He and Joeli discuss how this might be dealt with using a plant decoction that inhibits fungal growth. Plant leaves are soaked in water which is then applied to the plants. But this needs to be done before the appearance of the disease, before anthesis.

Solo and Haja both know about this practice, and they contribute to this discussion. The French name for this plant with fungicidal properties is *consoud*. Using it is safer than using chemical fungicides and almost as effective. Certainly it is much cheaper and more easily accessible since the plant is found in this region and can be grown along the edge of rice fields.

Is there any concern in Madagascar with the toxicity of agrochemicals for humans and for plant and animal life? Nobody is worried because most farmers do not have enough money to be able to afford them. Consequently there is no overuse. I tell them about Sri Lankan experience where agrochemicals have been heavily subsidized by the government and thus made quite inexpensive. There are many deaths each year from agrochemicals, though the majority of these are suicides. Still, hundreds die from overexposure.

Solo says that here there is the opposite problem. Because agrochemicals are so expensive and people know that they can kill, farmers consequently apply reduced doses, sometimes too diluted to do any good. In 1986-88, some farmers obtained peanuts that had been treated with fungicide for use as seed, and unfortunately some people ate them, and some of these died.

I thank Claude for his time and tell him that our objective with SRI is not to triple rice yields in Madagascar but rather to raise the productivity of land, labor and water that are presently used for rice production. Too much of the country's land, labor and water are now being devoted to rice production because the level of productivity is so low. If this level can be raised, farmers can grow enough rice on less of their land, and they can use more of their land, labor and water for other crops. We want everyone in Madagascar to be able to consume enough rice, at reasonable prices. But that only requires maybe 20 to 30% more. Diversification will be important for development. The Kolo Harenas can help farmers make this transition.

Claude thanks us for coming and says that he is very interested in all of these new opportunities. As we leave his house, we notice many nice, large ears of maize hanging on the railing of the balcony above us. We also see a shed full of drying tobacco leaves next to his house. Claude is obviously already engaging in diversification of production. We shake hands and drive back down the hill in the direction of Imerinamandroso.

Two large ox carts loaded with bags of rice are ahead of us, slowing our progress, while an even bigger cart, drawn by six oxen instead of four, is coming our direction so we cannot pass the carts ahead of us. Why are they hauling rice in opposite directions? Because farmers must cultivate wherever they can get access to land, and this is often far from their home villages.

As we reach Imerinamandroso the sun is setting. We drop off Haja, who stays in this small town and works with farmers to the north and east, gathering data for Joeli and Oloro. As we drive southward, there is a flamboyant sunset. We still need the four-wheel drive as we make our way through muddy red stretches on the road. This is the relatively dry season, though it has rained off and on today, complicating farmers' harvesting and drying of their rice. We can imagine how impassable the road can become during the rainy season.

These are the conditions of life for people in this region. It is one of the more fertile ones in Madagascar, but the physical infrastructure is limited and often bad. The marketing infrastructure and organization is even less advantageous. There are limits to what technological improvements can accomplish. Yet SRI because it does not depend on purchased inputs but can be utilized just on the basis of knowledge, skill and labor effort offers scope for improving food security and living conditions independently of infrastructure for many rural households.

We need to understand better its limitations as well as potentialities, and how to assist farmers to learn about and benefit from SRI. Certainly there are a number of experienced and enthusiastic farmers now scattered across the region who can help with any popularization effort. The aim of SRI as promoted by Association Tefy Saina is to introduce it in ways that improve human resources as well as raise production. The human resources we have encountered on this long day -- it is 7 p.m. by the time we get back to Ambatondrazaka -- have much capability to begin changing the agricultural landscapes around themselves.