

REPORT ON VISIT TO CUBA, MAY 25-30, 2003 -- NORMAN UPHOFF (draft)

Sunday, May 25

Upon arriving from Miami in the morning, I was met by Rena Perez, who has served as the coordinator for SRI activities in Cuba; Ruben Afonso, director of the national Rice Research Institute (IIA), and Luis Aleman, national director of *Arroz Popular*, a program to support smallholder (non-state) production of rice which is now promoting SRI. Most of the day was spent quietly at the hotel, doing some work on the planned presentations, with dinner that evening with Rena and her husband Orlando.

Rena's good news was that the sugar cooperative, CPA Camilo Cienfuegos in Bahia Honda, which has been in the vanguard for trying out SRI in Cuba, had recently reported the yield from its two SRI fields this past season, 10 and 14 tons/hectare, respectively. The cooperative was awaiting our visit on Monday. Another farmer who has taken the lead in SRI evaluation, Luis Romero, who lives near the Rice Research Institute at Bauta, had also obtained a yield of 14 t/ha from his SRI field, which I visited the previous July. So there were two solid demonstrations of the benefits from SRI methods that we can point to. SRI is referred in Spanish as "SICA," for the System for Intensive Cultivation of Rice. The literal acronym for SRI (SIA) sounds like CIA.

Monday, May 26

A team of Purdue University faculty members, led by Bob McNeil, joined up with us for the trip to Bahia Honda. En route, we picked up Telce Gonzalez, a young IIA researcher who has become most interested in SICA, especially the changes and effects of root systems (aerenchyma and mycorrhizal fungal associations). The drive was an hour and a half west of Havana. We received a most hearty welcome at the cooperative, which I had visited once before in July 2002, and started our conversation in the cooperative community center, built above a man-made lake with nice view and breeze.

The coop's president, Jose Antonio Espinosa, known to all as Nico, gave us some background on the organization, established June 4, 1980, with members pooling their land and machinery. Within five years, their respective financial contributions were paid off, so that all became equal members and get the same shares of net profits after all taxes and other expenses are paid. About 200 families, with over 600 members, belong to the cooperative and get their food and income from its production. Sugar is the main activity, but they raise livestock, practice horticulture and have other lines of production. (After our visit to the rice fields, the coop served us a splendid lunch, one of the best meals that I had while in Cuba, all with produce fresh from the farm.)

SRI has worked very well for them, Nico said. It raises their production and at the same time has reduced their labor requirements. In this area, 3 t/ha has been considered a decent yield. The cooperative by improving its terraces, and having rather good alluvial soil, was usually able to produce 6.5 t/ha previously.

With SRI, they achieved 9.5 t/ha the first season they tried it, and the next season, 11.2 t/ha. This year, with a new variety that tillered profusely, Los Palacios 9, they reached 10 and 14 t/ha, confirming what Rena had told me at the airport. Of the coop's 13 ha of rice land, 4 ha were cultivated with mostly SICA methods this last season, though some of these methods were used

on the rest now that farmers are becoming persuaded of their merits. The coop is planning to increase its rice area to 20 ha and put all of this in SICA production. Nico said that it took some time to get SICA accepted by the workers on the farm, since as coop members they cannot just be told to plant in a certain way; there must be agreement.

During our drive to Bahia Honda, Telce had raised the question whether with such profuse tillering as one sees with SICA, there would not be a problem of asynchronous ripening. (Rena had sent me a picture of one of the coop's rice plants having 87 fertile tillers.) This concern, that not all of the tillers would ripen at the same time, has been raised before by rice scientists. In his writings, Fr. Henri de Laulanié, who developed SICA in Madagascar, has said that this does not become a problem with the method. So I asked Nico about the coop's experience, whether it had had any such problem with its SICA crop. Nico looked surprised and said no.

I next asked whether they had been able to reduce the age at which seedlings are transplanted? The first season, CPA farmers had refused to transplant really young seedlings, because they thought this would be too difficult, so their 9.5 t/ha yield had been obtained with 25-day-old seedlings. These were well beyond the start of their fourth phyllochron of growth, so the coop got a fine yield without using all the SICA practices. Also, because it has few weed problems on its land, no weeding (which aerates the soil) was done. This meant that they did not need to plant with careful linear spacing in a square pattern, simply putting single seedlings into the paddy 30 to 40 cm apart. This explains why their labor requirements with SICA are reduced and low.

José Luis Martínez, who is in charge of the coop's rice operations, said that they now want to go to 12-day seedlings, having satisfied themselves that this is important. All the farmers could see the difference. The 14-ton field was planted with seedlings less than 15 days old. He said that farmers are starting to come to look at their crop and to see that success is not just due to genetics.

The main problem they have with SICA is water management. They are not able to practice good water control as recommended, applying only a minimum amount of water during the growth period. This makes their yield accomplishments all the more impressive, also making me wonder what kind of marvelous soil microbial populations they have in their soil. The irrigation water they use flows through the town of Bahia Honda before reaching the farm. Probably there is considerable dissolved organic matter in the water, including untreated excreta.

José Luis said that the time required for harvesting the larger production is less because the panicles are very even and easy to cut. He added, pulling out a notebook from his hip pocket, that planting time had been considerably reduced with SICA. In 2001, before they tried the new methodology, the coop needed 16 person-days to do the harvest from a particular area. They had calculated that 256 pounds were harvested per worker. In 2002, when SICA was first used, the same task required 14 person-days (336 pounds/worker), and in 2003, only 9 person-days were needed (457 pounds/worker). Person-days are 6 hours/day, he explained. He estimated that their labor productivity had been doubled with SICA. This is an important benefit in addition to the production increase and reduced cost of inputs, enhancing profitability for the cooperative.

We then drove to the fields and to see the rice the paddies. When I commented on one nice stand of golden rice being harvested by hand, Juan Francisco Rembiao, farm manager who walked with us, told us that they are using some SICA practices to some extent on all their paddies now. We see workers thrashed the crop by hand, beating the rice sheaves on the inside of an oil barrel to knock the grains off the panicles. Juan Francisco said that SICA is becoming popular, although for the first month or so, the fields look "ugly," something I have heard often before.

Rena and I stopped to talk with several young farmers who are resting after their six hours of work. We asked which method they prefer using, and the first says he favors the traditional method of planting. Why? The wide spacing between plants wastes space. I asked whether he didn't like the results of SICA better? Yes, SICA gives better results. The second farmer says that now that he has seen the results of SICA he prefers this methodology.

Rena and I were impressed to see the vigorous regrowth of the SICA field that gave a 14 t/ha yield. They are leaving it to ratoon and get a second crop from the same root stock. We speculated what yield they may get. Often in Madagascar and in one case in Peru, the second harvest has been 70% of the first with SICA. Such a second harvest seems unlikely here, but maybe 5-7 t/ha may be attainable, which would be a big bonus.

After looking at the fields, we stopped at the rice drying and storage area. Like the threshing operation, these facilities are decidedly low-tech. Drying is done on a concrete slab, and women watch the sky for showers, quickly rebagging the grain when rain starts to fall. As the rainy season has started, they may have to lay out the grain 5-6 times before it is dried enough for storing. One of our Purdue colleagues is an agricultural engineer, and he suggests that their program may be able to help improve upon the present technology. The bumper harvest with SRI has caused some problems for the coop, though unexpected abundance is the kind of problem they would rather deal with than its opposite

We had been joined during this visit by a group of researchers from the rice research station at Los Palacios of the National Institute of Agricultural Science (INCA). It is their variety, LP 9, that gave the 14 t/ha yield. The coop provided us all with a splendid meal, homegrown as well as home-cooked. We did not finish lunch and informal discussion until 3, when Rena, Telce and I as well as our Purdue associates headed back toward Havana, first stopping on a high hill overlooking the Bahia Honda bay to appreciate its beauty. As we drove, Telce told us that José Martí, known as the father of the Cuban nation, over a hundred years ago had said that the future of Cuba's agriculture lay in crop rotation, though sugar monocropping intensified after he made this astute observation.

Rather than drive straight back to Havana, we diverted a bit to visit the farm of Luis Romero, a very innovative farmer who lives not far from the Rice Research Institute. When we arrived at his house, he confirmed that his SRI field had yielded 14 t/ha, with a second crop (ratoon) of 4.5 t/ha. I had seen his field the previous July, and he showed me then what large root systems his rice plants had developed already. He did not have it planted in rice this season because he had no assurance of water this season.

Luis explained that had been planning to plant SRI rice on a larger area. The Rice Research Institute, being impressed by his success with SRI methods, had offered him 7 hectares of land about midway between his homestead and the Institute on which to plant rice. However, no license (official, written approval) had yet been issued to him, so he could not install a well there to provide the field with pumped water. Thus it looked like he would have to give up this idea for the season, much as he wanted to continue with SRI. He was very curious to know about the methods for 'upland SRI' that an NGO partner in the Philippines (BIND) had developed, applying SRI concepts and practices, with appropriate modifications, to unirrigated, rainfed production. Luis is enthusiastic about SRI and has begun training other farmers in its methods.

Tuesday, May 27

When Rena and I arrived at the Palacio des Convenciones where the 5th Organic Agriculture Congress was being held, to register and attend the first session, the first person who we were introduced to was Julio Taboada Perez, a retired military officer and now full-time farmer in Sancti Spiritus in central Cuba, who was presenting a paper on his experience with SICA. He had never met Rena but had read many paper on SICA that she had written, some translations into Spanish of our CIIFAD and Tefy Saina papers on SRI. He embraced her and began telling her enthusiastically about his work with SRI.

He had gotten a yield of 9 t/ha with SRI methods, and told us of one plant that he counted 291 roots on, just primary and secondary roots, not counting tertiary roots. He understood the value of soil aeration and had done some soil inoculation with mycorrhizae. He is doing SICA trials with different spacing, 15x15 cm up to 50x50 cm, using 10-day-old and 30-day-old plants, to see and to show the differences in plant response to these management practices. He is also evaluating several varieties.

Julio introduced us to another farmers from Sancti Spiritus, José Casimiro, who has not used SRI methods but plans to, having seen Julio's results. José is doing many experiments with animal traction (oxen), having developed many different implements for plowing, harrowing, weeding, etc. He showed us pictures of 28 different tools that he has been developing and using. He said he thought that ox-powered weeding should be feasible from what he had seen of Julio's fields.

We also met José Garcia Varela, program coordinator for the Cuban Council of Churches, which has a Sustainable Development Program has has been promoting SICA. Rena had previously given me the pamphlet of instructions on SICA that she had helped the SDP prepare. Thousands of copies have been distributed around the island.

The highlight of the morning was a talk by Dr. Ana Primavesi from Brazil, who has been a leader on sustainable and organic agriculture in Latin America for about three decades. She shared many unconventional views, based on a professional lifetime of working in and on tropical soils. Comments that I was able to write down from the translation included:

- Aluminum in the soil is not toxic so long as the soil is well-aerated; Al toxicity becomes a problem only when the structure of the soil has been ruined by compaction.
- Bacteria in tropical soils are adapted to pH levels of 4 to 5. If the pH is raised, this ruins the balance within microbial populations.

- Chemical fertilization of tropical soils is often counterproductive because the addition of particular nutrients such as N, S or K unbalances the chemistry of the soil, creating a good environment for pests and diseases.
- Micronutrients are needed to mobilize the enzymes needed to catalyze nutrients in the sap of plants. Plant nutrition problems are often not a matter of nutrient supply so much as of specific, seemingly minor deficiencies that interfere with metabolic processes. Organic matter in the soil is valuable because it contains trace amounts of micronutrients which are often all that are needed.
- The best test of whether our cultivation practices are correct is to look at its roots; if they are not full-grown and their color is not healthy, something is wrong with our practices.
- The roots of plants of different varieties go into different spaces in the soil and thus are usually complementary; plants of the same variety are more competitive.
- The greatest need is for soil cover; uncovered soils overheat, and beyond 32°C the absorption of water and nutrients by roots stops; cover also protects against the compacting effects of tropical rain.
- Temperate soils are different from tropical soils in many respects, among them that half of their precipitation is in the form of snow, which does not compact or erode soil.

Dr. Primavesi admonished members of the audience not simply to accept and apply to their own tropical areas the agronomic developed in and for temperate zones. She challenged them to think independently about tropical soil management, saying that people in developing countries are intelligent enough to draw conclusions for themselves. "After all, 90% of Harvard professors are foreigners, and they're supposed to be the most intelligent people in the world," she added with a touch of irony to drive home her point.

I spoke with Dr. Primavesi briefly after she finished her talk, telling her a bit about SRI. Her writing on tropical soils was some of the first that helped me understand how the farmers we worked with in Ranomafana, Madagascar, could raise their rice yields, with SRI practices, from 2 t/ha to 8 t/ha average, without adding chemical fertilizers to soils that according to soil chemistry evaluations (pH, CEC, P, Fe, etc.) ranked as some of the poorest in the world. She said she would be glad to learn more about SRI and I said I would send her some by e-mail.

Since the afternoon working sessions were mostly in Spanish, I worked back at the hotel. At 4 o'clock, the director-general of the National Institute of Agricultural Sciences (INCA), Dr. Roberto Martin Triana, and staff from the Las Palacios rice station, met me and Rena at the hotel for an hour's discussion on SICA. Roberto expressed strong interest in pursuing research issues raised by SICA and arranged for me to give a presentation to the Las Palacios staff on Friday.

Wednesday, May 28

At 9:30, Miguel Socorro, deputy director of the Rice Research Institute, picked me up at the hotel and drove me to the Institute at Bauta, about half an hour's drive south of Havana. About 30 staff were assembled for a presentation on SRI. The Institute is generally underequipped, but its powerpoint projector worked fine. This was one of the most attentive audiences I have had for discussing SRI. Afterwards, I presented to the Institute a microscope that CIIFAD was able to donate to support its rice research, particularly relating to root development (aerenchyma formation) and soil microbiology (particularly mycorrhizal associations with SRI). Institute

scientists have unfortunately very little equipment and few resources to work with. Miguel suggested that, since 2004 has been designated as The Year of Rice, the Institute would like to organize an international conference on SRI.

We have been thinking about having a follow-up in 2004 to the Sanya, China conference held last year, thinking there would by next year be a lot more known about SRI to share, and also more clarity about what knowledge is needed to advance the understanding and practice of this system. I said I will consult with SRI colleagues in other countries about timing and venue since planning should begin soon for such an event, which would be necessarily larger than the 2002 international conference. Finding funding for this will be a challenge, but it should be a very productive event. Cuba has excellent conference facilities as I have seen now twice.

After returning to Havana and having lunch, I went back to the conference and was pleased to hear a presentation by Prof. Shuichi Okumoto from Earth University in Costa Rica on the use of Effective Microorganisms (EM). This technology is controversial among SRI colleagues, some being dismissive and others singing its praises. I could not sort out the merits of the issue based on the presentation (in Spanish), but we agreed to exchange materials by e-mail.

Thursday, May 29

In the morning, I worked on the presentation for INCA, which was intended to provide some concrete research issues that staff might pursue, and polished the presentation for the Conference. When I got to the Palacio in the afternoon, Rena said that there was already a "buzz" going around about SICA based on several reports from farmers. Farmers from all parts of the island were expressing interest and coming to her for information, as she is known as the main font of knowledge about SICA in the country.

At 2:30, there started a very interesting panel organized by ANAP, the national association of smallholder producers, with 11 farmers sharing experience in introducing or developing agroecological methods and practices. There was great interest from a large audience, and questions ran beyond the scheduled 4:30, when our panel on SICA was supposed to begin. The presentation attractive most attention was José Casimiro's with an impressive video on oxen traction and equipment. It showed even his young children guiding the large beasts, who plowed or cultivated rows with a straightness surpassing human skill. Having him helping to solve practical cultivation problems with SICA should advance knowledge and practice greatly.

Although the hour was late (the conference had been going on since morning), we had over 100 persons saying for the SICA discussion. I managed to keep my presentation with powerpoint assistance to 25 minutes, so as not to cut into farmer presentation time. The session organizer and chair, Luis Aleman, national head of Arroz Popular, said it was just what was needed. Rena followed with a 15-minute report on SICA in Cuba. The country is importing 60% of the rice it consumes, so there is huge scope and need for import substitution. It will be a long time before there is any danger of excess production due to productivity gains with SICA. [The night before, at Rena's house, I had seen a World Bank report on the Cuban economy from the early 1950s that placed imports then at 88% of consumption; the economy was designed for maximum export of sugar and for importation of almost everything else.]

Then Juan Francisco, the farm manager at CPA Camilo Cienfuegos, made his report while a video showed the cooperative and its rice fields and rice operations. He said that the coop was at the forefront of the sugar cane production movement, but had started rice production to meet the nutritional needs of members, workers and their families. "Three tons of rice produced per hectare was a success in the past," he said. But they needed to do better because of population growth and economic urgency. They had built a small dam and constructed a gravity-flow distribution system. (This saved them the cost of petroleum products to pump water from the ground.) They sought to use the soils properly, with no adverse impact on the environment. Fertilizer was becoming too scarce and expensive. They were able to get 6 to 7 tons yield.

Then Rena, whom Juan Francisco identified as "the promoter of the rice revolution in our area," informed them about SRI, and they got 9.5 and then 11.2 t/ha the first two seasons. "We started slowly and carefully," wanting to test the methods out before using them on a larger scale. "SICA is really wonderful," he stated, explaining that he and José Luis had brought with them an example of a SICA rice plant to compare with one conventionally grown. Unfortunately, the plants were in their vehicle, and the parking lot was too far away to bring them. The SICA plant had 80 fertile tillers, he said, demonstrating what the proper use of SICA techniques can do.

The main problem has been getting workers and staff leadership to accept the new ideas and practices. Seeing is persuasive. "Today we can say that SICA represents a saving in terms of land and of labor." He said that for the same effort, they can get more production and with less cost, thereby raising the profits of the cooperative. He said also that women were finding it much easier to work with the smaller seedlings when doing transplanting. Higher productivity has raised the salaries from rice cultivation, and 35% of their labor force is women.

Sugar cane production is being retrenched on the island, so other crops must be grown, Juan Francisco said in conclusion. (Last year, the government decided to close half of its sugar mills, which were clearly uneconomic, and take much of the sugar land out of production.) We can productively expand rice cultivation with SICA. Last year the coop produced 120 tons of rice; this year they expect to produce 150 tons, using organic inputs entirely.

Next, Julio Taboada was invited to report on his SICA experience. He showed a rice plant that was just 10 days after transplanting, having been grown and nurtured with SICA techniques. It was a thick, stocky and tall plant. He said that the seedling had been gotten from the nursery and into the field in just 17 minutes, rather than in a matter of hours as is usual practice. It had been laid into the soil gently, with the roots making an L shape rather than a J shape (the technique we recommend in our usual instructions). He transplants seedlings in groups of only 100 so that they can be properly cared for. He also uses ECOMIC, a soil microbial amendment.

As Julio told us on Tuesday, he has counted as many as 219 roots on a single plant, not counting tertiary roots. How does he know if the roots are getting enough oxygen? He said that he uses a very simple calibration; he pushes his finger into the soil to see how uncompacted and loose it is. He did two weedings, at 20 DAT and 40 DAT, "and the plants are growing wonderfully." This was certainly true if the one he had on the table in front of him was representative of his crop. When he used all of the SICA elements together, he said that his yield was 9.5 t/ha.

Now farmers are coming to see his crop. They say "this is phenomenal" and want to expand it in their own communities. Julio said that he is open to any further developments in this technology and wants to try to apply it to millet rice. He has already found 316 people who want to use SICA techniques under the Popular Rice (Arroz Popular) program, and he expects there will be 1,000 persons in his area within the year. Everyone likes the prospect of needing less water. This is important, because the more the water applied, the fewer the tillers, he said in conclusion.

The presentations finished after 5:30, and there were still almost 100 persons in attendance. A variety of questions were raised, most responded to by Juan Francisco and Julio. Two women from different parts of the island said that this was the first time they had heard about SICA, but they wanted to know more and to try this in their own areas and to spread it. They spoke about the difficulty of feeding their families with what they produce now and about the need for such improvements in methods and results. About 6:15 we adjourned, well beyond schedule. Rena and I went with Juan Francisco to the CPA Camilo Cienfuegos jeep in the parking lot, where José Luis showed us the huge SICA rice plant they had brought in to show the audience, and a typical plant of the same age grown with usual methods. It was hard to believe that this wasn't at least three or four plants together.

Friday, May 30

At 8 o'clock, Rudolfo Castro, director of the INCA rice research station at Los Palacios, met me in the hotel lobby, together with two INCA staff members who came along to help with translation. It was an hour and a half drive east to the station, which was the most impressive facility I saw during the trip. The buildings were completed in 1987, built by the staff themselves and, as best I could understand, self-financed by the researchers and employees. I had admired the good maintenance of the old Czech Lada car in which we drove to the station, and I was struck by how neat and clean the buildings were, quite modern in design but not extravagant. The grounds, buildings and rooms were decorated with some of the most attractive sculptures and murals I have seen in public facilities, all created, Rudolfo said, by artists in the Pinar del Rio province.

We had a two-hour seminar on SICA. There was no powerpoint projector, but the staff member for infomatics hooked my laptop up to a monitor to provide a second screen for showing my slides. There was much interest across the range of disciplines represented, and Rudolfo gave me a four-page outline of the 12 SICA research projects already underway or planned, looking at things like effects of plant age, organic matter, planting distance, seed rates, direct seeding, irrigation schedules, seedbed preparation, and varietal responses. They also have plans for farmer demonstrations. The variety that CPA Camilo Cienfuegos in Bahia Honda used to boost its SICA yield from 11.2 to 14 t/ha was Los Palacios 9, a variety developed at this station that responds very well to SICA management practices.

We then had a very nice lunch in the canteen: rice and beans, of course, pork, plantains, and fresh vegetables, washed down with good Cuban rum. We talked particularly about how scientists and farmers can work together to advance knowledge and practice for SICA. I had a chance to discuss the 'farmer-centered research and extension' approach that CIIFAD works on with partners in a number of countries and that is particularly appropriate for SICA development and dissemination.

Because of the constraints imposed by the U.S. economic embargo of Cuba, made worse by the collapse of the Soviet Union and an end to Soviet economic aid, fertilizer which was previously used very liberally is now scarce and certainly expensive. For a decade or so, Cuban scientists and farmers have been working on 'organic' methods of agricultural production. Experimentation and scientific evaluation on various non-chemical-based technologies such as soil inoculation (e.g., for biological N fixation and mycorrhizal associations) and biological controls are more extensive and advanced than in most other countries.

It is ironic that the hardships imposed by what even most Americans consider a mistaken trade embargo are pressing Cubans to become leaders in the science and application of "biologically-improved agriculture," that will become increasingly important in the 21st century. This experience also makes them more open to SICA, being very knowledgeable about the contributions made by soil microorganisms to plant growth and health.

Cuba, which imports 60% of its current rice consumption, desperately needs to raise its rice production in ways that do not require capital or chemical inputs. The smallholder and state sectors now have roughly the same area under rice production, but smallholders are out-producing the state enterprises while also using much less costly production methods. Rena keeps reminding me that SICA has come along "at the right time" for Cuba.

Given the interest and support from government agencies, both for research and extension, and from NGOs, there could be rapid spread of SICA in the next year. More important, a growing number of farmers are enthusiastic about and experienced with SICA. They can work through their cooperatives and farmer organizations to spread knowledge about the new methods. Their communications carry both conviction and practical knowledge about how to make SICA work. This is a situation where great need and great opportunity are both meeting at the same time, a fortuitous conjunction.