REPORT ON SRI/SICA VISIT TO CUBA, May 31-June 8, 2008

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This was a fourth visit to Cuba to see what was being done with the rice-growing methods known in Spanish as ***el Sistema Intensiva del Cultivo de Arroz*** **(SICA).** This is actually a better translation of the original French designation – *le System de Riziculture Intensive* – than is the English term we use -- **the System of Rice Intensification (SRI)**. I was invited by the Ministry of Agriculture, along with my wife Marguerite, to participate in the **4th International Rice Meeting** which it planned to be hold in Havana, June 2-6. Previously I was able to participate in its 2nd international meeting in 2002, but not in the 3rd, held in 2005. It was possible for me to visit Cuba in 2003 and 2004 in connection with other events. However, I had not been able to get back for first-hand observations and discussions on the progress of SICA/SRI since that time.

Arrangements for the visit were facilitated by **Dr. Rena Perez**, who has been serving as a voluntary coordinator for SICA evaluation, demonstration and dissemination in Cuba since 2000. She had a full career working in the agricultural sector of Cuba, mostly as an animal nutritionist helping farmers and cooperatives get the most benefit from available feed sources for their livestock production. When she retired in 2000, Rena became a part-time food security advisor to the Ministry of Sugar. Under the government's policy of *autoconsumo*, ministries and agencies were responsible for providing daily meals for their employees and families. Given the large place of rice in Cuban diets and the need to produce food without dependence on costly external inputs, SRI offered an interesting opportunity for Cuban producers. Rena suggested the Spanish acronym SICA because SRI, translated literally, has the same initials as the American CIA.

Also attending the rice meeting were two SRI colleagues from Panama: **Ben Turner**, a British soil scientist now working at the Smithsonian Institution's Tropical Research Institute (TRI), and **Marie-Soleil Turmel**, a PhD student from McGill University in Canada conducting thesis research on SRI from the TRI research base, advised by Ben.

With his colleague Phil Haygarth, Ben made a major contribution to our understanding of how SRI methods can give good results in soils that are very low in available phosphorus (P) (http://www.nature.com/nature/journal/v411/n6835/full/411258a0.html) Although he is more engaged with environmental research than with agricultural issues, Ben has been drawn to work on SRI by the challenge of explaining its results in 'deficient' tropical soils. Ben's main interest is the dynamics of phosphorus in tropical soils, and it appears that P-solubilizing bacteria play a key role in response to the alternate wetting and drying of soil. Soleil is interested in how and why SRI methods perform differently on different kinds of soils. Her work, with Ben's assistance, should advance our understanding of SRI in this under-researched area.

Ángel Fernández García also attended from Peru. He has been trying to get SRI established in that country since he participated in the first international SRI conference in China in April 2002. His coming to this meeting in Cuba gave me a good opportunity to learn more about his progress in Peru than I had garnered from his written communications. Of course, during the week there were many more colleagues who became interested in SRI.

Field Trip on Sunday

We had hoped to make a field visit on Saturday to see SICA fields at the **CPA "Gilberto Leon"** (CPA stands for production cooperation). However, arrangements did not work out for a visit. This season, the CPA's SICA production has been expanded to 26 hectares, which Rena had hoped we could see this for ourselves. She had prepared a table of results from the data provided by the CPA manager, **José Borrego**, who has given leadership on SICA. While the 15% increase in yield may not be very impressive (SICA methods are not yet being used fully), the 70% increase in economic returns being achieved is quite satisfactory and very motivating. Reducing costs of production is an urgent need for all Cuban rice producers.

	Traditional Methods	SICA
Paddy yield (tons/ha)	4.0	4.6
Seed rate (kg/ha)	24	12
Inorganic fertilizer (kg/ha)	350	37
Visible pests	Moderate	Negligible
Water used (m^3/ha)	15,000-17,000	Ca. 40% less
Man-days for transplanting	16	5
Returns/ha (Cuban pesos)	439.34	747.15

On Sunday, Rena took Ben, Soleil, Marguerite and me to visit CPA "Jorge Dimitrov", about an hour's drive south from Havana, where SICA trials are being conducted this season. This initiative is advised by **Luis Romero**, a farmer-technician who was one of the first persons to try out SICA methods in Cuba, with some spectacular results. The picture that Rena took of him in 2002 has been seen around the world; Luis is holding two rice plants of same variety (VN2084) and same age (52 days). The SRI plant had a huge root system and 42 tillers, the 'normal' plant had much smaller roots and just 5 tillers. It has indeed become 'iconic' for the whole SRI movement. This past year, Luis joined the staff of the the Cuban Institute for Rice Research, **Instituto de Investigaciones del Arroz** (IIA), which we drove past on our way to Luis' home in the municipality of San Paul. En route, we also passed CPA "Gilberto Leon" where we could see its 26 hectares of SICA rice growing nicely under Borrego's management.

Once off the main road, the smaller roads were difficult to traverse because of recent heavy rains. (The hurricane season had begun officially just the day before.) With careful driving, we got to Luis' home and farm, where we were met by the president of the CPA we were to visit, **Miguel,** and two of his colleagues, **Eduardo** and **Rogelio**. We talked for a while, cooled by refreshing drinks. Water conservation is a very big concern of farmers these days, because gasoline and diesel have become so expensive. (Most irrigation is done by pump rather than by gravity flow.) All modes of power – human, animal and tractor -- are used for preparing the soil and for weeding, with economic costs and returns necessarily driving decision-making.

I was particularly intrigued by their use of ratooning, which involves letting the rice plants, once harvested, regrow for a second crop and harvest, with no need to replant. Although a second (ratoon) harvest is less than from a first cutting, this can yield respectable economic returns given its lower costs of production. The greater root growth promoted by SRI practices should make ratooning more productive. In Peru, one SRI trial had the ratoon crop reaching 5.5 tons/hectare, 70% of the first crop (8 t/ha): http://ciifad.cornell.edu/sri/countries/peru/peruechorep.pdf

Miguel and others said that because the second crop entails so little labor, even getting just 50% production compared to the first crop can be justified. It can cost just 10% as much to produce a second crop as for the first. (Ratooned SICA is called '*soca SICA*.') At the CPA that we were scheduled to visit on Friday, Rena said that they are already taking 3 harvests of rice a year from 2 plantings with SICA methods and are finding this quite profitable.

I encouraged systematic trials and evaluation of SICA methods for such multiple cropping. Miguel said that they are already convinced that ratooning works better with SICA. Luis explained to them, in Spanish that I could understand without translation, that just as the previous strategy to raise yields by making genetic improvement was called 'the Green Revolution,' SICA should be called 'the root revolution.' Roots are the key to SICA success.

The biggest concern that we discussed was how to reduce the percentage of sterile tillers in some SICA fields. With SICA methods, there is undoubtedly greater tillering; however, one wants to have as high a percent of fertile tillers as with conventional methods. I explained that with SICA, we see great variation in the rate at which panicles (heads or ears of grain) are formed from plants' tillers. The factors that appear to raise this percentage are: (a) active soil aeration, and (b) organic soil amendments.

This suggests to me that when microbial activity is promoted in the soil, rice plants are better supplied with the micronutrients (trace minerals) that are needed for enzymatic activity which is needed to support the protein formation necessary for creating panicles. No formal studies have been done on this, so this idea is conjecture. The relationship remains to be investigated and validated scientifically. However, we have seen that heavy applications of inorganic N in China have pushed the percentage down to about 50%, while purely organic management in the Philippines has pushed the rate up to 99% in rainfed SRI, this having the most aerobic soil conditions.

We all drove together to **CPA "Jorge Dimitrov"** to see the trials being conducted with two varieties -- I-29 and Bollito (VN2084). The first has a more erect leaf structure, while the latter spreads more. Seedlings 50-55 days old were transplanted in the control plots as this is the common practice in Cuba. The adjoining SICA plots, which had some degree of water control (but not as much expected for SICA), had been transplanted with 14-day seedlings, spaced 20x20 cm, 20x25cm and 20x30 cm in the respective subplots, and with Bollito, one subplot was spaced at 20x40 cm. The total area is one acre, we were told. We were told also that it was difficult on this CPA to get the persons doing the planting to adhere to such specific (and novel) spacing requirements.

We pulled up some plants to examine the roots. Their color was not bad, i.e., fairly light and white, but in the control plot, we counted 21 tillers on a clump of 5 plants, whereas this number (or more) was common on the single plants grown with SICA methods.

We agreed that what was being grown and evaluated here was not really 'SICA" but should be called "semi-SICA." There is less water control than recommended, and there is no active soil aeration. I said that we would be very interested in their results, encouraging or not. (One can

often learn more from negative results than from positive ones.) With rain threatening, we returned to Luis' home for a splendid Sunday dinner, the best meal we had during the whole week in Cuba, finishing and departing for Havana before the expected afternoon 'monsoon' rain began, flooding roads and streets and making movement more difficult.

Visit to National Institute of Agricultural Sciences (INCA)

Monday morning, Ben, Soleil, Angel and I went to Rena's home from where she drove us to the **National Institute of Agricultural Sciences** 45 minutes east of Havana. There we were met by the director of INCA, **Dr. Roberto Martín Triana**, and several staff, including **Dr. Alexander Miranda Caballero**, director of INCA's Rice Experiment Station at Los Palacios, which I had visited in 2004; **Dr. Ricardo Polon**, who works on water management for rice at Los Palacios; and **Ms. Yoannís Martín Enrique**, a rice specialist doing her PhD thesis on SICA.

Alex said that they had just recently had a SICA demonstration day, attended by 80 farmers, where SICA results with 7 varieties were assessed. The participants included farmers and managers from CPA "Camilo Cienfuegos" in Bahia Honda who have the most experience with SRI of any cooperative in Cuba. There was active participation from the government program ***Arroz Popular*** that supports small-scale producers. Although they have less land and capital to work with than the state-supported large-scale enterprises, they produce about 200,000 tons of the country's current production of 250,000 tons. Even this total amount meets only about one-third of the country's demand for rice, so there is much scope and need for expansion of rice production in Cuba.

Yoannís is doing a rather complete assessment of SICA methods, looking at interactions among age of seedlings, spacing distance, plants per hill, varietal differences, and water management options. When we gathered in the INCA meeting hall at 10 o'clock for a session on SICA, she led off. About 25 persons had assembled, about half of them farmers, including Luis Romero who had come from San Paul to join in this discussion.

Yoannís commented that she had learned a lot about rice production alternatives from a 6-month training program in Japan. While there she had attended a presentation on SRI given by **Mr. Shuichi Sato**, an agricultural engineer spending most of his time in Eastern Indonesia as team leader for a Japanese-funded irrigation management improvement project (DISIMP) that has given leadership for SRI promotion in that country.

Handling very young seedlings presents a particular problem for Cuban farmers, Yoannis said. She showed an interesting method for growing seedlings, which I dubbed 'the chocolate cake method.' A mixture of soil and compost is blended, and this material is pressed into a square mold which produces a moist block that resembles a flat, moist, deep-brown-colored cake. Yoannís scores the top of this 'cake' with parallel and perpendicular lines, about 10 cm apart, to mark a grid on the top of the soil. One seed of rice is placed in the center of each square, and the 'cake' is then covered while the seeds sprout vigorously in the growth medium that had been prepared. When the seedlings are 8 to 12 days old, the 'cake' is cut into square pieces, along the grid lines, and the 'pieces of cake' are put into the soil at precise spacing, say, 30x30 cm. Transplanting operations can be completed within 10 minutes.

Growing the seedlings is not difficult, Yoannís said, but farmers still find it difficult to plant in a grid pattern. For this, they need better implements like the roller-marker developed in India. Some are using home-made 'rakes' to mark a grid pattern onto the field. But the picture that she showed was of a field too wet to hold the marks well; thus the soil is too saturated for best growth of young plants. With the wider spacing, rice plants tiller profusely, having 50-80 tillers on a single plant, much more than obtained from 5 seedlings planted closely together.

Yoannís had some excellent pictures in her presentation. The main problem that she has found with SICA is water control and associated weed control. She and her colleagues know that different soils have a lot of influence on plant performance. On one soil where the yield with SRI methods was 8 t/ha, the yield was 11 t/ha when inoculated with mycorrhizal fungi. There are also varietal differences to be assessed in relation to soil differences and in response to alternative management practices. She will be sorting out a very complex set of interactions for her thesis, which can give guidance for SICA adoption and adaptation in Cuba.

My presentation focused on a number of scientific issues and possible explanations for SRI. Its practices produce quite a number and variety of 'deviations' from standard practices – massive tillering and root growth, resistance to biotic and abiotic stresses, shorter crop cycle, higher milling output, etc. I reported on some of the findings regarding pest and disease incidence, concentrations of soil bacteria in the rhizospheres of SRI plants, changes in grain quality, etc.

When I finished, Roberto Martín, the director of INCA, commented that I had raised a number of subjects that while "not taboo" are not much discussed, particularly regarding the roles and functions of microorganisms and soil ecology. "We need a new focus," he said, with better scientific foundations that underpin some new directions in agricultural practice, such as were developed for the Green Revolution. H ecited favorably the work of Dr. Ana Primavesi in Brazil on tropical soil systems, and I gave him (for INCA) a copy of the book that I had put together and edited with over 100 agricultural scientists from around the world contributing, titled *Biological Approaches to Sustainable Soil Systems*. The book's second chapter, on tropical soil systems was contributed by Dr. Primavesi.

Roberto thanked me for the book, but said that we need to go beyond books and to get changes made in the management of soil systems. "We need some new agricultural science. There is a big void here." I, of course, agreed with this statement. He said he wanted to invite me to an international meeting that INCA is organizing to address these questions next November.

Ricardo said that he was very happy with the presentation since it had called attention to roots. He has worked for many years on roots and on water stress and was one of the first researchers to start working in SICA when it was first introduced in Cuba. He expressed confidence that SICA will get more and more scientific explanation from now on. He referred to some work done in Japan on soil aeration and photosynthesis. Deeper roots in aerated soil support more photosynthetic activity in the canopy. (This contradicts the contention five years ago by Achim Dobermann, now director of research for IRRI, in an email communication, that one can model and evaluate photosynthetic limits without reference to the structure and performance of roots.)

The question was raised whether SICA can be used with ratooning, and it was agreed that we need to find ways, mechanically or chemically, to deal with weeds as these are a real problem for many farmers in Cuba. Next, Angel spoke about his experience with SICA in Peru, noting that in his small-plot trials, in one case, a modern variety (IR-46) had given a yield of 23 t/ha. This has not been replicated on a large field, to be sure, but it showed the potential that is in the rice plant. SICA methods are attractive in Peru because with high costs of production in the coastal region, yields less than 8 t/ha cannot break even. Yields above 8 t/ha, on the other hand, and especially 10-12 t/ha which are quite possible with SICA under Peruvian conditions, are quite evidently profitable. It has been difficult to get investments made in SICA in his country, Angel said, but now having gotten the area under SICA up to 500 ha, with good results, he has funding lined up to expand to 3,000 ha in one area by 2010, and to 5,000 ha in another area by 2012. If those results are as positive seen in the trials so far, expansion could be considerably faster than this.

After three hours of presentations and discussions, we adjourned for a nice lunch provided by the Institute, and then drove back to Havana, once again encountering strong afternoon rains. The International Rice Meeting began that evening with a large reception, where among other persons, Marguerite and I got acquainted with **Dr. Melissa Fitzgerald**, an IRRI staff member working on rice nutritional issues who was representing the International Rice Research Institute at this event.

4th International Rice Meeting

The first day of meetings, after an opening session, focused on three topics: milling, integrated pest management (IPM), and sustainable rice production. The latter subject was of most interest to me and most relevant to SRI, but its sessions had no simultaneous translation (the room with these facilities was assigned for the subject of milling). So after finding that I could get little from the presentations in Spanish, I spent most of the day catching up on SRI email traffic and polishing several reports of SRI colleagues.

The discussions of SICA were scheduled for the afternoon of the second day, Wednesday, as part of a day-long symposium on **Integrated Management of Rice Crop**. At the end of the morning session, just before lunch, **Luis Romero**, whose farm we had visited on Sunday, made a presentation on the dynamics of rice production in a cultivation rotation in a rural community. He told symposium participants about the introduction of SICA in his community, commenting also on Borrego's introduction of SICA techniques in an adjoining CPA, making "smart" adjustments, he said. Luis stressed that SRI is a matter of ideas, and it requires "a change in mentality." He presented figures on net income/ha for rice, cabbage, flowers and other crops. Rice produced with standard methods gives the lowest returns, and cabbage by far the highest. His main theme was the need to lower costs, which he said is possible with SICA. Unfortunately, the translation of his talk into English was not very clear, so I could not understand all of his points.

The Round Table (*mesa rodonda*) on SICA began about 3 o'clock with my presentation on "What We Are Learning about SRI (aka SICA) From Other Countries.' This was given half an hour instead of the usual 15 minutes, so I had time for a reasonably thorough review of what SRI methods can and cannot do. Discussion was deferred until all the presentations had been made, so **Marie-Soleil Turmel** followed with a 'meta-analysis' of 70 comparisons between SRI and

non-SRI production, using FAO GIS data to identify the kind of soils used in each case. Her analysis went well beyond the rather unsatisfactory and inconclusive 'desk study' by McDonald et al., published in *Field Crops Research* (2007). That paper used only 40 comparisons, and these were selected in a way that constructed a rather unrepresentative data set.

Using standard criteria, Soleil classified the soils involved in the 70 cases as having high, middle or low inherent fertility. Her regression analysis indicated that in absolute terms, yield gains from SRI methods are ***greater in low-fertility soils than in higher-fertility soils***. This conclusion -- which would apply in relative terms too -- is very interesting, and reasonably consistent with what we have been observing in many countries in an unquantified way. If this relationship is confirmed by further investigation, it will make SRI one of the few innovations that is inherently more beneficial to disadvantaged people, since most economic and institutional processes have enabled better-off persons to gain control over 'better' soils, and these in turn add to such persons' advantages, while less-well-off persons have been marginalized on 'poorer' soils.

Soleil did not propose an explanation for her observation, since her thesis research is still at an early stage. She plans to investigate this overall correlation with plot-level experimental data on a wide variety of soils, investigating biological as well as chemical and physical factors. Her set of hypotheses appeared very reasonable, consistent with our widespread SRI experience and grounded in existing scientific literature. Growing rice with organic fertilization and under aerobic soil conditions may prove to: (1) increase phosphorus availability, (2) increase the activity of beneficial soil microbes, (3) stimulate root growth, and (4) reduce Fe and Mn toxicity. All of these effects would contribute to higher yield.

Soleil's conclusions were that: (1) soil properties may contribute to regional differences and discrepancies in the yield response to SRI practices reported thus far, (2) relatively infertile soils may have the greatest yield response to SRI practices, and (3) even on fertile soils, SRI practices may have potential to reduce water requirements without sacrificing yield. For a report made in the early stages of PhD thesis research, this presentation represented very substantial work already done, and some very promising potential learning for SRI.

Lazaro Maquiera of INCA reported on some of his institute's research on the effects of SICA practices on a short-cycle variety, Los Palacios 5 (LP-5), during the rainy season. Seedling age was 13 days, with 30x30 spacing, and 80 kg of N fertilizer was applied per hectare. Lazaro gave data on the greater dry-matter weight of rice plants grown with SICA methods compared to standard methods, at maximum tillering, at flowering, and at maturation. By this last stage, the difference was 1400 g vs. 925 g. He also reported that SICA yield with same variety was 6.6 t/ha vs. 3.8 t/ha with regular methods. Grains per panicle were 127 vs. 74, and panicles/m^2 were 321 vs. 303. However, grain weight was slightly higher with regular methods, 29 vs. 28.8 g/1000 grains, not a significant difference. His conclusion was that SICA methods offer farmers productive opportunities.

Angel Fernández reported on his work with SICA in Peru, describing the problems he has encountered in getting it introduced despite evident economic advantages. There are very high costs of irrigation in the coastal region of Peru, and the costs of agrochemical inputs are mounting. With the introduction of new varieties, rice yields increased during the 1990s, up to

2000. But since then, there has been no further gain in yield. SRI thus comes along at an opportune time. With some financial support, the first 500 hectares of SICA have been planted, and he expects that the results will warrant expansion to 2,000 hectares, and then 3,000 hectares. In another area, they expect to expand SICA to 5,000 hectares. His goal is to reach 20,000 hectares within 5 years, but rising input costs and tighter water constraints could drive this acceptance faster if the yield gains hold up.

Juan Riambau, the agronomist working at CPA "Camilo Cienfuegos," presented a nicely-prepared powerpoint on that cooperative's SICA experience. He expressed appreciation for the Chinese proverb with which I had closed my presentation: "Those who say that something cannot be done should not interrupt those who are doing it." The cooperative was formed in 1980, so has been in operation for 18 years. It was formed as a sugar cooperative, so rice is a relatively new and less important production activity. In 2001, Rena Perez, whom they already knew from her services as an animal nutritionist, visited the cooperative and challenged them to "try something new."

At the time, paddy yields were not high enough to make rice an important crop for the co-op. They planted only 2 hectares to rice. When they introduced SICA methods, there was a lot of criticism from members, for example, about planting at such wide spacing, 30x30 cm. Their situation was not well-suited for SICA because there was not an appropriate drainage system at first. Most fields were too saturated to use the methods properly. Juan showed a video of the flooding. "We had to put in some new dikes to control the water better," he said.

Also, there was resistance to transplanting young seedlings at first; but women members learned quickly how to handle the plants. Now labor time for transplanting has been greatly reduced, from 30 days per hectare to 15 days. Seed costs have been cut by half, but they figure that their costs of production have gone up 10% overall. On the other hand, yield has increased by 58% on average, from 6 t/ha to 9.5 t/ha. Net returns per hectare thus went up more than 50%. In addition, they use less water, get better grain quality, and have fewer problems with pests and diseases.

The cooperative has expanded its area under rice to 14 hectares now because of the greater profitability, and on a plot where they were able to have good water control and have applied organic matter as recommended, they got a yield of 14 tons per hectare. So they know that with proper SICA management, there is still much potential to be capitalized upon.

Rena Perez concluded the round table presentations with a powerpoint on the dissemination of SICA in Cuba. She noted that she had learned about it from one of her Cornell professors from 50 years ago, David Pimentel. He visited Cuba in 2000 for a National Geographic Society committee meeting and put her in touch with me for details on SICA. She started contacting both farmers and researchers to enlist their interest and then their evaluations. She commented that when members of CPA "Camilo Cienfuegos" first started using SICA, they said "it looks ugly."

Rena showed many pictures of training sessions and paddy fields, including one SICA rice plant with 87 fertile tillers, and another plant with 104 tillers. Already the first results in 2002, from five locations where comparisons of yield were made, showed 5.75 t/ha with standard methods

(well above the national average) and 9.75 t/ha with SICA practices, with high yields of 14 t/ha reached in two of the cases.

CPA "Gilberto Leon" has expanded its SICA area to 26 out of 39 hectares, and it has found that best results result when each agricultural worker manages the same assigned area throughout the while season, rather than having assignment made randomly from operation to operation. This should not be surprising, but it is not standard practice. The manager there, José Borrego, says that he has cut his transplanting labor requirements in half.

Rena's presentation climaxed with a picture of the three directors of the Institute of Rice Research (IIA); *Arroz Popular*, the government's program for small-scale producers; and the Urban Agriculture Movement, meeting together last November and agreeing to cooperate on SICA promotion across the country. Her final slide was an impressive montage of pictures of many different 'promotores' of SICA throughout Cuba.

When the floor was opened for discussion, there were requests from countries around the region – Dominican Republic, Colombia, Guyana, Costa Rica, Panama -- for more information on SRI/SICA, and for visits by myself, Rena or anyone else knowledgeable about the new methods. In many Latin American and Caribbean countries, given land-labor ratios, there is now a fairly high degree of mechanization in rice production, so many questions focused on the possibilities for mechanizing the crop-establishment and weed control operations of SICA. Direct-seeding or sowing pregerminated seeds and then thinning the young plants out subsequently can be combined with other SICA methods (ideas). There was also interest expressed in 'rainfed' SRI.

Juan Riambau from CPA "Camilo Cienfuegos" said that they want to mechanize their operations more, and particularly they need to work on land leveling, to use water more efficiently. Luis Romero commented on his efforts to reduce SICA labor requirements by building an implement for direct seeding in rows with regular spacing to achieve a square pattern of plants.

Dr. Miguel Socorro, deputy director of IIA who chaired the round table, wrapped up the discussion after 5. Rena was immediately surrounded by Spanish-speaking participants from different countries. I was approached by **Dr. Dindyal Permaul**, Permanent Secretary of Agriculture for Guyana, and **D. Chedammi**, a senior researcher at the Rice Research Center for Suriname. Both invited me to visit their neighboring countries, perhaps next November. Rena and I later conferred on how we could jointly respond to the many requests. Angel Fernandez could assist some countries where all conversations would be in Spanish. Soleil can also help introduce SICA to regional audiences. Certainly there was much more interest expressed in SICA than after my presentation on it to the 2nd International Rice Meeting here in 2002. To be sure, now we have much more evidence and understanding to share.

Field Visit to CPA "Camilo Cienfuegos"

Friday morning, a busload of conference participants traveled to this cooperative, about two hours west of Havana. I sat together on the bus with **Dr. Kardie Kartosoewito**, director of the Rice Research Center in Suriname. Having my laptop along, I could share with him the presentation that I had made on Monday at INCA, going more into the scientific aspects of SICA than was possible on Wednesday.

At the cooperative, we were greeted by its manager, **José Antonio Espinosa**, known to everyone as **Nico**, who has become a strong proponent for SICA. Also there to show us around and answer questions were **Juan Riambau**, the CPA's agronomist (who spoke at the rice meeting on Wednesday), and **José Luis Martínez**, manager of field crops, now especially rice. Before braving the intense sun on a long walk to the rice fields, we were treated to the most splendid fresh fruit we had gotten in Cuba: mangos, pineapples, bananas, papayas, all grown locally.

Nico told us as we walked to fields that by using most of the SICA methods, but not all ("*semi-SICA*"), they are doubling their normal yield here, and with less requirement for seed, water and labor. This latter is a major consideration since labor is the main constraining resource. Juan repeated to a group of visitors what he had said at the meeting on Wednesday: when they use all of the practices properly, they have gotten a yield as high as 14 tons per hectare (paddy, not milled rice).

The main constraint that they encounter for practicing SICA properly is water control. Their water supply comes from a river that flows above many of their fields, so during the rainy season there is flooding, and they have difficulty in maintaining good drainage of their low-lying plots. We could see that some of their fields were not well-weeded, so weeding is evidently also a problem. Still, they have been getting significant benefits from the new methods and have made rice a major part of their production program. (While in the fields, Soleil took some pictures of me standing with Nico, using her high-resolution setting because the *New York Times* had asked to have such pictures to use with a story that is being written about SRI for its Science section.)

On our way back from the fields, we stopped at the cooperative's threshing facility, where unmilled (paddy) rice is dried on large, flat cement surfaces before being milled and bagged. The drying area was now twice as large as when I visited the cooperative in 2004, the addition being credited to "SICA." The resistance of farm workers to using single plants and to transplanting more widely is now overcome as these changes in practice are obviously worth learning and doing.

At the community center constructed by the cooperative near an artificial lake, where freshwater fish are produced, the operations of the cooperative were described and many questions were asked. We were given a very ample and delicious lunch, with more meat than we needed, and with all food produced on the cooperative (except the rum). At 3:30, we reboarded the bus for the trip back to Havana, well-fed, slightly sunburned, and pleased to see the successes of this cooperative. This is probably one of the most successful CPAs, having both good leadership and technical skill (e.g., when I visited in 2004, they were experimenting with biofertilizers). The coop has been very willing to host visitors from many parts of Cuba to share its SICA experience with them, and numerous researchers have come to assess the SICA performance. Through its links with other cooperatives and the national farmers' association (ANAP), I hope this experience can spread.

Concluding Thoughts

Next morning at breakfast, **José Chaves Alfaro**, director for research and technology transfer for **Conarroz**, the Costa Rican national corporation of rice producers, joined Marguerite, Soleil and

me. He wanted to discuss SICA some more and suggested that I visit his country to share what is known about SICA from other countries. There will be an agricultural meeting at the end of June which I can try to attend, making also a short visit to Panama, where a representative of the Ministry of Agriculture expressed an interest in a visit. [As it turned out, Soleil was invited to the meeting in Costa Rica, saving me another trip, and she and Ben will work with the Ministry of Agriculture in Panama to get SRI taken up there.]

Thus, although the visit was only for a week, the two main purposes were well accomplished: to maintain and expand contacts with Cuban colleagues, both researchers and farmers, getting updated on their varied experiences with SRI/SICA; and to establish contact with rice researchers and growers in other countries in the Latin American region.

I was not able to meet with the head of the **Urban Agriculture** program, **Dr. Adolfo Rodríguez**, who also serves as director of the Institute for Basic Research in Tropical Agriculture (INIFAT), which this past year celebrated its 100th anniversary, because he was out of Havana the whole week of the conference -- or with **Dr. Luis Alemàn**, head of ***Arroz Popular***, who was out of the country. But I was able to talk several times with **Dr. Jorge Hernandez**, director of the national rice research institute (IIA). The three of them have agreed to cooperate in promoting the use of SICA through their respective institutional channels across Cuba.

Several factors are working in SICA's favor: (a) the results achieved with SICA methods thus far in farmers' fields as well as on experimental plots; (b) the rising price of rice on the world market (Cuba presently imports two-thirds of the rice that it consumes); and (c) the higher price of petroleum, making conventional production practices more expensive. These factual trends will create more and more incentive to change conventional rice-growing practices. If INCA can now be added to this 'troika,' this will further strengthen the institutional capacities.

Arroz Popular works with the farmers' association, **ANAP**, which has the most direct connections to rice farmers, so it will have a key role in this. INCA is willing to share its research knowledge, as it already shares the improved varieties it develops, with anyone in the country. It is good to know that there will soon be research results coming also from Panama, thanks to Soleil and Ben, and we hope to see more field results being reported from Peru, as a result of Angel's endeavors.

There has been relatively less uptake in Latin America among all of the world's regions so far. Even in the Near East and North Africa there has been more interest, thanks to efforts by SRI colleagues in Iraq, Iran and Afghanistan, and now Egypt and Morocco. Cuba was for some years the only country with SRI/SICA activity, and then Peru, and this past year now Brazil. But the rice sector situation has been changing all around the world. It seems now that there will be a quickening of interest and initiatives that will develop a number of regionally-adapted variations of SRI to meet the needs of producers and consumers in Latin America and the Caribbean.