

## TRIP REPORT ON VISIT TO JAPAN, JULY 1-5, 2007, CONCERNING THE SYSTEM OF RICE INTENSIFICATION – Norman Uphoff, CIIFAD

This visit was arranged at the invitation of the newly-formed **Japan Association of the System of Rice Intensification (J-SRI)**, formed last April with a secretariat at the Department of Global Agricultural Sciences in the University of Tokyo. The schedule was organized by **Mr. Shuichi Sato**, Nippon Koei team leader in Eastern Indonesia for the Decentralized Irrigation System Improvement Project (DISIMP), together with J-SRI's chairman, **Prof. Eiji Yamaji** from the University of Tokyo's Graduate School of Frontier Sciences.

### **Monday, July 2**

Having met us at the airport the night before, Sato picked up my wife Marguerite and me at 10 to take us to the University of Tokyo for an early lunch in the university dining hall with Prof. Yamaji and **Dr. Masaru (Mizo) Mizoguchi**, secretary of J-SRI, before we joined other members of J-SRI for a 'technical meeting' at 12:30.

Before this meeting started, we met also J-SRI's deputy secretary, **Dr. Tetsuya Araki**, who is also in the Department of Global Agricultural Sciences, and **Shimizu Keisuke**, graduate student in the department who is currently doing master's thesis research on SRI in Indonesia. In all, ten members of J-SRI joined in the session.

Dr. Yamaji began the self-introductions, explaining that he first learned about SRI three years ago from Sato when he visited the University of Tokyo to elicit interest in SRI. Two years ago, Yamaji visited Indonesia and saw SRI for himself in farmers' fields. As an irrigation specialist, he was interested particularly in its water-saving possibilities. But like so many others before him, he said: "I didn't believe it myself at first." Finally, a year ago he began supporting scientific investigations of SRI and helped to form J-SRI. Next, Mizo introduced himself as a professor of agro-informatics with professional training as a soil physicist. Previously he worked on the effects of soil freezing on rice-growing in temperate climates; but his exposure to SRI in Indonesia two years ago has evoked his interest, and now he has started to do research on SRI. Sitting next to him was a graduate student, **Heriko Sato**, who introduced herself saying that she will soon start her master's research on SRI.

Sato then described briefly his long-term involvement with the irrigation sector in Indonesia, dating back almost 17 years ago. He described how as an agricultural engineer he had been curious about SRI when first learning about it in 2002. "For first two years, I was skeptical," he said, "But I asked my Indonesian agronomic staff to try out the methods, and now the area under SRI is expanding rapidly." More than 5,000 hectares are under SRI practices within DISIMP. The effort is now supported by both the Ministries of Irrigation (PU) and Agriculture (Deptan).

Indonesia is currently the #1 rice importer in the world, Sato said. "Everyone agrees that this needs to be reversed." Also, there is great need for water saving in Indonesia. If just 10% of the irrigated rice area in Indonesia can be converted to SRI, he has calculated that this could change Indonesia from an importer to an exporter of rice. Now he is working with some Indonesian colleagues on 'organic SRI,' which has very high quality. "This could become an excellent export commodity." Sato had on display outside the meeting room a package of organic SRI rice

from Indonesia, which commands in local markets about twice as high a price as that usually paid by consumers for rice.

**Hiroshi Akutsu** from the Hokkaido prefectural government in the north of Japan said he had made a special trip to Tokyo to participate in this day's activities. He learned about SRI just two months ago and found it "very interesting," saying that he was "very happy to join the meeting." Subsequently, another participant from Hokkaido, **Prof. Shuichi Hasegawa** from Hokkaido University, joined the discussion, introducing himself as a root scientist with "much interest" in SRI. **Shigeyuki Mori**, a farmer in Chiba Prefecture who is using some of the SRI methods, introduced himself to the group and welcomed Marguerite and me to visit his farm on Wednesday, as planned in our schedule.

**Dr. Dorothea Kimura**, a soil scientist at the University of Tokyo, then introduced herself. When she visited Cornell in March, she had come to see me. After our conversation about SRI, she got in touch with Sato and Yamaji upon returning to Japan, and she now has started some research on SRI on University of Tokyo trial plots. She adapted her on-going work on C and N flows in soil and atmosphere under different rice production methods to include SRI techniques. She planned to report to the J-SRI group on her findings so far.

Shimizu started the session with an interim report on his experiments in Lombok, Indonesia, where he is measuring water use and its effects under different water management regimes. He does this work at the SRI research station that Sato has established under DISIMP. It is near Puyung village, 15 km from Mataram, the capital of Lombok in West Nusa Tenggara province. This research is co-sponsored by DISIMP and the University of Tokyo SRI research team. The first period of his research is the current dry season, May to August.

The station has 20 plots, 5x5 m, each with its own water control, so very precise measurement of water applications and soil moisture levels is possible. Shimizu is evaluating four intermittent irrigation patterns against a control (conventional continuous flooding). Each treatment has a fixed flooding period of 5 days followed then by different drying periods -- 5, 10, 15 and 20 days, all with 2 replications. He is trying to evaluate also any synergy between SRI methods and intermittent flooding.

The conventional control plots have 21-day-old seedlings, 4 plants per hill, spaced 20x20 cm, with continuous flooding and 5 cm water depth -- compared with intermittent irrigation that has only 1-2 cm water depth and either 8-day or 21-day seedlings, 1 or 4 plants per hill, and 30x30 cm or 20x20 cm spacing. All plots get the same fertilization (150 kg of N, 50 kg of P, and 50 kg of K per ha), and all use the same variety (Ciherang).

Shimizu has not been at the station since the 25<sup>th</sup> day after planting, but he plans to return next week and stay through the harvest. Since he left Lombok, the station staff have been making continuous measurements, including a fascinating record of 'fixed-point photography' that takes images of the plots every 5 minutes. Weather can be monitored in this way while monitoring temperature and other parameters. Five plants have been selected at random as representative for each plot, and they are observed every 5 days for height, number of tillers, and leaf color. Roots are being occasionally observed, although not measured.

So far, the plants in the intermittent irrigation x conventional plant management plots are doing better than the SRI-managed plants; however, the data are only for the first 25 days. This is not surprising, since SRI growth acceleration usually begins after the 30<sup>th</sup> day. Shimizu showed very interesting and precise soil-moisture data over time, noting that these are all ‘interim’ data because he needs data from the full season before drawing any inferences.

Shimizu also showed yield-component data from Sulawesi from the 2006 dry season: about 10% more panicles/m<sup>2</sup> for the SRI plants compared with conventional plants; more than twice as many spikelets per panicle; 120% more spikelets per m<sup>2</sup>; with about the same percentage of filled spikelets. The 1000-grain weight was about 5% less for the SRI harvest, but the total SRI yield per m<sup>2</sup> was more than twice that of conventional practice.

Shimizu closed with a slide quoting an Indonesian farmer who said about the SRI crop last year: “SRI is art in the paddy field.” As soon as this season’s crop is harvested next month, Shimizu will undertake systematic analysis of all the different crop and crop-water relationships that he is monitoring, hoping to advance everyone’s knowledge of these.

Dorothea Kimura then showed powerpoint slides of the four plots on the university experimental farm where she is doing current experiments on a total area of 440 m<sup>2</sup>. Each plot has its own separate water supply. She is studying methane and nitrous oxide emissions as affected by management practices. Her alternative water-management treatments are intermittent irrigation vs. continuous flooding, and the different plant densities she is evaluating are low (40 x 35 cm spacing) and high (20 x 35 cm spacing).

Dorothea is also measuring the uptake of cadmium (these plot soils were previously exposed to high concentrations) to see whether there are any effects of soil oxygenation, as well as of soil temperature, on its concentration in plant tissues. Her trials will provide some interesting initial data on the effects of SRI practices on greenhouse gas emissions. We discussed the tradeoff between ‘rigor’ and ‘realism’ in such evaluations, as the very carefully-controlled trials make the growing conditions somewhat artificial, e.g., cutting off the plant and soil from a natural circulation of the atmosphere. The numbers calculated may not be very meaningful in absolute terms, but relative differences can be interpreted to have some real-world relevance.

During the break between the technical session and public lecture, **Daisuke Takahashi**, another University of Tokyo student doing master’s thesis research on SRI in Indonesia, talked with us. His subject is farmer adoption, trying to determine what predictive factors can explain farmers’ decisions whether to take up SRI or not. He was just starting to analyze and write up his data, which should provide some helpful insights.

About 100 persons came for the public lecture on SRI. Before it started, **Prof. Keisuke Nemoto**, professor of agriculture and environmental biology at Tokyo University, gave me an offprint of a recent article he co-authored on “Quantitative trait loci for phyllochron and tillering in rice,” published in *Theoretical and Applied Genetics* (2004). An earlier article that he wrote with two colleagues on phyllochrons in rice, published in 1995 in the journal *Crop Science*, was one of the most important articles that contributed to our early understanding of SRI performance.

The dean of agriculture, **Prof. Shogenji**, opened the forum, saying that SRI is welcomed in his faculty because it was a very good subject for integrative work across disciplines. Prof. Yamaji gave a brief introduction of J-SRI as an organization, and then Sato introduced me. I was able to stay within the hour given me for the presentation, followed by almost an hour of questions and discussion afterwards. Then, about 30 of the faculty and students came to a reception and light dinner in the university dining facility, with almost two hours more of informal discussion.

Two faculty there were from Chiba University, **Dr. Kazuyuki Inubushi**, a professor of soil biology, and **Dr. Masao Kikuchi**, an agricultural economist who is now dean of the agriculture faculty. Masao and I became acquainted in the late 80s when he worked at the International Water Management Institute (IWMI) in Sri Lanka. After we met again and spoke about SRI in 1998, he tried to get Japanese faculty interested in SRI, but without success. Now it may be possible to mobilize some academic interest at Chiba University, and to get some SRI activity started also at Hokkaido University.

Several of Sato's colleagues from Nippon Koei attended both the talk and reception. **Norio Takayanagi**, who has responsibilities for assessing and developing water supply for the megacity of Jakarta in Indonesia, commented that their projections are showing that by 15 years from now, Jakarta's water supply will be insufficient to meet all urban requirements. Having learned about SRI from Sato, he tried to get SRI built into the development plans for the main watershed that provides water for Jakarta, thinking that water savings in the rice sector, the major consumer of freshwater in the watershed, could extend the useful life of the current and planned water supply infrastructure. This would be an unexpected application of SRI to benefit urban populations. Norio said that at first there was resistance to the idea of introducing SRI, but once decision-makers contemplated the dire effects of running out of urban water supply for Jakarta within 15 years, they decided that SRI should be looked into.

Another Nippon Koei manager, **Naoto Morioka**, had worked previously in Sri Lanka and thus knew my work on irrigation management to improve performance in the Gal Oya scheme. He said that one of his counterparts in the Sri Lanka Irrigation Department had used SRI methods himself on his own paddy fields. Naoto will be going to Ghana in August, to work on improving the rice sector there. He said he would try to get SRI introduced in irrigated areas of Ghana. I will put him in touch with Dr. Maxwell Asante at the Crop Research Institute at Kwadaso, who is beginning SRI trials in Ghana this year.

### **Tuesday, July 3**

This was planned as a less busy day. The main morning task was to get a visa from the Vietnamese Embassy for my visit to Hanoi planned for the following week. This was the most pleasant and simplest experience for getting a visa that I have ever had. After lunch, Sato brought **Ms. Mitsue Tamagake** from the editorial staff of the *International Development Journal of Japan* to the hotel for a two-hour interview on SRI. She had previously done an article on Nerica rice developed by the African Rice Center (WARDA), so she had a lot of good questions.

Then at 5:45, a Cornell alumnus, **Kazuhito Suga** from the consulting firm **IC Net** which plans and manages many development projects funded by JICA, JIBC, ADB and other agencies, came

to take us to the IC Net offices in Saitama, north of Tokyo. An evening seminar for IC Net staff and associates was planned, on ‘the farmer context of SRI.’ IC Net focuses mostly on ‘software’ for development programs, including farmer organization and participation, so the discussion focused more on the process of evaluating and spreading SRI than on agronomic concerns. Afterwards, Marguerite and I had a Japanese dinner with IC Net staff at a nearby restaurant. Many knew our son-in-law, Toshi Kato, who works for IC Net from his home in the U.S.

### **Wednesday, July 4**

Sato picked us up at the hotel about 8 to go by train to a station where Prof. Yamaji and Shimizu met us and took us onward by car to visit the farm of **Shigeyuji Nori** in Chiba Prefecture. En route, we drove through a 6-km tunnel under Tokyo Bay. Nori and his wife welcomed us and showed us pictures of the way they have been growing rice for many years now. Nori adapted his mechanical transplanter so that it can transplant 7-day-old seedlings, which are half the age of most seedlings used by other Japanese farmers. The number of plants per hill is often though not always one because it is hard to control this number with a transplanting machine. He has developed a special material for planting ‘trays.’ He grows his seedlings in a kind of mat that can be rolled up (with very young seedlings inside) and carried easily to the field for transplanting.

After a delicious lunch of rice balls with fish or pickled plum filling, we visited Nori’s field. He is doing only ‘partial SRI’ since no effort is made to minimize water application. As chairman of the local water users’ association, Nori has been reluctant to practice alternating wetting and drying (AWD) of his field because it is thought that this uses up more water, because cracks develop in the soil when it is dry. This is not necessarily correct, however. Shimizu’s data from the SRI experiment station in Lombok, Indonesia, where inflow and soil moisture are both carefully monitored, show that water savings are definitely possible with AWD. Nori agreed that it was worth trying alternate wetting and drying together with his use of single young seedlings.

Even though nitrogen fertilizer had been applied to Nori’s field, along with compost made from kitchen scraps and other organic matter, the greenness of the rice plants varied considerably – although in general the color was darker green than in neighboring rice fields. He expects to get a yield of about 4.8 tons/ha. This could be improved upon with fuller use of SRI methods, in my view. In general, rice cultivation seems to be as ‘traditional’ an enterprise in Japan as elsewhere, indeed, maybe more so given that it is millennia rather than centuries or decades old.

After the field visit, Yamaji drove us to a railway stop at the campus of Tokyo University near to Tsukuba, from where Shimizu took us by train into Tsukuba. There Sato met us almost exactly at 3 as planned. We took a taxi to the **National Agricultural Research Organization (NARO)**, where its president, **Prof. Takeshi Horie**, welcomed us. He has taken on this responsibility after retiring as professor of agronomy at Kyoto University last year. He has been interested in SRI for several years, having presented a paper on this at the 4<sup>th</sup> International Crop Science Congress in 2004 ([http://www.cropscience.org.au/icsc2004/symposia/2/4/1869\\_horiet.htm](http://www.cropscience.org.au/icsc2004/symposia/2/4/1869_horiet.htm)), subsequently published in *Plant Production Sciences* (2005, 8: 257-272). He currently has a graduate student doing field research on SRI soils in Madagascar.

About 60 scientists attended the special NARO lecture on SRI that Prof. Horie hosted and introduced. I had 40 minutes for an overview, and Sato had 20 minutes to report on SRI results from Indonesia, a good back-to-back arrangement. There were very good questions and

discussion that followed. That Prof. Horie shook my hand vigorously when I finished my lecture indicated a positive reception to the ideas and evidence presented.

After showing us through the NARO museum, Prof. Horie took us to a local restaurant for a truly 'authentic' Japanese dinner, attended also by **Dr. Kiyoaki Maruyama**, vice-president of NARO and director-general of the National Agricultural Research Center. He is a plant breeder with very broad-ranging interests and will soon succeed Prof. Horie as a member of the board of directors of the African Rice Center (WARDA). Also with us was **Dr. Tsukasa Nagamine**, director of the Department of Research Planning and Coordination of the National Institute of Crop Science. The supper and discussion were unhurried, and Sato accompanied Marguerite and me on the long train ride back to Tokyo from Tsukuba.

#### **Thursday, July 5**

At 10:30, we traveled by train with Sato to Chiba City, north of Tokyo, to the **Institute of Developing Economies (IDE)**, an interdisciplinary research and training center that has given leadership and impetus to development studies for over 30 years. I have participated in several of its training programs previously. The subject requested for a lecture to the IDE staff was 'social capital,' one that interests me as a social scientist and has some bearing on our SRI work.

Attending the lecture was **Akira Munakata**, until recently a staff member with the **Asian Productivity Organization (APO)**, a regional program funded by the Japanese government. Previously, Akira enlisted me as a resource person in several APO seminars, in Sri Lanka and in Tokyo, where it has been possible to do some networking for SRI. Specific linkages for introducing SRI in Sri Lanka, India and Iran have come out of these activities, and Akira personally contributed to holding a national SRI workshop in Colombo in December 2003. He was interested to get updated on SRI, so he accompanied Marguerite and me from Chiba back to Tokyo, to the headquarters of the **Japanese International Volunteer Center**, the NGO base for the Japanese Volunteer Corps (JVC) that is the Japanese counterpart to the US Peace Corps.

JVC's Deputy Secretary General, **Kazuhito Suga**, welcomed us and hosted the seminar on SRI from 5 to 7 with JVC staff. **Koa Tasaka**, JVC board member and formerly director of the Asian Rural Institute (ARI), was there. ARI operates outside Tokyo and has done some training on and promotion of SRI. I learned that our Cambodian colleague, Dr. Koma Yang Saing, director of the NGO CEDAC which has spearheaded SRI in that country, was on JVC's staff in Cambodia before he started up CEDAC, and he has also been involved with ARI. Once again it was evident how extended are the personal networks involved in this movement.

JVC program officers for Laos, Cambodia, Vietnam, Thailand and South Africa attended the seminar. Some JVC volunteers have already begun working with SRI promotion in Cambodia, Laos and Vietnam. The Laos/Vietnam program officer, **Chiho Kawai**, reported on some initial SRI experience in Vietnam, in Hoa Binh province where JVC volunteers are working in three mountain villages. They have been promoting a rice-duck integrated farming system and are adding SRI components. Chiho said that villagers told them, "Our grandparents used to transplant rice with wide spacing," but this changed when the Green Revolution came along.

JVC has sent volunteers and farmers from Vietnam to Cambodia to learn about SRI from CEDAC, which recommends a set of 13 practices. From interviews with six families that tried SRI the first year, they have found that:

- All have adopted the seed selection practice (using eggs or salt in a bucket full of water to separate good seeds from less viable ones), and low-density seeding in the seedbed, as well as wide transplanting spacing of 30x30 cm. All agreed that these are good and feasible practices.
- Two-thirds used seedlings less than 15 days and were satisfied with this, although not all were sure that this could succeed, given uncertain rainfall.
- Almost all transplanted within 15 minutes of uprooting the seedlings from their seedbed, and all said that this was feasible.
- None had transplanted in straight lines, but two-thirds thought this could and should be done.
- None had uprooted seedlings very carefully, but all agreed that this should and could be done.
- None had transplanted shallow (less than 1 inch, or 2-3 cm), but all thought this feasible.
- Most important, none had practiced water control, and they were not sure how feasible this would be for both rainy and dry seasons.
- Also, weeding/tilling 3-4 times had not been done by any of the households, and all were wary about having enough time to do this.

Overall, one can say that there was about one-third utilization of the 13 practices recommended by CEDAC. However, households thought that that more than 2/3 were possible to implement. In 2006, of the 10 families participating in the SRI initiative, one had reached 5 t/ha, much more than the usual 2-3 t/ha that farmers usually get in that area. In 2007 with the initiative extended to two villages, a number of different practices were compared. One household using SRI methods with 20x20 cm spacing got a yield of 6.88 t/ha, not relying on purchased inputs. Another with 30x30 cm spacing had a yield of 5.31 t/ha, suggesting that the soils there will not yet support very wide spacing. Since the yield with standard methods and chemical fertilizer was only 3.86 t/ha, JVC sees good potential in SRI use and wants to expand its involvement.

The main problem identified from interviewing 18 families, according to Chiho, was that given the uncertain timing of rainfall, it was difficult for farmers to transplant young seedlings in a timely way (reported by 13 out of 18). The solution suggested is to plant 2 seedbeds sequentially, and to transplant from whichever one would give farmers the best seedling age. This adaptation is being used in eastern India by the NGO PRADAN, where farmers plant three nurseries at 10-day intervals. This requires about 30% as much seed as they were using before, and it means that they sacrifice two of the nurseries in order to get optimally-aged seedlings to transplant. With just one nursery, they would use only 10% as much seed; but then if the onset of the monsoon is delayed, they risk having seedlings that are 'too old' and yield will subsequently be constrained.

Not having enough manure or compost was another problem reported by 11 of 18 households. But farmers are starting to collect more biomass, and some are using biological enrichment (microbial inoculation) to improve their organic fertilization. Inadequate weeding was seen by some as a problem (4/18), but this can be mitigated once they have access to weeders, and also by better selection of the areas where SRI methods are used. There was some insect damage reported, which affected non-SRI crops as well. Some experimentation with 'herbal medicines' is planned, using extracts or decoctions of local plants that repel insects.

There was good discussion afterwards for almost an hour. We then adjourned for dinner at an ‘organic’ restaurant, like Moosewood Restaurant in Ithaca. It uses only home-grown ingredients and gets its rice from rice-duck farming systems. Even the sake came from specially-grown rice.

As testimony to how much email has transformed our work, after dinner, the JVC program officer for Vietnam emailed the JVC representative in that country, Ino Mayu. By the time we got back to our hotel that evening, there was an email from Ino in my computer inbox, expressing interest in participating in the national SRI workshop being organized by the Vietnam Academy for Agricultural Sciences the following Wednesday. I forwarded her message, with my suggestion that she be invited, to the VAAS official responsible for organizing the workshop. By next morning, he had already sent an official invitation to Mayu, and she had accepted it, asking to bring along another staff member.

This also shows how international is the SRI network. This visit to Japan planned for the first week of July meant that I was ‘in the region’ and could respond to invitations to visit also Vietnam, Cambodia and Thailand. Reports on those visits have been written separately. This was all made possible by the initiative of a Japanese colleague in Indonesia, Shuichi Sato, and then by the efforts of J-SRI, operating at the initiative of colleagues at Tokyo University. The Japanese Volunteer Corps and the Asia Rural Institute have already been helping to spread SRI from their respective bases in Japan. So this increasingly international story of SRI continues....