

System of Rice Intensification

—A Pro-Poor Option for Food Security

Prof. Norman Uphoff, in an interview with B.C. Barah

Acknowledging that SRI can result in a high payoff for poor and small farmers, that the SRI process of rice production will cost less and that it has many environmental benefits, Norman Uphoff engages in an untiring campaign to promote SRI around the world

Barah: *We are trying to build a detailed database on the area covered under SRI, the total number of farmers who have adopted it and its quantitative impact on India's food security. We are also looking at the role of SRI as an agro-ecological approach in dealing with the hazards of climate change. There has been much discussion about the introduction of SRI in India, with some skeptics still insisting that there is not enough scientific evidence to justify large-scale efforts. Do you consider the limitations on the supporting data to be a serious deficiency? How important is it to have comprehensive and accurate quantitative data on SRI before proceeding?*

Uphoff: The claim that there is 'not sufficient scientific data' to support SRI extension is itself contradicted by data. The Tamil Nadu Agricultural University (TNAU) has been evaluating SRI methods since 2000, and while there is variation in results—as there is with any agricultural system—I don't think that there are reservations now at TNAU about spreading knowledge of SRI to Tamil Nadu farmers. See the recent book, *System of Rice Intensification: A Synthesis of Scientific Experiments and Experiences*, edited by Dr. B.J. Pandian and other faculty at TNAU, Coimbatore.

An evaluation by TNAU researchers in 2004, with 100 farmers in the Tambiraparani river basin, through on-farm trials, using standard methods and SRI methods on plots one acre each, side by side, showed farmer income per hectare to be \$242 and \$519, respectively. This more than a doubling of the net income was achieved with 8 per cent less labour input per hectare and with less water. Also with less incidence of pests. TNAU, therefore, advised the World Bank to make SRI extension a major part of its IAMWARM project, for improving irrigated rice production in the state.

In 2004–06, the World Wide Fund-International Crop Research Institute for the Semi Arid Tropics (WWF-ICRISAT) dialogue project supported joint research by scientists at the Directorate of Rice Research/Indian Council for Agricultural Research (DRR/ICAR) in Hyderabad, at Acharya NG Ranga Agricultural University (ANGRAU) and at ICRISAT, with on-farm evaluations in 10 districts complemented by on-station studies. Those results also confirmed the productivity gains achievable with SRI management in Andhra Pradesh conditions.

Since then, there have been studies by the ATMA program in Gurdaspur district of Punjab, by agronomists at Shere-e-Kashmir Agricultural University in J&K, at the ICAR Directorate of Water Management in Bhubaneswar, and many other institutions. This has been complemented and confirmed by *pukka* agronomic research in China, Indonesia, Philippines, Thailand, Iraq, Japan and other countries, plus systematic field studies in countries such as Myanmar, Vietnam, Nepal, Iran, and Bhutan.

All of these results are posted on the SRI website (<http://sri.ciifad.cornell.edu>); so it is hard to explain why some persons keep saying that there is 'not enough scientific evidence' to support SRI. There are now over 250 articles published in journals around the world, about one-third in China, and several hundred reports that should have satisfied reasonable skeptics. Anyone in doubt should consult the Research section of the SRI website: <http://sri.ciifad.cornell.edu/research/index.html>

There is a broader, somewhat philosophical issue in that SRI is not as easy to evaluate conclusively as other component kinds of agricultural technology like a new variety, an improved machine or an agrochemical. Being a system, with many 'moving parts', rather than a technology, SRI is not something binary: was it used or not? SRI is more a matter of degree than of kind. SRI can be practised more or less fully, and more or less well. We know from factorial trials and from experience that the more the recommended SRI practices are used—and the better they are used—the better will be the results: higher yield, more water saving, more resistance to pests and diseases, etc.

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But it can be difficult to say 'how many farmers' used SRI practices in a particular area or in a particular season. How well did they use the practices? In Vietnam, the Ministry of Agriculture and Rural Development reported last October that the number of farmers surpassed one million,

having been less than 10,000 four years earlier (*People's Army Newspaper Online*, 18 October 2011). The Ministry notes, however, that only about 20 per cent of these farmers are using all or practically all of the recommended practices, and using them as fully and well as recommended. The other 80 per cent are using SRI ideas and methods to some degree because they have limitations on water control or insufficient labour at certain times of the season.

Does this mean that SRI does not work, or is unsuccessful? The gains in yield, only 10–20 per cent, are not as great as in many other countries. But farmers are taking up the ideas and practices to a growing extent because these reduce farmers' costs of production, require less water, the crops are less susceptible to insect damage and to lodging from typhoons; farmers, thus, get more net income.

That the methods are not yet being fully used means that there is still a lot of scope for Vietnamese farmers to raise their production further, and to have more of the other benefits when and as they use the recommended methods better and more fully. I might note further that some Vietnamese farmers report that when SRI has been practised on a village basis for several years, not just by a few individuals, fishes and frogs return to their irrigation channels. This supplements

household protein and income, and it signals a healthier environment because it was the overuse of agrochemicals that reduced these populations.

Unfortunately, the shifting nature of SRI means that it does not lend itself readily to aggregated numbers. One needs to have many footnotes and qualifications with any single number that represents either the area or the use of SRI.

Barah: *Would your totals include farmers who are using chemical fertilizers?*

Uphoff: We are not purists. We want to see farmers benefiting as much as they are willing and able from SRI opportunities. Many farmers continue to use more chemical fertilizers with other SRI practices than I would like to see, based on very solid factorial trial results. They can't believe that they can get best results with purely organic farming.

In some soils, especially soils that have been 'chemicalized' for many years, affecting the life in the soil, unbalancing it or depressing it, they are right. For the next season, there will be better results with still some use of inorganic fertilizer. Over time, if they can restore and accelerate life in the soil by providing abundant supplies of organic matter, they will find that they can have better and, probably, more cost-effective results by shifting to reliance on compost, vermi-compost, green manure, etc.

How one might achieve top yields with some optimizing combinations of organic and inorganic nutrient sources in SRI production systems is still being explored. SRI is not necessarily an organic production system; I like to say that it is not doctrinally organic but

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needing to make cash outlays for soil nutrients. The out-of-pocket costs of buying and relying on chemical fertilizer can be quite constraining and even daunting for small farmers.

Should we count farmers, who are using young seedlings, widely spaced, with less (but still some flooding), mechanical weeding (just two, not three or four weeding), and mainly chemical fertilizer as 'practising SRI'? Deciding this can become almost a theological matter, which I don't think is useful.

Barah: *Let's come back to the question of how to evaluate and report the extent of SRI practice. How can we know what constitutes SRI utilization?*

Uphoff: Perhaps we should talk about 'SRI-inspired practice' or 'SRI-influenced farmers' as somewhat inexact categories. The farmers, who have been influenced by SRI training and observations, or whose paddy management has been altered because of this experience, know that they are 'following SRI'. It is gratifying to listen to farmers, who are enthusiastic about and dedicated to what they understand as SRI. There is no question in their minds that the more productive phenotypes of rice that now populate their fields and give them higher

incomes and greater household food security come from the phenomenon of SRI.

There was also no ambiguity about the reality and effects of SRI in Minister Sharad Pawar's mind when he confirmed in Parliament on the 20th of March that a farmer in Nalanda district of Bihar had achieved a world-record-beating yield of 22.4 tonnes per ha of rice, properly measured by state and local officials, with hundreds of people watching the yield evaluation, and confirmed later by ICAR. He had a pretty concrete idea of 'what is SRI', as did the farmer, Hemant Kumar, who got that record yield, and the other farmers in Darveshpura village, four of who got similar super-yields of 19 or 20 tonnes per ha.

So, let me come back to your original question: Does India need extensive, systematic, very precise data before proceeding to take advantage of the production opportunities that SRI knowledge has opened up for Indian farmers, and Indian consumers? Not really, given what is known already about SRI results in India and other countries.

It should be kept in mind that this gives the government some large opportunities for budgetary savings because with SRI management there can be reduction in the huge expenditure on providing subsidized or free electrical power and on chemical fertilizers to support paddy production.

The question as posed is not a very meaningful one in my view. It reflects the conventional thinking of certain scientists, who regard themselves as gatekeepers, or of commercial interests that benefit from keeping the current agricultural-subsidy raj. They would like to put brakes on the spread of SRI for fairly

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transparent reasons. Remember: nobody is proposing that SRI use be imposed on Indian farmers. If farmers find these alternative management practices to be beneficial in their trials, they can—and will—use them on a larger scale, and will continue using them for as long as the methods prove to give them net advantages.

Some encouragement to get SRI methods tried out by farmers is justifiable, for example, giving farmers credit for buying mechanical weeders (still requiring that these be paid for, once the harvest has increased farmer incomes by much more than the weeder price), something like hire-purchase arrangements; or MGNREGA-subsidized labour could get fields levelled for SRI use and planted and weeded the first time around, to show farmers what can be achieved with the alternative practices.

It would be beneficial if state governments and the central government began keeping records of the best SRI use and results. The Provincial Department of Agriculture (PDA) in Sichuan, China, (where yields are already fairly high—7.55 tons per ha, and where SRI use by PDA criteria has expanded from 1,133 ha in 2004 to 301,067 ha in 2010, a total area of over 950,000 ha) has calculated that SRI yields over the seven years have averaged 9.25 tons per ha. The additional paddy production that the PDA attributes to SRI methods adds up to over 1.66 million tonnes of paddy. This would not have been produced if farmers using SRI practices had continued with the practices that other Sichuan farmers use for growing rice.

PDA has calculated that the value of this additional paddy produced was over \$300 million. This is income that went into farmers' pockets because there had been little increase in their production costs; possibly the costs

had reduced! This reckoning does not take into account that water use got reduced by 25 per cent when SRI methods were employed. How much was this water worth?

Barah: *Indian official statistics on SRI are almost negligible at present, and there have been no systematic attempts to collect aggregate data on SRI, as there have been in some other countries. The spread of SRI in India during the past decade or so is said to be impressive, but in the absence of standardized documentary evidence, the opponents of SRI find it convenient to keep saying there is no scientific evidence. Reports are dismissed as impressionistic; media reports cannot be considered entirely credible. Ministers, policy formulators and the Parliament are recognizing SRI as an innovation for increasing productivity and reducing the impact of climate change. Do you think that there is a change in the mindset of scientists and the scientific establishment towards SRI?*

Uphoff: I wish that governments in India would keep such records as in Sichuan province of China. But I don't think the results of such data collection would have any effect on decisions because the resistance is not really based on scientific considerations. Solid data to support at least letting farmers know about and try SRI have been available for a decade now. Indeed, the most conclusive data were published in 2002 by International Rice Research Institute (IRRI) in the proceedings of an international workshop on water-saving rice production, organized by IRRI and Wageningen University.

The argument that there is 'no scientific evidence' has been misleading because all that the proponents have been asking for is that farmers be informed about SRI, be shown its

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effects and be assisted in trying the methods out under local conditions with various varieties, thereby letting farmers make their own decisions. Introduction of incentives to get farmers to try out the alternative methods on their own fields is also quite justified when the results and spread of SRI methods in other countries (and now also in many Indian states) are considered.

The economic reasons, plus the concern for reducing demand for water, for moving to SRI management in most, if not all, parts of the country are already powerful and should be sufficiently persuasive for the government to proceed. Nay-sayers and skeptics, who have resisted official support of SRI evaluation and demonstration, have been depriving farmers of substantial income, and have been keeping food off household tables. Moreover, they have been contributing to a waste of water in the agricultural sector, where shortages are increasingly real.

The campaign against SRI resembles in some ways how tobacco companies in the U.S. for many years held back public understanding and acceptance of the link between cigarette smoking and lung cancer by repeatedly insisting there was 'not sufficient scientific evidence' to warrant efforts to curb smoking. Many of thousands of lives were lost unnecessarily as a result.

It is interesting that in science, we penalize and go to great lengths to avoid what are called Type I errors, that is, 'false positives'. But there is unfortunately no corresponding aversion to Type II errors—people are not held accountable for 'false negatives', for rejecting something as false when in fact it is really true, and when it could have beneficial

consequences. Those who obstruct correct conclusions should be as liable to criticism as those who propose conclusions, which later turn out to be incorrect.

Barah: *In the Round Table on SRI held in Delhi on 13th January 2012, you talked about the role of soil biota—the interaction between plants and the micro-organisms in their environment, and even in the plants themselves—that leads to higher productivity. What are your hypotheses for higher productivity in SRI?*

Uphoff: The two most evident differences we find between rice plants growth with conventional practices (older seedlings, close spacing, continuous flooding and use of synthetic fertilizer) and plants raised in an SRI environment is that the latter have much larger root systems that do not die the way the roots of conventionally grown rice plants do. And the soil around the roots has larger and more active populations of soil organisms. Already in a 2001 thesis done in Madagascar, we found that the populations of a nitrogen-fixing organism (*Azospirillum*) were much increased by the use of SRI practices, and particularly by the addition of compost to the soil when SRI methods were used. These increases were accompanied by an increase in yield from 3.0 tonnes per ha to 10.35 tonnes per ha—a huge difference. Previous thesis research there had shown that it took almost six times more force per plant to uproot SRI plants, 28 kg for three conventionally-grown plants vs. 53 kg for single SRI plants. This early research by Malagasy University students gave us insights into why SRI phenotypes were more robust and more productive than standard-practice rice.

Research since then, on the association between rice plants and soil microbes, unfortunately not yet on SRI-grown rice plants (but we expect this to be done soon)

has shown that beneficial soil microbes, both bacteria and fungi, inhibit the leaves, sheaths and even seeds of rice, and are associated with higher levels of chlorophyll, greater rates of photosynthesis and higher yield. Because these three parameters have been frequently seen to be higher with SRI management, we think that soil microbes are probably contributing to better phenotypes.

That SRI management practices extending to wheat, ragi, sugarcane, and other crops are also eliciting more productive phenotypes reinforces the hypothesis that something about the management methods, creating a particular kind of plant growing environment, is affecting the populations and activity of soil organisms. But this remains to be established. There is some unpublished research from Indian Agricultural Research Institute (IARI) that has shown SRI management to be associated with both larger populations of micro-organisms, more uptake of micronutrients (surely connected with the larger, deeper, better-functioning root systems), and higher yield.

This is an area where there should be a lot of research done because I think it will have very high payoff. There is even some research done in China showing that when certain soil rhizobacteria migrate up through the roots into the leaves and sheaths, there is up-regulation of the expression of certain genes that produce specific proteins, supporting the process of photosynthesis. And other genes in the roots are up-regulated to produce proteins that confer greater resistance to pathogens. So this is a very interesting area, which I hope Indian and other scientists will investigate further.

Barah: *Norman, I think that you are aware of the recent developments in Bihar, in Darveshpura village in Nalanda district, where a farmer was able to harvest world-record rice*

yield in the last kharif season. You may also be aware of reports of phenomenal yields of potatoes and mustard grown with adaptations of the rice intensification system. How do you react to this?

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Uphoff: Yes, I am aware of these developments. Dr. M.C. Diwakar, director of the Directorate for Rice Development in Patna, has shared with me the official data from the Department of Agriculture in Bihar on Hemant Kumar's record paddy yield of 22.4 tonnes per ha (20.16 tonnes dry weight), and we have written an article, together with Arvind Kumar (Directorate of Rice Research, DRR) and Anil Verma (Professional Assistance for Development Action, PRADAN), which is being published in *Agriculture Today*, giving details on this accomplishment, which bodes very well for agriculture in Bihar and in India. What has been overlooked is that four other farmers in Darveshpura, neighbours of Hemant Kumar, got yields of 19 and 20 tonnes per ha, also tying or breaking the world record in China. I also know about the potato yield in Darveshpura of 72.9 tonnes per ha, another world record, using practices inspired by SRI ideas and experience. And when visiting Bihar and West Bengal last year, I stood next to mustard plants as big as I am (and I am not short!). One official measurement of mustard reached 4.92 tonnes per ha, I understand.

What do these results mean? That there is huge productive potential available in our present crop varieties if we give them appropriate management, optimizing growing conditions. Improved varieties can give high yields—the five farmers in Darveshpura, who got the super-yields, were all using hybrid varieties. Yet, those varieties used on the same soil with conventional management yielded only one-third as much. So management was more

important than genes in these cases. We get higher yields from crop varieties bred for maximum yield. However, there is usually some trade-off such as in taste or grain quality, or in resistance to pests and diseases. Consumers

usually prefer traditional rice varieties for eating, and certainly for special occasions. The market price may thus be 2 or 3 times higher. So a yield of 6, 8, 10, even 12 tonnes per ha from a preferred local variety can be a more profitable crop for farmers than a hybrid rice that gives top yield.

There is also another implication pertaining to these high yields, especially those clustered in Darveshpura village, and covering both paddy and potatoes, two utterly different crops. I think that this should direct our attention to better study and understanding of, and if possible utilizing, the soil biota—the multiplicity of soil organisms ranging from bacteria and fungi to the indispensable earthworms. The message I draw from these record yields is that we should be directing much more attention to soil biology.

A further implication of these record yields is that we should already start looking beyond the staple crops. If such fine yields can be obtained for paddy and potatoes, and for wheat (PRADAN has reported to me a 12.6 tonne per ha SWI yield recently in Bihar, measured by Department officials), we will not need to devote so much of our land, our labour and, especially, our water to growing staple foods. We can meet basic caloric needs with less of these resources, and the price of these foods in the market can, indeed should, come down. People should be able to feed themselves the basics with less of their income. Farmers should be able to maintain a good income because their yields have gone up and their costs of production have come down

with adaptations of SRI practice.

But this also means that farmers should start thinking about how they can diversify their farming operations, producing more vegetables, pulses and fruits. These can improve both income and, most important, nutrition. We should be producing more quality foods for local rural and for urban consumption. Fortunately, we find that adapted SRI methods can raise the productivity of many other crops, certainly of the pulses and many vegetables. I was very happy to learn—and then to see for myself—some time ago about SBI, the System of Brinjal Intensification! We should begin experimenting with SRI ideas and methods for fruit production, encouraged by the fact that in Jharkhand, the PRADAN field staff have worked with very poor, marginalized, and intelligent tribal farmers to develop what they call SLI, the System of Lac Intensification!

In Cambodia, small farmers, having increased their paddy yields by 2 to 4 times, from admittedly very low levels, on just 1.66 acres (two-thirds of a hectare), are diversifying their production, very profitably. They take as much as half of their land out of paddy production, being able to produce a surplus of paddy for their family on just about one acre, and they construct a fish pond on the reclaimed paddy land, and plant vegetables, beans, fruit trees, start chicken raising, etc. The average investment cost for converting their farms is about \$300.

One farmer, whom I have visited twice and who has a super-diversified farming system on his farm of less than half a hectare (1.20 acres), has been able to increase his net household income by five times, and he now pays two of his five children a salary better

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than what they would earn in the capital city, to maintain this highly productive system. A manual on this diversification strategy is available at: <http://ciifad.cornell.edu/sri/countries/cambodia/cambSidMPREng.pdf> Because much of Cambodia has better rainfall and humidity than many areas of India, I cannot

say how widely this same strategy could be utilized for smallholders in India. But PRADAN has already started moving in this direction in Eastern India with its '5% solution' of water harvesting through pond construction that supports more secure and diversified farming.

Barah: *What is the quality of SRI work in India?*

Uphoff: Most of the SRI fields that my wife Marguerite and I visited in Tamil Nadu in December 2008 during the 3rd National SRI Symposium hosted by TNAU in Coimbatore were disappointing, some even dismal. Many farmers and extension personnel—with a few exceptions, I should add, not to disparage all the people involved—had mostly done routine demonstrations, going through the motions, getting paid for doing the minimum specified work, without understanding the principles and without the commitment to making them work, with appropriate adaptations for local conditions.

There have been some benefits for farmers just from their reducing the water applications; from having fewer plants per hill, if not just one; from using younger seedlings, if not 10–12 days old; from applying more compost, using mostly chemical fertilizer if compost was inconvenient; and from doing some soil-aerating weeding, even if not a lot. But what is called 'SRI' by many there was what I would predict from a top-down extension effort. This

was different from the more participatory approach usually followed (but not always) by NGOs. It would be hard to say 'how many' farmers are using SRI methods when the methods themselves appear not well understood and not well used. This can come playing by 'the numbers game', concerned more with quantity than quality. It also shows how robust SRI principles are that they can succeed by

half and need not be fully utilized to make some improvements in production. Yet, it was disappointing to see mostly mechanistic, not informed or intelligent, use of the alternative methods.

I understand that the Chief Minister of Tamil Nadu has offered a prize of 5 lakh rupees for the best SRI yield in 2012, maybe hoping to match or surpass the record yield in Bihar last year. This could be a tremendously effective way to spread the better use of SRI methods. If farmers, hoping to win the prize, will fully inform themselves about SRI principles and practices, and try to utilize these 'to the max', considering the high prize at stake, I expect that there will be thousands of excellent 'demonstration plots' scattered all over Tamil Nadu. Now that farmers know the basic ideas of SRI, they will be able to see, on their ambitious neighbours' fields, how proper use of the methods can pay off. There would be 'non-formal extension' of great effectiveness and impact, at relatively low cost. A prior investment in making SRI known across the state would be necessary for this 'ratcheting up' of SRI practice. Just offering the prize will not substitute for a widespread extension and publicity effort. I am looking forward, however, to seeing the results of this Tamil Nadu experiment in 'extensive extension', in contrast to intensive extension efforts.

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I think that the efforts of Bihar Rural Livelihoods Promotion Society (BRLPS) in Bihar is going to be reasonably exemplary for SRI dissemination in India because the state's rural development department has a good philosophy and a good approach, with good leadership. It is working with some first-rate NGOs such as PRADAN and Action for Social Advancement (ASA). How I wish that India

could clone field workers such as Anil Verma, the PRADAN team leader in Gaya district! I would entrust an SRI programme to him anywhere in India, and I would expect it to take root and flourish.

I should add that I was very impressed with the way that Subir Ghosh has steered the NABARD programme in Jharkhand. He is a resource about to become underutilized because he will retire from NABARD at the end of March. Elsewhere, in India, there have been many very effective efforts by NGOs such as People's Science Institute in Uttarakhand and HP; Sambhava and PRAGATI in Orissa; AME in Karnataka and neighbouring states; PRASARI in West Bengal, working in the Sundarbans; and surely many others that I do not know about. However, there have also been some exemplary government efforts, such as those led by Dr. Baharul Majumdar in Tripura and by Dr. Amrik Singh, deputy director of ATMA, in Gurdaspur district, Punjab.

Barah: *How should we map and assess the numbers and places of farmers adapting and 'using' SRI?*

Uphoff: Rather than focus on total numbers, I would look for the three or four best examples of SRI extension/dissemination/impact in India, and focus on them—what they are

doing, or have done; how they work, with what costs, and what benefits that can be documented and clearly attributed to SRI interventions. I would present them as 'role models' for other states, not to be 'carbon-copied,' but to serve as a source of ideas and inspiration for others.

India is a huge and diverse place. Serious efforts, highly scattered and mostly under-funded, have been made only in the last three to four years that disseminate knowledge and skills for SRI. This cannot be compared in any way with the financial and institutional support that the Green Revolution got 50 years ago. I would not look yet for significant aggregate impacts, except in places like Bihar where the impact of SRI should be evident by this 2012 season, similar to what is happening in Vietnam now, or in the Sichuan and Zhejiang provinces of China. It is better to look for effects in smaller domains, at the state or even district levels.

Barah: *Skeptics/Critics have, first, resisted the evaluation of SRI, writing in 2004 that SRI should not even be evaluated, that this would be a waste of resources. They have objected to its extension, wanting to minimize SRI by saying that there has not been enough evidence of aggregate spread and impact. How do you respond to this?*

Uphoff: This is a Catch-22 situation. Government and donor agencies were first discouraged from evaluating SRI, and then there was objection to spreading SRI knowledge because it had not been evaluated. There were no funds available for the kind of systematic evaluation that we wanted to conduct, so we proceeded as best we could with NGOs, universities, sometimes the private sector and,

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in some places such as Vietnam, government actors. Over the last ten years, there has grown, in a fully decentralized, rather non-standardized way, a body of knowledge and diversified practice that has nevertheless begun having an impact, for the better, on farmers' lives and on the environment. How much impact? Nobody knows.

There have not been resources available for any proper collection of data. But the results are positive 9 times out of 10 and sometimes remarkably positive.

Rather than be overly concerned at this stage with aggregate numbers, my preference has been to work with 'strong points' when and where they emerge, emphasizing quality, critical assessment at local levels, and as much learning and further adaptation and innovation as possible. This is a qualitative approach more than a quantitative one, trying to build from strength to strength, seeking to develop a solid cadre of agricultural specialists, researchers, administrators and most of all, farmers and NGO workers who understand SRI, its methods, its agronomic theory, its philosophy, its farmer-centredness, and who can proceed because they have come to believe, based on observations and results, in the merits and potential of SRI.

If I may speak personally, we need more scientists, who are willing to spend time in the field and who are open to farmer experiences and interests, rather than sticking to their laboratories and bureaucratic territory, trying to satisfy superiors more than to serve the farmers.

Barah: *How would you assess your efforts of advancing SRI in India? Tell us about your journey vis-à-vis SRI from the outset.*

Uphoff: What have I done to advance SRI in India? It occurs to me that I should describe my role principally as that of a 'recruiter'. I have assumed that

once good, motivated people are in place, are well informed and are working co-operatively with one another, they can begin to 'move mountains'. I am mindful of Margaret Mead's admonition: "Never doubt that a small group of committed people can change the world; indeed, that is the only thing that ever has." The SRI-community in India started some time back, in 1998, when Rita Sharma (current member secretary, National Advisory Council; ex-Secretary, Rural Development, and ex-Additional Secretary, Agriculture, Government of India) visited Washington, DC. We met at the World Bank, and as I had been one of her academic advisors during her PhD studies at Cornell University, we were well acquainted. I told her what I knew at that time about SRI and its opportunities, and then when I visited Delhi in September 2000, she organized a seminar on SRI at Krishi Bhawan, the first in India. There was mostly disbelief about what I reported, I recall, even though Rita vouched for my veracity as her former teacher and long-time friend.

Then we added Dr. T. M. Thiyagarajan (TMT), who at the time was a TNAU faculty member and Director of its Soil and Crop Management Studies Center. He had been informed about SRI by Wageningen University when it started a Dutch government-funded project on water-saving rice production. I was an unpaid advisor for this project. TMT started trials in 2000–01, and we met first in China, not India, at a Wageningen workshop held at Nanjing Agricultural University in April 2001. We bonded immediately, and he has been a great stalwart ever since.

I started lobbying PRADAN on SRI, knowing

PRADAN's involvement grew, based on its good results across eastern Indian states.

that it is an excellent NGO. My acquaintance with Deep Joshi dates back to the mid-80s and I knew that PRADAN was probably the NGO best positioned to get

things going 'at the grass roots'. Its Programme Director, Nivedita Narain, had done a Master's degree in International Development with me at Cornell, so I could approach her first. Then my wife and I talked with Dinabandhu, from PRADAN's team in Purulia district when we were in Delhi in November 2002. Marguerite and I both still remember that meeting at Claridges' Hotel. Bhuban, you got involved with SRI from early on, maybe through Dr. Rita Sharma, also being a former student of mine at Cornell. Dr. Shambu Prasad was an important early recruit to the SRI 'team'. He became interested in SRI when he was at ICRISAT, being involved with a 'history of science' project. He had decided to examine SRI as a contemporary case of science/technology innovation—and he became thoroughly 'infected' by SRI, even getting 'a raging fever' from this very benign and beneficial 'virus'!

PRADAN's involvement grew, based on its good results across eastern Indian states. By good fortune, Alapati Satyanarayana emerged as a champion for SRI in Andhra Pradesh. How he got 'infected' by SRI is a long and wonderful, even entertaining story; but I will not go into it here. Somehow, the NGO Watershed Activities Network and Supported Activities (WASSAN) and its director, Mr. A. Ravindra, got involved as well in 2003 and various people at ANGRAU and NGOs in Andhra Pradesh joined in. Another former student of mine, Dr. Ramasamy Dwarakinath, who had done a PhD in extension education at Cornell in the mid-70s, and who subsequently became Director of Agriculture in Karnataka and then Vice Chancellor of the University of Agricultural Sciences in Bangalore, practically had to begin working with SRI through his

NGO (Agriculture-Man-Ecology Foundation, AMEF) because I was his guru, and he had to take SRI seriously when I asked him to get involved! How did a wonderful colleague like Dr. Amrik Singh get involved with demonstrating SRI in the Punjab? I am not sure; something attracted him to SRI, perhaps the urgency of reducing water requirements for rice production because the Punjab water tables are falling. He became one of our most courageous SRI colleagues, working on behalf of SRI in the mostly-hostile territory of the Punjab. How did we get Anuradha Saha and her husband Vijay Bharti involved in Jammu? I do not know. Many people have come into SRI community, all by their own ways.

How Dr. Biksham Gujja, then a senior advisor for the WWF, working concurrently in Switzerland and Hyderabad, got involved in SRI is a special story, quite wonderful. He learned about it while visiting his home village and seeing an old farmer whom he knew well from his childhood proudly using the new methods. Without his courage and the financial support that he could mobilize from WWF, SRI would have moved much more slowly in India. He and Satyanarayana did a great job in getting ANGRAU, DRR and ICRISAT into a joint research project to evaluate SRI. This got Dr. O.P. Rupela involved with SRI. As a soil biologist, he had a natural affinity for this work. I do not know how Dr. Mahender Kumar at DRR became an early ally, the only ICAR scientist with enough boldness to join in the SRI effort, for which I am deeply grateful. Having three strong research institutions like ANGRAU, DRR and ICRISAT work together on SRI was a great step forward. Then getting Amod Thakur to join the SRI fold, based on his own, completely independent evaluations at the Water Management Centre in Bhubaneswar, is another wonderful story. His personal courage matches his scientific capability, both marvelous.

And I remember how Debashish Sen and Ravi Chopra from People's Science Institute came into the SRI community subsequently and effectively. I was in Delhi on a personal visit, to attend a wedding, and spoke on SRI at the Institute of Social Sciences (ISS), thanks to some help from Himanshu Thakur, who had 'signed on' for the SRI campaign, given his interest in water saving. And so it goes. The innovations and efforts in the Himalayan region for SRI, then SWI, and SMI, and SBGI, etc., were a great advance for agro-ecological methods in India.

These are stream-of-consciousness reflections as I try to reconstruct in my mind how SRI was introduced and established in India. How Baharul Majumdar got involved is a separate and wonderful story. And how Biswanath Sinha was able to mobilize SRI funding from the Sri Dorabji Tata Trust (SDTT) is another hugely important 'chapter' in the SRI story in India. Gopalakrishnan, a former student of mine and Joint Secretary in the Prime Minister's Office, was also very helpful at a few junctures, playing a small but very useful role. The SRI story in India could be the stuff of several novel-like volumes, and it would all be true!

I have kept a log of the presentations that I have made in various countries since I got started on the SRI 'circuit' in 1997, with a presentation made to the Indonesian rice research establishment, arranged by Dr. Achmed Fagi, a former director of Indonesia's equivalent of DRR-Hyderabad. So far, I have made presentations on SRI in 40 countries, sharing what I and the others know about it as broadly as possible. But my pace is slowing down. Others, as hoped, are taking up the task and expanding the scope of our efforts. To some extent, my efforts have shifted to trying to get the SRI knowledge and experience into print, so that it is more widely accessible. Happily,

there are now many publications that are listed on the SRI website that have contributed to SRI literature (over 250) from all over the world. Our SRI-Rice staff have just posted a listing of 84 Chinese scientific publications on SRI, most in Chinese (unfortunately for us), which shows how the ideas and issues of this technique have been taken up in that country.

Barah: *How is SRI progressing in India in your opinion? What do you see as the road ahead?*

Uphoff: I think SRI is proceeding quite well now, based mainly, although not yet inexorably, upon its demonstrated productivity and other benefits. This momentum is due, in large part, to the multi-faceted progression of SRI in many parts of India, which is due, in turn, to the efforts of the member of the National Consortium on SRI plus many other colleagues, who have been drawn into, and who have drawn sustenance from, our 'web' of ideas, ideals and friendship. This refers to the 'trinity' of factors conducive to social change that I came to know and value from my decade of involvement in Sri Lanka, introducing participatory irrigation management in the Gal Oya system. If I had not had that intense and mind-altering experience, unlearning much of what I had learned in my previous academic studies, I could not have comprehended the SRI opportunity as well and could not have worked as effectively with dozens, then hundreds and now thousands of colleagues around the world on this phenomenon.

In 2006, after visiting Haveri district in Karnataka and seeing how the farmers there, working with The Green Foundation led by Dr.

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Vanaja Ramprasad in Bangalore, were doing their own version of SRI with *ragi*—and after getting pictures from Binju Abraham, PRADAN staff member in Jharkhand, who worked with farmers to develop what was called 'SFMI' (System of Finger Millet Intensification), I began to think and hope that maybe SRI ideas would not only change the way in which the rice sector works but could also lead to major changes in the way that much of the agricultural sector

operates—to a paradigm shift that would supersede the assumptions and doctrines of the Green Revolution, going from 'modern agriculture' to what I would call 'post-modern agriculture'.

Shambu Prasad coaxed me to speak about this idea a workshop at the Centre for World Solidarity (CWS) in Hyderabad. And I elaborated on these ideas for a Hugh Bunting Memorial Lecture at the University of Reading in June 2007. Since then, I have gotten more and more confidence in these formulations.

Events just keep moving along, and the evidence that we can, and should, make major changes in our paradigm for agriculture, 're-biologizing agriculture,' to speak broadly, is becoming stronger. I trust that these changes will be of broad benefit to the world's farmers, consumers and the environment. You and Rita, who both know me as a teacher at Cornell, are used to my being so bold, and Shambu shares my penchant for grand formulations. So, I trust that you are not scandalized by such ambitious thoughts. These answers are perhaps not the kind that you were expecting, but I have just shared my thoughts.

Barah: *Thank you, Prof. Norman Uphoff.*

Norman T. Uphoff is Professor, Government and International Agriculture, at Cornell University in the USA, and a former Director of the Cornell International Institute for Food, Agriculture and Development (CIIFAD). Currently, he is also Director of the Cornell Institute for Public Affairs (CIPA), which manages Cornell's MPA program. He has worked for decades in Africa and all parts of Asia on participatory development, and particularly on improving irrigation and other natural resource management. He has been the most visible ambassador for SRI for the past 15 years at a global level. He has visited India on the SRI mission on many occasions since 2000 and has interacted with a large number of farmers, practitioners, researchers and policy managers.

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