Abstracts submitted for the **World Rice Research Conference**,
Tokyo-Tsukuba, Japan, November 4-7, 2004

A. Papers proposed for a panel with a focus on ***The System of Rice Intensification*** under the theme **"Improving Rice Yield Potential"**. Note: the first paper is an overview paper, and the number of country reports is now fairly large, so the first paper could be a plenary paper; the country papers, and the stature of their authors, should assure people that SRI is 'for real.'

- ***The System of Rice Intensification: Capitalizing on Existing Yield Potentials by Changing Management Practices to Increase Rice Productivity with Reduced Inputs and More Profitability***, Norman Uphoff, Cornell International Institute for Food, Agriculture and Development, Cornell University, USA
- ***The System of Rice Intensification: Evaluations in Andhra Pradesh, India,*** A. Satyanarayana, Director of Extension, A. N. G. Ranga Agricultural University, and P. V. Satyanarayana, Agricultural Research Station, Maruteru, Andhra Pradesh, India
- ***On-Farm Evaluation of the System of Rice Intensification in Andhra Pradesh, India***, P. V. Satyanarayana, T. Srinivas, Agricultural Research Station, Maruteru, West Godavari District, Andhra Pradesh, and A. Satyanarayana, Director of Extension, ANGRAU, India
- ***On-Farm Evaluation of SRI in Tamiraparani Command Area, Tamil Nadu, India***, T. M. Thiyagarajan, College of Agriculture, Killikulam, Tamil Nadu Agricultural University, India
- ***Opportunities for Rice Self-Sufficiency in Indonesia with the System of Rice Inensification***, Anischan Gani, Indonesian Institute for Rice Research, Sukamandi, Indonesia
- ***The 3-S Rice Cultivation Method Developed in Northern China: Comparisons with the System of Rice Intensification***, Jin Xueyong, Northeastern Agricultural University, Haerbin, China
- ***Diversifying Rice-Based Farming Systems in the Southern Philippines with the System of Rice Intensification***, Felipe Rafols Jr., Allan Gayem, Ligaya Belarmino, Flor L. Magbanua, Rene Q. Nombre, Joel A. Basiao, Carlos S. Salazar, Edgar F. Tagarao, Elmer T. Nepa, Pacifico E. Calibayan, and R. C. Lazaro, National Irrigation Administration, Philippines

  Note: this last paper could go on a panel under the theme of **"Diversification of Rice-Based Systems."** The five preceding papers come from leading rice researchers in the three largest rice-growing countries in the world: China, India, and Indonesia, making a good set.

B. Papers proposed for a panel with a focus on ***The System of Rice Intensification*** under the theme **"Farmers' Participatory Approaches"**. Note: these papers could be on a panel with other papers not focusing on SRI, or this could be a panel on SRI participatory approaches.

- ***Farmer Participatory Extension in the System of Rice Intensification in Cambodia***, Yang Saing Koma, Georg Deichert, Or Thy, and Yi Kimthan, CEDAC and GTZ, Cambodia
- ***Farmers' Participatory Approaches to Facilitate Adoption of Improved Technology: Adaptation of System of Rice Intensification in Sri Lanka***, Gamini Batuwitage, Gemi Diriya Community Development and Livelihood Improvement Project, H. M. Premaratna, Nature Farming Center, and U. G. Abeygunawardana, Sri Lanka, Sri Lanka

- ***Extension Initiatives and Farmer Response in Popularising the System of Rice Intensification in Andhra Pradesh, India***, A. Satyanarayana, P. Punna Rao, P. Gidda Reddy, and I. Srinivasa Rao, A. N. G. Rao Agricultural University, Andhra Pradesh, India
- ***Farmers' Participatory Extension: A Case Study of SRI Technology Adoption in West Godavari District, India***, A. Satyanararyana, R. S. N. Rao, T. Ramamohana Rao, and P. Rambabu, ANGRAU, Andhra Pradesh, India
- ***Popularisation of SRI in Andhra Pradesh, India: A Success Case of Participatory Approach of One-Man Army***, P. Punna Rao, A. Satyanarayana, P. Gidda Reddy, and I. S. Rao, ANGRAU, Andhra Pradesh, India

  Note: These last three abstracts were prepared separately and consequently have some overlap. They could possibly be consolidated into two papers, or maybe even one if the number that can be accepted is very limited. Andhra Pradesh has the most experience, and the most success, in SRI extension with farmer participation, so the number of abstracts reflects the amount of experience and enthusiasm in this state of India.

C. Two abstracts were submitted from Madagascar that could fit under other themes. One deals with soil microbiology and the effects of inoculation through seed and/or compost treatment, and the other analyzes the economic returns to different factors of production comparing SRI with a modern and a traditional set of cultivation practices:

- ***Effects of the Use of SRI Root Exudates in the Improvement of Aerobic Rice Culture***, Robert Randriamiharisoa, University of Antananarivo, Madagascar
- ***An Evaluation of Alternative Rice Cultivation Methods Used in Eastern Madagascar: The System of Rice Intensification, the System of Rice Improvement, and Traditional Farmer Methods***, George Rakotondrabe and Glenn Lines, Landscape Development Interventions Project, and Cornell University, USA

D. Finally, a paper analyzing the differences across seven rice varieties when grown with SRI and standard cultural practices, in terms of yield and components of yield, should be of considerable scientific interest and could be presented on a panel with other such scientific analyses.

- ***Varietal Performance under the System of Rice Intensification and with Standard Methods of Cultivation*****,** P. V. Satyanarayana, T. Srinivas, L. Madhavilatha, Y. Suneetha, P. Raghava Reddy, and A. Satyanarayana, Agricultural Research Station, Maruteru, Andhra Pradesh, and ANGRAU, Hyderabad, India

Abstract for World Rice Research Conference, Tokyo-Tsukuba, Japan, November 4-7, 2004

THE SYSTEM OF RICE INTENSIFICATION: CAPITALIZING ON EXISTING YIELD POTENTIALS BY CHANGING MANAGEMENT PRACTICES TO INCREASE RICE PRODUCTIVITY WITH REDUCED INPUTS AND MORE PROFITABILITY

Norman Uphoff, Cornell International Institute for Food, Agriculture and Development

The System of Rice Intensification (SRI) developed in Madagascar 20 years ago is starting to gain understanding and acceptance around the world. By changing the way that rice plants, soil, water and nutrients are managed -- with more intensive labor inputs and management but reduced water, capital and agrochemical inputs -- rice yields are being increased by 50-100%, and by even more with good use of the methods. SRI has been controversial in scientific circles, but evidence is accumulating that SRI methods work as reported.

An IWMI evaluation of SRI in Sri Lanka found that even farmers not using all the SRI methods got a 50% increase in production, increasing their labor productivity by 50 to 62% and their water productivity by 90%. Costs of production were reduced, and profitability was increased (by 83% if all labor costs were calculated, and by 206% not counting family labor). Risk was reduced as non-SRI farmers had net economic losses in 28% of seasons; SRI farmers had losses in only 4%. These benefits can be even greater when SRI methods are used fully and properly.

This does not mean that attempts to improve rice yield potential should be halted. With SRI methods, all of the >15 $t.ha^{-1}$ have been with high-yielding varieties or hybrids. However, traditional varieties have produced in the 6-12 $t.ha^{-1}$ range with SRI methods. This paper will review the changes in plant, soil, water and nutrient management that affect both plant growth and the populations (and processes) of soil biota that enhance plant nutrition and health. SRI is still a methodology under development as farmers are making continuous improvements in it, e.g, for labor-saving purposes, and as researchers gain a better understanding of the effects of these practices, particularly creating an aerobic environment for rice plant roots and soil biota.

Abstract for World Rice Research Conference, Tokyo-Tsukuba, Japan, November 4-7, 2004

THE SYSTEM OF RICE INTENSIFICATION: EVALUATIONS IN ANDHRA PRADESH, INDIA

A. Satyanarayana, Director of Extension, Acharya N. G. Rao Agricultural University, and
P. V. Satyanarayana, Agricultural Research Station, Maruteru, Andhra Pradesh, India

The System of Rice Intensification (SRI) was introduced in Andhra Pradesh, India, during rainy season 2003. Wide publicity on SRI was given through electronic and print media, and farmers were informed before the season about the skills needed by organizing 300 on-farm demonstrations (0.4 ha each) in farmers' fields across all 22 districts of the State.

Rice yields averaged 8.36 t/ha with SRI methods compared to 4.9 t/ha uisng conventional methods on the comparison plots. The current average rice yield in the state is 3.87 t/ha. The highest SRI yield was 16.2 t/ha, followed by 15.7 t/ha, so SRI potential has not been fully achieved. State-wide, a 2 t/ha average yield advantage was recorded with SRI, irrespective of present yield levels. 25% of the farmers realized yields over 10 t/ha in their first season. Of special interest, the SRI crop matured 10 days earlier than normal, contrary to the claims of some scientists that SRI rice takes longer to mature.

Based on the success of SRI in the rainy season, a larger number of Andhra Pradesh farmers adopted SRI on over 2,500 ha in the post-rainy season 2003-04. This crop is reaching maturity now, and the results look much more encouraging than in the previous season, as farmers have developed their skills for practicing SRI. Average yield for the entire SRI crop is expected to be over 10 t/ha. Various innovations are being made by farmers to save labour and make the work easier, such as developing better implements for marking and weeding.

The experiences of Andhra Pradesh farmers, the reasons for high yields of rice with less inputs (reduced seed, water and chemicals), and microbiological contributions to increased yields with SRI are all discussed in more detail in the paper.

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ON-FARM EVALUATION OF THE SYSTEM OF RICE INTENSIFICATION IN ANDHRA PRADESH, INDIA

P. V. Satyanarayana, T. Srinivas, and A. Satyanaraya
Agricultural Research Station, Maruteru, West Godavari District, Andhra Pradesh,
and Acharya N. G. Ranga Agricultural University, India

The System of Rice Intensification (SRI) involves transplanting single seedlings at 8-12 days age, with a spacing of 25 x 25 cm, in a well-manured plot managed with alternate wetting and drying until panicle initiation, and with periodic use of the rotary weeder. SRI, evolved in Madagascar, has been successfully adopted in several countries. The technology was first introduced and evaluated in the state of Andhra Pradesh, India during wet season 2003.

Based on initial encouraging results obtained from SRI plots, the technology has been extended for wider evaluation on farmers' fields during the dry season 2004, using the most popular rice varieties of the state. Detailed evaluation studies were conducted on 20 farmers' fields of West and East Godavari Districts of Andhra Pradesh state, on land holdings ranging from 0.4 to 3.0 ha. The varieties tested were Swarna, Prabhat, Cottondora Sannalu, MTU 1038, MTU 1061 and MTU 1071.

Data on performance of these varieties in farmers' fields were obtained for both SRI and non-SRI practices, measuring grain-bearing tillers/m^2, spikelet fertility, grain yield (kg/ha), harvest index, grain weight, and quality parameters such as milling per cent and rice recovery rate. The results revealed higher grain-bearing tillers/m^2, increased spikelet fertility, greater grain weight, and more grain yield. The yield advantage for SRI technology over normal (non-SRI) ranged from 1.5 tons to 5.6 tons/ha, with 2.6 tons/ha being the average for the different varieties studied in the different fields, with lower costs of production.

The range of yield advantage was seen to be similar for all the varieties studied, indicating varietal non-specificity for SRI technology. Results on the quality parameters also revealed greater hulling, milling and rice recovery from SRI plots, compared to non-SRI rice harvested. This indicates the superiority of SRI practices for achieving enhanced yield levels.

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ON-FARM EVALUATION OF THE SYSTEM OF RICE INTENSIFICATION IN TAMIRAPARANI COMMAND AREA, TAMIL NADU, INDIA

T. M. Thiyagarajan, Dean, College of Agriculture, Killikulam

Tamil Nadu Agricultural University

The System of Rice Intensification (SRI) was first evaluated in Tamil Nadu during 2001-2002 through field experiments. Based on encouraging results -- increased yield with less need for irrigation water, seed, and labour for weeding -- the State Government agreed to promote this system in two major rice-growing areas of the state.

SRI was evaluated during wet season 2003-2400 through 100 adaptive research trials in selected farmers' fields in different parts of the Tamiraparani basin. The trials compared SRI with conventional cultivation methods on 1000 m^{-2} plots, without replication. Seed bed preparation and planting were done under the supervision of research staff. Trials were continuously monitored. Only 36 farmers followed all the recommendations, so SRI potential is probably understated in the results. All participating farmers used 14 d old seedlings with 20 x 20 cm spacing. Grain yield was reported at 14% moisture.

The yields under SRI and conventional cultivation ranged, respectively, from 4214 kg ha^{-1} to 10655 kg ha^{-1}, and 3887 kg ha^{-1} to 8730 kg ha^{-1}. Mean grain yields were 7227 kg ha^{-1} and 5657 kg ha^{-1}, respectively, with SRI methods having an overall yield advantage of 1570 kg ha^{-1}. Yields over 8 t ha^{-1} were achieved by 31 farmers using SRI; only 3 achieved this with conventional cultivation. Maximum yield advantage recorded for SRI was 4036 kg ha^{-1} (70%). Yield increases were due to increased numbers of panicles m^{-2} and increased numbers of grains $panicle^{-1}$. Three of the 10 varieties used by the farmers were found to perform very well with SRI.

The benefits of SRI realized by farmers were (i) drastic reduction in seed rate, (ii) no requirement of herbicide, (iii) multiple advantages from using the weeder, (iv) water saving, and (v) increased number of panicles m^{-2}, grains $panicle^{-1}$, and grain and straw yield.

Abstract for World Rice Research Conference, Tokyo-Tsukuba, Japan, November 4-7, 2004

OPPORTUNITIES FOR RICE SELF-SUFFICIENCY IN INDONESIA WITH THE SYSTEM OF RICE INTENSIFICATION

Anischan Gani, Indonesian Institute for Rice Research, Sukamandi, Indonesia

In Indonesia, rice production has been stagnant since 1996, and area harvested and yield have decelerated over the last decade. National rice productivity decreased 1993-1998 at a rate of 42 kg/ha/year. Production factor efficiencies are also decreasing. The System of Rice Intensification (SRI) offers promise for Indonesia because it increases concurrently the productivity of the land, labor, capital and water employed in rice production.

The Agency for Agricultural Research and Development (AARD) began evaluating SRI in 1999 dry season at its rice center in Sukamandi, West Java. The result was 6.2 t/ha compared with a control yield of 4.1 t/ha. In next wet season, the SRI average was 8.2 t/ha, with one plot reaching 9.2 t/ha.

SRI was then evaluated together with integrated pest management (IPM) and reduced use of chemical fertilizer in a variety of locations over the next two years. Yield increases of 5.3 to 51.4% were documented. Consequently, AARD incorporated these methods into a new national strategy for Integrated Crop and Resource Management (ICM) for lowland rice.

A number of NGOs in Indonesia have begun experimenting with and promoting SRI. Farmers working with ADRA in Sumatra and East Nusatenggara got more than double their usual yield in 2002; the highest was 12.4 t/ha. The Small-Scale Irrigation Management Project in South Sulawesi documented average yield of 8.0 t/ha in 2002 with SRI. Hundreds of farmers working with the Integrated Pest Management Program in Indonesia have begun using SRI; a 2003 evaluation showed an average yield of 9.3 t/ha.

SRI experience in Indonesia suggests that changes in plant, soil, water and nutrient management practices, without increased capital inputs, can fairly easily raise Indonesian rice production to self-sufficiency levels or beyond. More important, it encourages farmers to become more dedicated innovators, learning from changes rather than continuing with past practices.

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THE 3-S RICE CULTIVATION METHOD DEVELOPED IN NORTHERN CHINA: COMPARISONS WITH THE SYSTEM OF RICE INTENSIFICATION

Prof. Jin Xueyong, Northeast Agricultural University, Haerbin, China

A system for improved rice cultivation in cold zones was developed in Heilongjiong Province between 1994-95 and is now being popularized. It is called the '3-S' cultivating technique because it combines: (1) selecting Super rice variety with best quality; (2) wide Spacing of transplanting; and (3) Sustaining high yield with organic matter for the soil. It has many similarities with the System of Rice Intensification (SRI), developed in Madagascar under very different, more temperate or even tropical conditions.

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The factors that restrict realization of the productive potential of rice in Heilongjiong include: less than best quality of seeds and seedlings; excessive number of plants per m^2; long recovery period for seedlings after transplanting; unsuitable fertilization; and over-irrigation. The 3-S cultivating technique introduces countermeasures that have the goal of developing the individual plant's productive potential and of strengthen the whole population of rice plants.

The methods used include: sowing in a protected nursery earlier in the year, fostering vigorous seedling growth, transplanting single seedlings at the proper time with very wide spacing, reducing the amount of N application at the initial stage and applying it more deeply in the field, reducing and controlling water applications to use nutrient space more fully and improve nutrient timing, and stimulating the development of the plants' root systems. These methods make rice plants stronger and enhance the rate of photosynthesis, increasing both source and sink and thereby supporting higher-yielding plant populations.

In Heilongjiang province, the area planted with 3-S methods was more than 40,000 ha in 2003, with an average yield of 8.5 t/ha. This is 40% higher than with conventional cultivation methods used in the region. This increase is achieved with less water and with less cost of production, making the system more profitable and more sustainable.

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DIVERSIFYING RICE-BASED FARMING SYSTEMS IN THE SOUTHERN PHILIPPINES WITH THE SYSTEM OF RICE INTENSIFICATION

Felipe Rafols Jr., Allan Gayem, Ligaya Belarmino, Flor L. Magbanua, Rene Q. Nombre, Joel A. Basiao, Carlos S. Salazar, Edgar F. Tagarao, Elmer T. Nepa, Pacifico E. Calibayan, and R.C.Lazaro[1]

This paper reports results of techno-demo trials to save water and raise farmer incomes with crop diversification using the System of Rice Intensification (SRI). The trials were supported by the Southern Philippines Irrigation Sector Project of the National Irrigation Administration, with loan funding from Asian Development Bank.

Mindanao. An SRI yield of 8.9 $t.ha^{-1}$ was obtained on a one-hectare plot in Caragas region, with gross farm income of PhP 72,200 and net income of PhP 40,828, a benefit-cost ratio of 2.34 to 1. Irrigation water was applied only at ten-day intervals. These results extrapolated to the Lower Agusan Development Project (LADP) showed water use during land soaking reduced by 45% and during crop maintenance by 73%. Power cost savings amounted to half a million Philippine pesos for land soaking, and 1.1 million for crop maintenance during the wetter months, and up to 2.0 million during the drier months. On farmers' plots in Gibong Subproject standard methods using hybrid variety 72H gave yields of 4.6 $t.ha^{-1}$ while SRI methods and IR64 with 35x35 cm spacing yielded 7.5 $t.ha^{-1}$. Net income with standard methods was PhP 23,532, and with SRI, PhP 38,482, a 64% increase.

Visayas. On farmer-managed, pump-irrigated small farm plots in Negros Occidental, rice yield from traditionally-flooded rice production with random spacing was 2.65 $t.ha^{-1}$; the Total Quality Production Management (TQPM) system that uses inorganic fertilizer as a booster and 10 x 30 cm spacing yielded 3.66 $t.ha^{-1}$; while SRI at 35 x 35 cm spacing produced 7.33 $t.ha^{-1}$. Net farm income was PhD 7,592 with farmers' practice; PhP 11,130 with TQPM; and PhP 24,054 with SRI. Net income from SRI was 126% more than with TQPM, and 215% more than with farmers' practice. Assessment of irrigation savings indicated a 67% reduction with SRI and pumping cost savings about 160%.

[1] Respectively are two pioneering farmers of Barangay Balicotoc, Ilog Municipality, Negros Occidental; Researcher, Institutional Development Officer (IDO), Technical Staff (TS), Provincial Irrigation Engineer (PIE), Regional Irrigation Manager, FIA President, IDO, and PIE-Gibong, SubProject Management Offices; and Monitoring and Evaluation Specialist, Consultants' Consortium (CC), SPISP.

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FARMER PARTICIPATORY EXTENSION OF THE SYSTEM OF RICE INTENSIFICATION IN CAMBODIA

Yang Saing Koma, George Deichert, Or Thy, and Yi Kimthan
CEDAC and GTZ/IFAD Kampoth/Kampong Thom Rural Development Project

The first use of SRI in Cambodia was in 1999, introduced by CEDAC, a national NGO, with farmer-based field experimentation starting in 2000. That year, only 28 farmers were willing to participate in SRI evaluation. By 2003, nearly 10,000 farmers were using SRI, and the number is expected to reach 50, 000 during 2004.

The main approaches for wider adaptation and adoption of SRI are farmer-led experimentation and farmer-to-farmer extension. To strengthen farmer capacities, CEDAC uses farmer-group and farmer-promoter approaches. The focus of training is on basic principles and techniques of SRI, as farmers are encouraged to organize their own experimentation and share experiences among group members. The best farmers are chosen by group members to become farmer-promoters, who advise and teach other farmers in their own villages and in neighboring villages.

Through CEDAC or other NGOs/projects, they interact with other group leaders and receive further training in agriculture and community development. Farmer-promoters are now managing agricultural extension in around 200 villages. This number is increasing year to year. A farmer-to-farmer extension fund is established, from which the association and/or individual farmers can request funds for conducting farmer training and exchanges.

After five years of field experience, SRI has shown itself to be an appropriate solution for millions of rice farmers in Cambodia. It is a good entry point for starting or strengthening the process of farmer experimentation and farmer-to-farmer extension as well as for developing farmer organizations.

With SRI, farmers have gained confidence that the future of rice farming is more favorable than previously thought. They become interested in developing their rice fields into a highly productive, diversified and sustainable operations, combining rice, fish, fruit and multi-purpose trees, vegetables and herbs, in what is known as a multi-purpose rice field.

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FARMERS' PARTICIPATORY APPROACHES TO FACILITATE ADOPTION OF IMPROVED TECHNOLOGY: ADAPTATION OF THE SYSTEM OF RICE INTENSIFICATION IN SRI LANKA

Gamini Batuwitage, Director, Gemi Diriya Community Development and Livelihood Improvement Project, H. M. Premaratna, Ecological Farming Center, and U. G. Abeygunawardena, Ministry of Agriculture, Sri Lanka

The System of Rice Intensification (SRI) was introduced to Sri Lanka in 2000 as a response to the need of farmers for low-cost, low-input techniques for improving rice production, quality and income. As the environment for agricultural extension through official channels was not favorable, enthusiastic groups of farmers took over this task. They used farmer-to-farmer extension methods to extend information on the new techniques for increasing rice production with less inputs, and getting much higher returns, in 19 districts out of the 25 in Sri Lanka through various farmer-managed approaches.

The principles of SRI were adapted to local conditions; appropriate implements and tools were produced; practical training and orientation arrangements were designed and put into practice; material the for dissemination of information were produced. A number of political stakeholders were attracted to the approach, including a Deputy Minister of Agriculture who used the methods personally on his own rice farm, getting yields as high as 16 t/ha. The President was impressed by the results as reported to her by farmers. Several Parliamentarians took keen interest in dissemination of information to farmers using farmer demonstrations of results in rural areas.

Formal and informal methods of communication have been used to attract practitioners, demonstrating the best practices to adopt for SRI in many locations. The results have been recorded and disseminated. The paper describes how the impressive outcomes can be made to speak for themselves, given the inherent potential in SRI. The demonstrated progress has attracted an ever-wider acceptance of SRI, with the scientific basis for its success also expanding now to explain the data coming from a large number of practitioners who are using the methods in diverse production environments.

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EXTENSION INITIATIVES AND FARMER RESPONSE IN POPULARISING THE SYSTEM OF RICE INTENSIFICATION IN ANDHRA PRADESH, INDIA

A. Satyanarayana, P. Punna Rao, P. Gidda Reddy, and I. Srinivasa Rao
Acharya N. G. Ranga Agricultural University, Hyderabad, India

The System of Rice Intensification (SRI) is a low-cost technology for lowland rice that can increase yield potential and factor productivity. Adoption of this methodology on a wider scale requires major extension efforts to create awareness and educate farmers about required skills. SRI was introduced in the state of Andhra Pradesh during rainy season 2003 for the first time through 300 on-farm demonstrations (0.4 ha. each).

State-wide awareness programs communicated SRI concepts and techniques through electronic and print media, VCDs, training programs, etc. Pattern of adoption and perceptions of farmers were studied after the season, with 67 randomly-selected farmers, to develop a strategy to further extend SRI. The data indicated that most initial adopters were middle-aged (76.6%) and educated at high school or higher level (85%). Mass communication was effective for reaching such farmers, but the most common source of information was the state's agricultural university (ANGRAU).

All categories of farmers, small, medium and large, adopted SRI irrespective of availability of family labour. Farmers with limited irrigation water were attracted to SRI because of its water-saving. However, high SRI yields have led farmers in canal-irrigated areas of the Godavari delta also to adopt SRI in a big way during the subsequent season.

As many as 26 different varieties of rice were tried by the farmers with SRI. All gave improved yields, showing that SRI methods are variety-neutral. Almost all farmers (87.9%) adopted the transplanting of 8-12 day old young seedlings at 25x25 cm spacing. Farmers' expenditures on seeds, fertilizers, pesticides and irrigation were all less under SRI. The findings of the survey indicated that farmers can get 2.0 tons per hectare additional yield just by planting younger seedlings, carefully and with wider spacing, accompanied by better water management, compared to yields using conventional methods with more costly inputs.

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FARMERS' PARTICIPATORY EXTENSION: A CASE STUDY OF SRI TECHNOLOGY ADOPTION IN WEST GODAVARI DISTRICT, INDIA

A.Satyanarayana,[2] R. S. N. Rao,[3] T. Ramamohana Rao,[4] and P. Rambabu[5]

Farmers' participatory extension as a means for transfer of technology has helped significantly in the adoption of the System of Rice Intensification (SRI), a low-input rice production technology, among farmers of West Godavari district of India. Initially, a few progressive farmers were motivated to lay out demonstration plots after seeing video material on SRI and learning about the technology and its scientific basis. Newspaper articles and TV programmes further spread knowledge about the technology. SRI demonstration plots were supervised, 300 in the first season (2003 kharif).

The new technology attracted neighbouring farmers, other farmers in the village and in other villages also. Media coverage on the progress of SRI plots plus regular visits to the plots during the growing period by the Director of Extension along with research and extension scientists drew additional farmers to the plots, who interacted scientists and SRI farmers directly. SRI farmers in turn became motivators, freely exchanged information with interested farmers.

The first-season yields with SRI were very encouraging even though most farmers only followed two to three of the six recommended practices, getting 20-50% yield improvement. Farmers were impressed with the crop's performance, especially tillering, panicle size, grain weight, crop health, and low water requirements. This motivated many farmers to adopt SRI in their own fields in the next season.

Motivator-farmers took an interest in supervising other farmers' plots, advising them and sharing implements. Both small and big farmers (over 10 acres) are attracted to SRI technology, with one farmer adopting SRI on over 100 acres. SRI technology with its obvious positive aspects is spreading well with active farmer participation. The spread is being accelerated by farmers' innovations, devising implements that save labor time and cost.

[2] Director of Extension, ANGRAU
[3] Senior Scientist (Crop production)
[4] Coordinator
[5] Senior Scientist (TOT), DAATT Centre, Eluru, West Godavari dist, AP

Abstract for World Rice Research Conference, Tokyo-Tsukuba, November 4-7, 2004

POPULARISATION OF SRI IN ANDHRA PRADESH, INDIA: A SUCCESS CASE OF PARTICIPATORY APPROACH OF ONE-MAN ARMY

Dr. Parisa Punna Rao,[1] Dr. P. Gidda Reddy,[2] and Dr. I. S. Rao[2]

The Director of Extension for Andhra Pradesh state agricultural university (ANGRAU), Dr. A. Satyanarayana, visited Sri Lanka on a study tour 25-31 January, 2003, to learn about the System of Rice Intensification (SRI). Impressed by its high yield potential with low inputs, especially less irrigation water, he shared what he had learned about SRI back in Andhra Pradesh through a powerpoint presentation supported by self-explanatory visuals. Presentations were given to scientists, officers of the Department of Agriculture, the Agricultural Commissioner, the Secretary of Agriculture, and farmer organizations.

In the initial stages, people were not convinced about the potential of SRI, having a number of doubts in their minds, particularly researchers who considered rice an aquatic plant. With persistent efforts, the Director of Extension convinced top executives at the university and in government and also farmers. In collaboration with ANGRAU scientists, the extension service organised 500 on-farm demonstration trials in 2003-2004, 200 in dry season and 300 in wet season.

Electronic media were used effectively to popularize SRI. The Director of Extension participated in many interviews over television and interacted with farmers and scientists. Information was spread through more than 35,000 copies of booklets on SRI, coupled with training on nursery management, transplanting and weeding. News of SRI innovation spread rapidly within the farming community.

Initially only a few innovators accepted SRI in Andhra Pradesh on hearing from the Director of Extension either personally, over telephone, television, or through print media. On-farm demonstrations in kharif 2003-2004 showed an increase of 2.0-2.5 t/ha over conventional methods. Knowledge about the performance of SRI is now diffused all over the state, and the number of adopters increased to about 2,500 the next season. The paper describes the strategy of the Director of Extension in massive awareness-building and large-scale adoption of SRI in Andhra Pradesh.

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1. Assistant Director of Extension, 2. Deputy Director of Extension, Acharya N. G. Ranga Agricultural University, Hyderabad, India

Abstract for World Rice Research Conference, Tokyo-Tsukuba, Japan, November 4-7, 2004

EFFECTS OF THE USE OF SRI ROOT EXUDATES IN THE IMPROVEMENT OF AEROBIC RICE CULTURE

Prof. Robert Randriamiharisoa, University of Antananarivo, Madagascar

In the predominantly ferralitic soils of Madagascar, available phosphorus and nitrogen are very limited. The high yields resulting with SRI practices may be attributable, at least in part, to the synergistic activity of microorganisms in, on and around the roots. Root exudation is probably a contributing factor.

We investigated with replicated trials the variation in yield associated with different inoculations of paddy seeds made from SRI root exudates extracted 40-45 days after transplantation and before the end of tillering. We compared the results obtained with different applications of compost (F1, F2, and F3) with a control (F0), and with different strengths of inoculant made from root exudates (C1 and C2), again with a control (C0). In all cases SRI cultural practices were used.

Inoculation with root exudates of SRI-grown plants gave better yield compared with the control. The average for 3 replications with no fertilization and no root exudates was 458 kg/Ha; with inoculation C1 and C2 but without compost fertilization, yield was 568-1282 kg/Ha; with inoculation C1 and C2 and compost fertilization F1, F2 and F3, yield was 1413-2888 kg/Ha

We identified by chromatographic and other analyses various microorganisms in the inoculant, including mycorrhizal fungi and the diazotroph *Azospirillum*. Mycorrhyzae enhance plant roots' access to phosphorus, and *Azospirillum* contribute N-fixation and other benefits to plants. Both organisms benefit from the aerobic soil conditions that SRI creates compared to conventional growing of rice with flooding of fields. Flooding is especially significant in Madagascar where ferralitic soils contribute to iron toxicity under anaerobic soil conditions.

Much research remains to be done on these relationships, but our results indicate that microorganisms and other substances in SRI root exudates participate in the improvement of yield. Our results indicate also that stimulation of microorganismic processes may make the use of fertilizer much less necessary.

Abstract for World Rice Research Conference, Tokyo-Tsukuba, Japan, November 4-7, 2004

AN EVALUATION OF ALTERNATIVE RICE CULTIVATION METHODS USED IN EASTERN MADAGASCAR: THE SYSTEM OF RICE INTENSIFICATION, THE SYSTEM OF RICE IMPROVEMENT, AND TRADITIONAL FARMER METHODS

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In Madagascar, paddy rice is the most important staple. The System of Rice Intensification (SRI) was developed there 20 years ago by Fr. Henri de Laulanié to redress the serious problems of hunger and poverty. The spread of SRI has been slow, but is accelerating. This paper reports on results attained by rural households in Eastern Madagascar who have taken up SRI through Kolo Harenas, farmer associations that bring together farmers who are abandoning slash-and-burn cultivation, adopting instead improved methods that do not require forest clearing. SRI is one such method. The System of Rice Improvement (SRA in French), which requires more purchased inputs but less labor for transplanting, water control and weeding, is also disseminated.

This study evaluates SRI and SRI compared with traditional methods of rice cultivation; 5% of KH households are now using SRI, which is more demanding of labor and skill; 15% use SRA methods, and 50% still employ traditional methods; the rest do not grow rice. The data were collected from Kolo Harena families randomly selected from among those which grow rice. Each keeps a 'household book' on its cultivation practices, from which detailed economic data could be obtained.

SRI gave an average yield of 7.7 tons/ha, compared with 3.8 tons/ha for SRA and 1.5 tons/ha with traditional methods. Labor productivity was higher for both SRI and SRI, about triple (125 and 122 compared to 42 kg/day); returns to non-labor cash investments were much higher for SRI than either SRA or traditional methods (81.42 vs. 52.48 vs. 41.11). These results reflect the greater labor requirements of SRI (thus not much higher returns to labor than SRA) but also the reduced cash commitment with SRI (much higher returns to capital investment, important for poor farmers). The paper gives more details on SRI practice and comparisons.

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VARIETAL PERFORMANCE UNDER THE SYSTEM OF RICE INTENSIFICATION AND WITH STANDARD METHODS OF CULTIVATION

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The performance of seven popular and elite rice varieties used in Andhra Pradesh state of India was investigated under two different cultural systems, the System of Rice Intensification (SRI) and standard methods (non-SRI) at Maruteru, Andhra Pradesh, India during dry season 2003-04. The experiment was laid out in strip plot design with SRI and non-SRI as the main treatments and with varieties as sub-treatments.

Analysis of variance revealed significant differences between SRI and non-SRI for yield and for a majority of yield components and quality characteristics studied. SRI was noticed to be significantly superior with regard to fertile tillers/plant, filled grains/panicle, 1000-grain weight, grain yield, and certain quality parameters, namely, milling per cent and head rice recovery. A yield advantage of 921.9 kg/ha was observed for SRI compared to non-SRI. This enhanced yield was attributable to increased number of fertile tillers (167.5% higher), filled grains per panicle (29% higher), spikelet fertility (6.4%), and 1000-grain weight (1.7%) with SRI practices. Milling per cent and head rice recovery were also significantly higher (4.4 and 4.8%, respectively) under SRI compared to non-SRI. Further, the varieties recorded lower number of days to 50 per cent flowering under SRI compared to non-SRI.

The results also revealed significant differences between the varieties for all characteristics studied, except for fertile tillers/plant and hulling per cent. The variety MTU 1010 had the maximum grain yield (7,213 kg/ha), followed by MTU 1061 (7,208 kg/ha) and MTU 1001 (7,015 kg/ha). Interaction effects of the cultural systems with the varieties were observed to be non-significant for most of the characteristics studied, except for days to 50 per cent flowering, panicle length, spikelet fertility, milling per cent, and head rice recovery. This indicates that SRI was not particularly variety-sensitive and that advantages of the system can be well utilized by any variety.

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FARMER INVENTIONS THROUGH PARTICIPATORY TECHNOLOGY DEVELOPMENT WITH SRI METHOD OF CULTIVATION

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The System of Rice Intensification (SRI) is an ecofriendly method of rice cultivation that produces more with less external inputs by manipulating agronomic practices. Two of the six focal components of SRI require more effort from farmers: (a) marking a grid on the puddled field surface, to plant young seedlings at regular, wider spacing (25x25 cm), and (b) removing weeds, preferably by churning the soil and incorporating weed biomass into the soil. This work can be made easier and quicker by appropriate implements that can function under wetland conditions to reduce cost of cultivation and improve efficiency and profitability.

(1) A cono rotary weeder designed by the Acharya N. G. Ranga Agricultural University (ANGRAU) has now been redesigned by placing ball-bearings in the wheels to make the operation easier, smoother, and more efficient. .

(2) A hollow cylindrical roller made from iron rods, developed by a farmer in Anaparti village, East Godavari District, Andhra Pradesh, India, Mr. Lakshmana Reddy, to mark fields with the desired 25x25 cm spacing greatly reduces the time required to score a grid on the surface of the field. This is easy to operate, gives precision marking, and involves less drudgery, compared with using the wooden rake now commonly used or pegs and lines of rope as the method was originally developed.

These implements have been refined and improved further at the farmers' level through participatory technology development (PTD), further reducing expenditure and drudgery with increased efficiency, contributing to higher productivity.

Farmers' positive feedback response has been encouraging, and these innovations through PTD are spreading fast across the farming community in Andhra Pradesh. Photographs of the two innovations, the cylindrical marker and the improved weeder, will be displayed along with data on their efficiency.

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