



inside pages

Page 2

Where SRI is Successful

Page 5

Norman's column

Page 8

SRI: Perceptions and
Suggestions

Page 12

Impact of cost of cultivation
and mechanization
on paddy cultivation

Page 16

Research on System of Rice
Intensification

Page 20

Glimpses of National
Symposium on SRI
– 2006 and 2007

Page 22

Possibilities to reduce the
drudgery of weeder operation
in SRI

Page 24

Success Story:
Farmer V.K.V Ravichandran

Page 30

CWS Action Research Initiative
in Andhra Pradesh

Page 32

SRI in Northeastern Provinces
of Afghanistan

Page 34

Introduction of SRI in Morocco

Working towards scaling up SRI

SRI has made remarkable progress in the last five years in India, which has inspired policy makers to include SRI explicitly as an approach for the National Food Security Mission (NFSM). Credit for this is a result of the combined efforts of partnerships among farmers, civil society, government, research agencies and some committed individuals. Farmers have been in the forefront and driving this process by experimenting, promoting, refining and evaluating it at the same time. They took great risks and got many rewards.

Last two Symposium held at Rajendranagar, Andhra Pradesh and Agartala Tripura, played a major role in forging partnerships, mobilizing resources, and supporting nationwide adoption. The 3rd National Symposium at Coimbatore, Tamil Nadu is to learn from the process of large-scale adoption in this state. The results reported are very impressive. The media have reported that paddy production has increased significantly in the state due to farmers adopting SRI methods on an ever-larger scale. This confirms that SRI can not only benefit individual farmers but it could effectively increase food security of a state or nation. We hope this will inspire the discussions at the Symposium and play a major role in setting up national-level targets for the next five years to scaling-up SRI. Of course, there are many practical issues related to SRI. It is essential to discuss them openly and find out solutions collectively, learning from each other. To facilitate that process, several publications have been prepared which will be released during the Symposium. This special issue is one attempt to present experiences, lessons, and different views of SRI and its future direction.

As Prof. Norman Uphoff says SRI is 'a work in progress'. In India, SRI is definitely 'a work in progress with great speed'. Now based on the available information, SRI is present in all states and in almost 200 of the 564 paddy-cultivating districts of the country within a span of five years. This too is changing fast, and we hope soon there will be examples of SRI production in all the districts. It is difficult to compile statistics on the area under SRI, but several hundred thousand farmers have adopted SRI under different agro-climatic zones.

Productivity of rice production is very low in certain parts of India. By promoting SRI in these areas, it should be possible to improve the production significantly without any major investments in infrastructure or agro-inputs. India could easily meet its future demand by improving the productivity at the same time saving water, reducing fertilizer use, improving ecosystem quality and sustainability, and avoiding further water-related conflicts. SRI can be part of that solution. Particularly in the current context of collapse of global financial systems, there will be less money for agriculture. Indian farmers might get even less credit, less subsidies, and even less support price. SRI is more relevant now than before to improve production with less cost and less water. For that we need to plan to scale it up at a level where its benefits will be seen at national level. The goal is to adopt SRI in at least 20% of the irrigated area by 2015. We also need to discuss mechanisms on how to meet goal. There are some ideas presented in some of the publications including this one.

We welcome Indian and foreign dignitaries to the 3rd National symposium and hope the presentations, discussions and interactions will lead to positive engagement and will truly be a turning point in promoting sustainable agriculture methods in India and in many developing countries.

Dr. Biksham Gujja

Where SRI is Successful

Dr. T.M. Thiyagarajan

The agronomic practices of SRI may baffle conventional farmers, scientists and extension personnel in the beginning, evoking a feeling of disbelief about its benefits. But a change in attitude comes when these people witness the resulting profuse tillering in person. Then comes personal interest and a commitment to follow SRI practices and extend them.

System of Rice Intensification involves the same agronomic practices as with usual irrigated rice production -- nursery, transplanting, irrigation, weed control, and organic manure application -- but it is the way that these activities are performed, according to the principles that SRI proposes, which is drastically different from what is done by most rice farmers worldwide. These principles are

- a) use of young seedlings, 8-12 days old and certainly less than 15 days, instead of 3, 4 or more weeks old as conventionally done,
- b) planting single seedlings per hill instead of multiple seedlings,
- c) planting in a square pattern at wider spacing, 25 x 25 cm or even wider if the soil is fertile, instead of close and random planting,
- d) keeping the soil under moist but mostly aerated conditions rather than flooded, and
- e) intercultivation at 10-day intervals with a mechanical weeder, in between the hills in perpendicular directions, stirring up the soil at the same time controlling weeds, as against

The key factor in the successful spread of SRI, country after country, has been the commitment of individuals who 'pick up the torch' and carry it actively and smartly to 'light the torches' of many other carriers.



hand weeding or herbicide application in conventional cultivation.

These agronomic practices of SRI may baffle conventional farmers, evoking an initial feeling of disbelief about its benefits. Thus, most would not accept SRI immediately as they might accept a new high-yielding variety. This is the case not only for rice farmers, but also many rice scientists and extension personnel. A change in attitude

comes only when these people witness the resulting profuse tillering in person. Then comes personal interest and a commitment to follow SRI practices and extend them. Thus, adoption, spread and scaling-up are mostly a matter of getting people to believe it.

SRI, known only in Madagascar in 1980s and 1990s, was made known to the rest of the rice world mostly through the initiatives of Dr. Norman Uphoff and then people who were willing to cooperate in SRI dissemination, through meetings with all categories of stakeholders in rice production, viz., farmers, extension personnel, NGOs, scientists, policy makers, and private sector. The torch of SRI was carried by him and a growing network of partners to engage key personnel in more and more parts of the world who joined in testing, evaluating and promoting SRI methods. In some areas, the extension of SRI has been quick, like the rapid spread of an infection; and in some areas, diffusion has been at slow pace. The key factor in the successful spread of SRI, country after country, has been the commitment of individuals who 'pick up the torch' and carry it actively and smartly to 'light the torches' of many other carriers.



Persons who understood the importance of SRI for increasing food production of the region, raising net incomes of farmers, and enhancing the quality of our natural resources and protecting natural ecosystems, become keen and committed to SRI, and take the necessary steps to popularize it to the extent of their potential.

Practically anyone who has an open mind and is willing to try SRI will see the effects that the principles of SRI can have on the growth of the crop, coming to appreciate its potential. Farmers who come to know about SRI could be categorized into three categories:

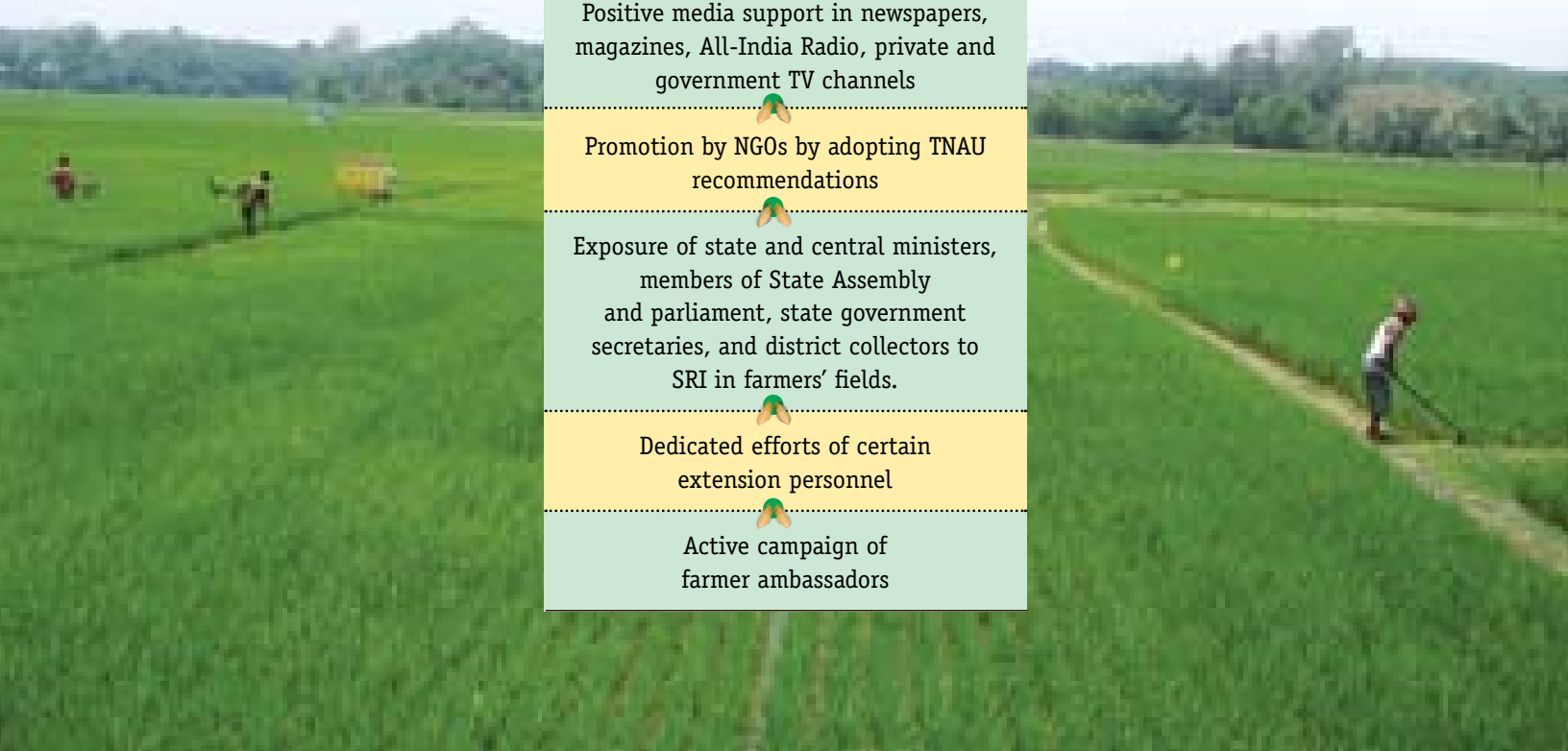
- (1) enthusiastic farmers who have constant thirst to try new innovations,
- (2) farmers who are constantly in touch with knowledge dispensers (media, meetings, experts), and

The key points that have been responsible for the scaling up of SRI in Tamil Nadu

- Active involvement of both Tamil Nadu Agricultural University (TNAU) and the state government Department of Agriculture (DOA)
- Initial evaluation by field experimentation
- Exposure of higher officials of TNAU and DOA at the experimental stage itself
- Discussions among rice scientists
- Formulation of a package of practice
- Evaluation in farmers' fields
- Recommendation to farmers
- Promotion in all government schemes concerned with food production with financial support
- Promotion through the World Bank-funded Irrigated Agriculture Modernization and Waterbodies Restoration and Maintenance (IAMWARM) project in 63 river basins from 2007 with a budget allocation of 24,000 million rupees.
- Positive media support in newspapers, magazines, All-India Radio, private and government TV channels
- Promotion by NGOs by adopting TNAU recommendations
- Exposure of state and central ministers, members of State Assembly and parliament, state government secretaries, and district collectors to SRI in farmers' fields.
- Dedicated efforts of certain extension personnel
- Active campaign of farmer ambassadors

- (3) farmers who are cooperating with extension agencies and can be persuaded to take up demonstrations. Country-wide experience shows that these farmers are the ones most likely to achieve the positive aspects of SRI.

But why is it that in spite of the increased yields and additional benefits such as cost saving on seeds, water, labour etc., SRI has not spread widely across the country? This is certainly a matter of concern. Let us take the example of Tamil Nadu state as a case where there is now tremendous support and adoption. First trials started in 2000 at Tamil Nadu Agricultural University (TNAU) and by some organic farmers who had read about SRI in written communication. There was little spread until after 2004, but now there is considerable momentum so that as much as one-third of



the rice area this past season was under some form of SRI management.

Apart from the efforts of TNAU and DOA, there has been more autonomous farmer initiative and more NGO activity on behalf of SRI especially by those promoting organic farming.

The maximum grain yield obtained by farmers through TNAU evaluation was around 10 t ha⁻¹, with an average increase of 1.5 t ha⁻¹ over conventional cultivation. There has been 16.2-43.5% yield increase in farmers' fields.

Extension officials have reported a maximum yield as high as 14.2 t ha⁻¹ by a farmer in Dindigul district.

Total rice area covered under SRI requires a good investigation, but we should also see why certain farmers of Tamil Nadu could not embrace SRI or have dropped (dis adopted) the methods. Some of the reasons are:

- Negative mindset of contract labourers who do not like square planting and handling single seedlings. Perhaps they should be paid more as the method will bring more net income to the farmers.
- Drudgery in weeder use [also, the weeders supplied are often not the best design for the soil conditions; or they are of inferior quality and break down or clog easily]



The happy SRI farmers of Tripura

- Fear of failure due to heavy rains when using very small young seedlings
- Non-availability of weeders, or poor quality of weeder design or construction
- Need for constant attention and care of the crop
- Exaggerated expectations of very high yields, expecting to start by getting the maximum and not being satisfied to achieve the average yield increase
- Inadequate technical support

There are other examples where SRI is spreading, most notably in Tripura state. Tripura does not have a separate agricultural university, but research is done there by the Agriculture Department. Mr. Baharul Mazumdar of DOA came to know about SRI from the first SRI paper of Dr. Norman Uphoff and he tried the methods for several years on his own, with no Department support or encouragement. In 2004, when he contacted Dr. Norman Uphoff, he arranged for him to communicate with Dr. Satyanarayana, who then provided more in-depth knowledge. Since then the DOA had taken systematic and dedicated efforts to

popularize SRI in the state. They have been fully supported by political leaders and higher officials in the state, and by the enthusiastic participation of farmers, even in tribal areas.

In the state of Andhra Pradesh, SRI had a quick take-off after scientists of Acharya N.G. Ranga Agricultural University (ANGRAU) had an exposure visit to Sri Lanka in January 2003. There was also some good support from the Government, but some agricultural personnel also gave resistance. NGOs and farmer organizations helped to carry SRI forward once ANGRAU trials in 2003 had validated the methods under the full range of agro-conditions in A.P. The spread and interest have not accelerated as in T.N. and Tripura, however, perhaps for serious ambassadors.

In states like Orissa, Gujarat, West Bengal, Jharkhand, Assam, Bihar, Chhattisgarh, Madhya Pradesh, Himachal Pradesh, Uttarakhand, Kerala, and Punjab, different combinations of leadership have come from NGOs, universities, private sector, government agencies and research institutions to take an effective role in promoting SRI. The close contact that NGOs in particular enjoy with farmers has had a tremendous effect on the spread of SRI. These efforts have provoked and supported farmer-to-farmer extension which is the most effective way to disseminate SRI.

Dr. T.M. Thiyagarajan is Consultant, ICRISAT-WWF Project, and former Dean/Director, Tamil Nadu Agricultural University, Coimbatore.



Norman Uphoff

FAQ:

Why do reported SRI yields differ so much?

Some thoughts

One of the misgivings that some persons have about SRI is the fact that the yields reported for its methods are highly variable -- year to year, from country to country, within countries, and even within fields. Why is this? When certain 'super-yields' reported with SRI practice are not widely or always replicated, this can be regarded by some as invalidating the case made for the methods themselves.

Variability in SRI yields arises, I think, from the fact that the main reason for the higher yields achieved with SRI practices is neither (a) 'improved' genotypes, i.e., new varieties, nor (b) increased external inputs -- chemical fertilizer, water, agrochemicals. Indeed, with SRI the latter are reduced. SRI yields are not improved by essentially *mechanical* or *industrial* processes, in which inputs produce predictable and proportional outputs. Rather, SRI practices stimulate and benefit from *biological* processes that can be, and usually are, quite variable, for better or for worse. SRI practices are intended to capitalize on this *potential for variability* -- to get better results through biologically-directed interventions.

Biology differs fundamentally from the realm of engineering with its mechanistic relationships, and while the elements of biology are all reducible to chemical components,

SRI interventions are primarily biological or physical. They are intended to improve the physical environments that support biological actors and processes and that in turn enhance chemical availability and transformations.

In biological processes, *small inputs* such as seed, can lead to *large outputs*, full-grown plants and generous harvests under the right conditions. At the same time, *large inputs* of resources and energy may produce *no output* at all, if the plants being grown die. The enterprise of agriculture is basically biological, even though scientists and engineers have worked hard to make it as much like mechanics, and thus as controllable and predictable, as possible.

Just using the basic practices of SRI -- starting with young seedlings, giving them wider spacing within and between hills, growing them in soil well-aerated and rich in organic matter -- produces higher yields, in most instances in the range of 6-8



Cuba - SRI plants at 52 d, 5 vs 43hijos

tons/hectare. This productivity is possible because the following kinds of processes and mechanisms are instituted:

- Rice plant roots in mostly aerobic soil do not die back from lack of oxygen. They can keep supplying nutrients throughout the whole crop cycle. This makes grain formation less dependent upon the translocation of nutrients from stems and leaves as plants start to senesce (age and die).
- With wider SRI spacing, plants' leaves are all photosynthetically active. With close spacing, on the other hand, many leaves in the lower canopy are shaded and do not contribute photosynthate to the plant's pool of energy. Instead they draw energy resources from this pool, in a parasitic way, rather than add to this supply.
- Since roots get most their energy resources from plants' lower leaves, when these are not photosynthetically active throughout the crop cycle, roots' supply of photosynthate to sustain their metabolism and physiological activity is diminished.
- Reliance mostly on organic materials (compost, mulch) for soil and plant nutrition makes for



Picture courtesy: Ali Muhammad Ramzi, AKF

SRI rice plant in Afghanistan with 133+ tillers at 72 days after transplanting, growing in field of Juma Gul in Dushi district, Baghlan province, cooperating with Aga Khan Foundation to introduce System of Rice Intensification.

more balanced and more complete nutrition of rice plants. According to the theory of trophobiosis (Chaboussou, 2004), this helps make plants more resistant to pests and disease.

These are just some of the explanations for superior performance of SRI-grown rice plants. There is nothing 'magical' about SRI; it capitalizes on processes and potentials that are known within agronomic science. SRI is not 'voodoo science' as suggested by some skeptics (e.g., Sinclair and Cassman, 2004).

However, some very high yields achieved with SRI methods, over 15 or even 20 tons per hectare, have been dismissed by some rice scientists as being beyond 'the biological maximum' (Dobermann, 2002; Sheehy et al., 2004).

Divergence between these observed results and expectations based on currently-accepted scientific understandings remains to be adequately explained.

This disparity presents a challenge to proponents and skeptics alike. At the same time it also offers opportunities, which should be of interest to everyone interested in improving rice science and practice. It should not be expected that SRI practitioners, most of whom are not trained in scientific methods and theories, should be doing the work of rice scientists for them.

Based on a decade of observing and reviewing SRI results across many countries, I would suggest that when SRI practices are well and fully used, they powerfully enhance the abundance, diversity and activity of the myriad species and

many trillions of organisms residing in healthy, fertile soil systems. Soil microbes together with all kinds of soil fauna can render so many services and benefits to rice plants, synergistically and free, that these plants' phenotypes are greatly altered, and their productivity is dramatically improved.

A picture sent to Cornell from northern Afghanistan showed one farmer's SRI plant at 72 days having 133 tillers; his SRI plot harvested at end of October gave a yield calculated as 11.56 tons/hectare, in a region which is almost the antithesis of what has been considered a good rice-growing agroecosystem. A Swiss colleague who did her PhD at Cornell in crop and soil sciences is now introducing SRI methods in the Timbuktu region of Mali. She has reported an SRI plant with 160 tillers, soon to be harvested, on the edge of the Sahara Desert, grown with less water than usually required. Her blog on this season's experience is available at: http://www.erikastyger.com/SRI_Timbuktu_Blog/SRI_Timbuktu_Blog.html

I remember visiting a Sri Lankan farmer who has pioneered SRI in his country. W.M. Premaratne gave me a huge panicle of rice to hold in my hand and to count its 930 grains. To be sure, this was his largest panicle, but his crop's panicles that season averaged around 400 grains. Prema had farmed organically for 8 years before he took up SRI, so his soil was very fertile. Otherwise he could not have started out with SRI yields of 10 to 15 tons/hectare. Usually,



such fertility needs to be built up over some years.

How do such unusually productive plants come about? When basic SRI practices are used as recommended they enable rice yields to 'take off' in the way that – speaking metaphorically -- a *propeller airplane* escapes the force of gravity and can fly at impressive levels. When the practices are used really well, optimally attuned to local conditions and functioning as a whole management system, not just separate methods, they can mobilize the life in the soil, giving rice plants the equivalent of *jet propulsion*. This enables them to break (yield) barriers, soaring high, and making super-yields possible.

Soil organisms are the key to such remarkable performance. It is well-established that they can:

- Expand the volume of soil to which roots have access, by orders of magnitude -- through mycorrhizal fungi which cannot survive in flooded soil,
- Fix nitrogen, solubilize phosphorus, and increase micronutrient availability -- through various kinds of microbial activity,
- Speed up nutrient cycling -- as done by protozoa and nematodes which 'graze' microorganisms living on roots and in the root zone,
- Produce growth-promoting phytohormones -- which can

enlarge both roots and shoots, and

- Confer induced systemic resistance (ISR) – when the presence of microorganisms enables plants to resist damage done by pests and pathogens.

Some of these processes are well-known and well-documented in the literature; others, such as ISR, are not well understood though well established and require much more study. Enough is known in the scientific literature, however, so that we can see how these various biological factors (microbiological and ecological) could help to explain, when the conditions are supportive, the remarkable reported performances of some SRI plants and some SRI crops (Randriamiharisoa et al., 2006).

Large variations in SRI results should not be surprising, given that they depend upon biological factors and dynamics, rather than upon the genetic expression of a given 'blueprint' for growth, or on yield increases strictly proportional to the external inputs provided.

The capacity of the soil biota to greatly accelerate the growth of plant roots, shoots and panicles depends, first, upon *pre-existing endowments* of soil biodiversity, and then, upon many *interactive processes* of soil humidity, aeration, temperature, carbon supply, micronutrient availability, N fixation, nutrient cycling, etc. which relate as cause and effect to the *proliferation and functioning* of

all kinds of organisms, from invisible microbes (bacteria, fungi, actinomycetes, protozoa, etc.) all the way up to mites, ants, earthworms and other humble but superabundant animals in the soil habitat.

When all of these actors and processes in the soil are 'in sync' and in turn are operating symbiotically with plants, most directly through their roots but also in their leaves, we can get much greater crop productivity than imagined when plants are regarded as little self-contained machines, which we design (or redesign) and which we 'fuel' with our inputs, to get them to perform as we desire. That soil organisms (rhizobia) even inhabit rice plant *leaves*, enhancing their chlorophyll levels and rate of photosynthesis, ultimately increasing grain yield by 10-36% (Feng et al., 2006), should make everyone more open to two ideas:

1. there are still important things in this world that we do not yet fully know and understand, and
2. agriculture needs to be understood and pursued with greater appreciation of its biological dimensions, not focusing primarily on engineering and chemical solutions. SRI is not a technology but a set of ideas and principles that should help us advance both science and practice.

Norman Uphoff is Program Leader for Sustainable Rice Systems, Cornell International Institute for Food, Agriculture and Development (CIIFAD)



SRI: Perceptions and Suggestions

Dr. V. Vinod Goud

In recent years System of Rice Intensification (SRI) has grown as one of the important agricultural interventions, attracting attention of farming community. It is spreading in the country but its area of cultivation is not as significant as one would expect considering the benefits that SRI method offer to farmers. It is important to understand the reasons and take measures so that the area under SRI will reach to significant levels in next five years or so. The two dimensions, viz., a) some farmers who have adopted with great enthusiasm seem to be not continuing b) the area under SRI is not improving in the areas it has been introduced initially, even though new farmers are trying in the same place and in other places. This requires a very critical look at some ground realities which will help in promoting SRI in a strategic way. And this is the main objective of this

article. The debate is not about merits of SRI. The method has proved its potential beyond doubt and that is not for debate here.

For example the state of Andhra Pradesh is one of the states where SRI was introduced and great results have been reported with very high yield increases. Many success stories have been reported, but still the aggregate area under SRI is not reaching to a significant level. Some farmers are able to continue the method and reap its benefits, some have adopted SRI for a season or two and have discontinued it, others appreciate the method but do not adopt it, and some want to know more about the methods but do not know whom to approach for details.

Some of the general perceptions and views mentioned below could explain why SRI is not being adopted

on a large scale. Some of these views might not be correct or proved with data. That is not the point; it is essential to consider these views instead of judging them. Also, there will never be one view on each of these issues mentioned below, especially in case of a new method like SRI, which is radically different from the conventional practice of rice cultivation.

- **It is not a Seed:** Until now, developing high-yielding seeds has largely if not entirely driven agriculture research. Once scientists develop new and improved seed varieties after field trials, they release these to farmers. Generally farmers have come to look towards agriculture research for providing new and more suitable seeds as the solution to their problems. Therefore, seed has become



central to the interaction between agriculture researchers and farmers. Governments start promoting such seeds through extension, mass media and even subsidies. The private seed companies have a vested interest in promoting high-yielding seed varieties. Unfortunately SRI is not a seed-based improvement but a skill-based agronomic intervention. So, the skill-oriented SRI method needs a different strategy to promote it.



- **Research, extension and tools gap:** SRI method has caught up faster among some farmers before researchers took notice of it. Enterprising farmers started adopting the method fairly early, inspired by television channels and other media. They addressed problems such as marking the fields for transplanting young seedlings at wide spacing and weeding operations by inventing markers and weeders with the help of local fabricators. While local agricultural extension staff and research stations watched the success of the method on farmers' fields with dismay, farmers have gained knowledge on the principles and practice of SRI methods. This created a kind of artificial gap between the two. Some agricultural extension staff and researchers could not easily accept this situation and started resenting helping new farmers who want to adopt SRI methods.
- **Lack of trained workers:** SRI methodology involves a set of simple practices which rice

farmers have never heard or seen before. The conventional methods of rice cultivation have been deeply entrenched in the minds of farmers, labourers, officials, and others, which further hinder SRI adoption. As farmers cannot learn or get guidance on this new method from their peers, they hesitate to try the method. For some labourers, transplanting young single seedlings and removing weeds with implements is unthinkable, so they either refuse or do not cooperate with their employers in efficiently carrying out the operations. Agriculture Department staff can neither say much for or against, as they are not trained on SRI methods. The support systems like seed, fertilizer and pesticide companies and market agents who are important players in the conventional method of rice cultivation have no or rather minimal roles in promoting the method given that the recommendation with SRI methods is less seed, more FYM application, and less pesticide use due to low pest incidence.

- **Confidence building and re-assurance:** For many, the psychology and attitude of farmers has also been a major deterrent. Farmers generally will venture into something new after seeing it elsewhere or seeing neighbouring farmers successfully doing it. But SRI farmers often face ridicule from their neighbouring farmers, especially after transplanting one-week-old seedlings takes more than a month to fully cover the field. Planting one-week old seedlings at wider spacing is unimaginable. No one appreciates SRI fields during this initial period, as conventional fields look lush green from the next day of transplanting, whereas SRI fields look more or less empty with sparsely spread out small seedlings. In fact, this is the most critical period for someone who is doing SRI method for the first time to withstand pressure from neighbouring farmers or from their own family.
- **There is also a role reversal:** In conventional method, trans-



planting is entirely done by women who generally take pride for skilful execution of the operation. In SRI method, there is interference of men in marking the lines and constantly supervising the women with all kinds of instructions to ensure that they plant at the right place and as per the recommendations. Weeding is another operation where women's role is replaced by men. SRI recommends weeding with a rotary weeder to stir the soil in the interspaces near plant roots and in-situ incorporation of weeds into the soil. It is a physical labour-intensive method, and for cultural reasons male farmers generally take over the weeding. This affects the men's psyche, as generally weeding is something "looked down upon" and regarded as women's work traditionally. These reasons, although they may not appear as major issues, do affect the spread of SRI method in some communities in subtle ways by affecting the psyches of both

genders, which can create deterrents to change.

- **Perception accuracy:** The accuracy required in executing the recommended practices of SRI impacts on the success of SRI adoption. Any singly mistake during any single operation will result to low yields. This fact often discourages farmers to continue with SRI method.
- **Weeding problems:** As weeds grow profusely in the interspaces often weeding, the SRI fields is

seen as a major problem. Many farmers get discouraged to go for SRI method for fear of weeding woes. Those farmers who take up SRI method for the first time are petrified if guidance is not available on time. But initially though it appears quite laborious, gradually as the labour acquires the experience to run the weeder in a thin film of water soon they get used to it. Many farmers are able to get over this problem and successfully manage weeds in their fields. Though still a good weeder suitable for all soils is desired, farmers have selected an appropriate one from the existing models designed and marketed by farmers and Acharya N.G. Ranga Agricultural University. Most farmers reported that the Cono weeder is not suitable for heavy soils. The Star and Mandava weeders are reported to be of good use in many soils.

- **Water management is complex:** Alternate wetting and drying



requires a well-levelled field to ensure spread of water throughout the plot to wet it uniformly. So, land levelling is another important aspect for rice cultivation under SRI method.

So far the experience of Andhra Pradesh has been that adoption of SRI method may not be possible in delta areas during the kharif season as the alternate wetting and drying cannot be ensured due to poor drainage leading to continuous water logging and seepage from the neighbouring fields. Besides, release of water through distributaries by the Irrigation officials not coinciding with individual SRI farmers' requirements is also a problem. The intermittent monsoon rains further aggravate poor drainage. Many delta region farmers reported good yields under SRI method in the rabi season. Whereas SRI method is found to be performing well in the upland areas like Telangana and Rayalaseema during the kharif season, the performance was not as successful in the Rabi season due to water stress. However, in 2005, SRI rice fields were spoiled in Telangana areas due to the continuous down pour. So good drainage is another critical factor for the success of SRI method.

Despite constraints, SRI method is quite popular among many farmers and continues to attract the new farmers every year. The method has to be promoted on a large scale in the interest of increasing food security and conserving the depleting and degrading ground



water and eco system. In spite of these reported and perceived problems, more and more farmers are attempting SRI. That is the interesting part of this method. The attention should be towards developing deeper understanding of these issues and provide solution sot these issues. That should be the priority of these organizations working to promote SRI. Government institutions and policy makers have greater role in systematic analysis of the issue and providing enabling policy environment to take full benefit of SRI method.

Following are some suggestions to help the Government, farmers, and civil society and others to work together in evolving those appropriate policies and mechanisms.

- **Training and skill development:** SRI is a skill-based method. Generating awareness and conducting trainings for all interested farmers is important.

Adequate extension material has to be produced and training kits has to be sent to all the Grampanchayats. The agriculture extension staff should be trained in SRI method, with incentives announced for those who motivate large number of farmer to adopt SRI. Experienced SRI farmers should be provided with extension kits and a panel of such farmer resource persons to be made available district-wise to meet the huge demand of reaching to all rice farmers. They should also be given some incentives besides meeting their basic requirements for travelling and conducting trainings. Resources should be allocated for facilitating farmers to farmer field visit exchanges.

- **Role of seed companies:** The Seed Corporation and other private seed companies should sell seeds in two kilograms bags unlike the present practice of

(Contd. on page 19)

Impact of cost of cultivation and mechanization on paddy cultivation

Dr. Biksham Gujja

Farmers are starting to reduce their costs of cultivation by employing mechanical harvesters. Will this continue to other operations such as transplanting and weeding? What would be the implications for SRI?

Mechanization of certain agricultural operations is rapidly happening in many parts of India. Labour shortage is reported to be the prime reason. There are other contributing factors like the National Rural Employment Guarantee Scheme (NREGS), seasonal migration to cities in search of higher

wages, and the younger generation's disinterest to work in the fields, and also others. Experts are analyzing this, but already we can consider the cost of cultivation and its implications for SRI now and in future. The cost of cultivation varies from year to year and place to place. Based on interactions with five farmers, the data presented in the table below gives an idea on the cost of cultivation (per acre) in the region of Nalgonda and Warangal districts,

calculated on a per acre basis since this is a unit that farmers are familiar with. Sometimes the data has been converted to hectares for easy reference and understanding.

Some observations

- The cost of cultivation per acre ranges from Rs.11,090 to Rs. 13,880, or from Rs. 35,000 to Rs. 28,000 per hectare (\$780 to \$620 @ Rs.45/\$1).
- Farmers can save Rs. 1600 to Rs. 2000 by engaging a harvester which is a very new intervention in the region. Within one year, most of the traditional harvesting practice has been replaced by harvestors.





| Serial No. | Component | Farmer 1 | Farmer 2 | Farmer 3 | Farmer 4 | Farmer 5 |
|--------------------|---|---------------|---------------|---------------|---------------|---------------|
| A. | Seeds (40 kg) | 600 | 600 | 600 | 400 | 400 |
| B. | Land preparation | | | | 3,500 | 3,500 |
| | Ploughing (4 times @Rs. 625 each) | 2,500 | 2,500 | 2,500 | | |
| | Land leveling (one time) | 360 | 360 | 360 | | |
| C. | Nursery | | | | | |
| | Bed preparation | 250 | 250 | 250 | | |
| | Raising seedlings | 80 | 80 | 80 | | |
| | Uprooting nursery (5 Labourers @ Rs. 80) | 400 | 400 | 400 | | |
| D. | Transplanting (12 Labourers @Rs. 80) | 960 | 960 | 960 | 1,000 | 1,000 |
| E. | Weeding (Total 22 persons @ Rs. 80 each, two times) | 1,760 | 1,760 | 1,760 | 2,500 | 2,500 |
| F. | Fertilizers and pesticides DAP 75 kg, Rs. 750; Urea 100 kg, Rs. 500; Potash 50kg, Rs. 250; labour Rs. 100 | 1,600 | 1,600 | 1,600 | 1,400 | 1,400 |
| G. | Pest Management Endo sulfon - 1 Liter, Rs. 300; M45-1/2 kg, Rs. 200; labour Rs. 230 | 730 | 730 | 730 | | |
| H. | Harvesting | | | | | |
| | Without Harvester | | | | 4,500 | |
| | Cutting (26 labourers @ Rs. 80) | 2,080 | | | | |
| | Thrashing (6 labourers @ Rs. 80) | 480 | | | | |
| | Cleaning & Keeping (4 labourers @ Rs.80) | 320 | | | | |
| | Transport | 350 | 350 | 200 | | |
| | With Harvester | | | | | |
| | Harvesting, thrashing and cleaning charges for harvester | | 1500 | 2000 | | |
| I. | Miscellaneous | | | | 500 | 500 |
| Total (Rs.) | | 12,470 | 11,090 | 11,440 | 13,800 | 11,300 |

- The total labour days required (person-days to work in the field, excluding the farmer) without harvester for paddy cultivation is around 86-95 or a maximum of 100. This includes the traditional way of harvesting which is estimated to require 40-45 labour days. Harvesting represents about 50% of the total labor requirement for paddy.
- Total wage component @ Rs.80/ day/person is around Rs. 7,600 to Rs. 8,000.
- By engaging the harvester, farmers can save Rs. 3,600 toward wages, but will have to spend Rs. 1600- Rs.2000 on the machine
- In a good season, production in this region is around of 35-32 bags. Each bag weighs 70kg, so yield is 6.1 to 5.5 t ha⁻¹, which is higher than the district average of 3.6 to 5.1 t ha⁻¹ over the last five years.

- At an average of 32 bags per acre (5.5 t ha⁻¹), with the minimum support price around Rs. 900/100 kg this year), a farmer may get a gross income of Rs. 20,000. After deducting all the expenses, the net income could be around Rs. 5000 per acre (without engaging the harvester). This excludes labor inputs by the farmer and his family and the cost of electricity, etc. When engaging a harvester, this net income per acre might go up to Rs. 6,500 (Rs. 16,000, or \$360, per hectare).

Implications on SRI

Farmers' perception is that SRI requires more labour and demands more of his/her time and attention. This seems to be the first impression of farmers looking at the SRI practices. It is different than what they are usually accustomed to doing. That may be the case initially, but later labor requirements might gradually be reduced as farmers gain skill and confidence from experience. But transplanting single young seedlings, marking the field for

precise spacing, leveling it, and weeding all certainly appear labour-intensive. Right now, many farmers are confronted with issues of labour availability and finding skilled persons. Even though there is possibility of recovering the cost from an increase in production, farmers need the cash and people on time. So, this is an issue more of availability of skilled and motivated labor than of shortage per se. In the conventional system of cultivation, there is more flexibility of time, as farmers can transplant over a period of time, and weeding can be casual. This matter of flexibility is a crucial issue to farmers.

Mechanization of rice cultivation in transplanting and weeding

Farmers think that the next level of support for SRI has to come from mechanization of the most crucial operations -- transplanting and weeding. Already several prototypes of such implements are being developed to meet this growing demand. This will have huge implications for SRI. It is difficult

to predict the future speed and the extent of mechanization. But farmers are expecting that such tools will accelerate the process of SRI considerably. For instance, farmers are ready to adopt SRI in large scale if machines can transplant single young seedling at precise distances. However, the implications of such mechanization must be discussed and debated. On the other hand, we see that in the area of rice harvesting, for instance, mechanization is happening apace and may be irreversible process.

Mechanization of transplanting and harvesting operations could reduce the labor requirement by more than 60-70 % in rice cultivation. This might not so much reduce the cost of the operations as make the operations more timely. Farmer may plan to practice SRI and then implement it in a timely way. Not just cost, but also timely nature of operations is involved in SRI. The cost reduction of transplanting may not be possible through the machines. The current cost of engaging labor for transplanting is about Rs. 1500 and for weeding between Rs. 1800 to Rs. 2500.

Mechanization and agricultural labor

It is difficult to estimate the impact of mechanization on agricultural labor and wages, but to understand the likely implication of such mechanization, we have considered Nalgonda district for analysis.

The total area under paddy cultivation in Nalgonda district was about 311,000 ha in 2005-06. In





the year 2003-04, the figure had fallen to 123,000 ha due to bad monsoon, leading to water shortage and ground-water depletion. The total labour days (persons required to complete the operations) could be around 67 million person-days (for 311,000 ha with 215 days per ha). The wages would be Rs.5,360 million (Rs. 536 crores @ Rs. 80 per day) in the peak year of production. This could be as low as 26 million person days or Rs. 2,100 million (Rs. 210 crores).



At Andhra Pradesh state level, with similar assumptions, currently rice cultivation provides employment for 870 million person-days with Rs. 7,000 crores of wages. This is without any mechanization. With mechanization, this can be reduced significantly. Through harvest operations alone, the reduction in wages could be as high as Rs. 3,000 crores. However, these are very broad estimates, assuming that all the area, 3,982,000 ha in AP, is harvested through machines.

There are about 671,000 agricultural workers reported to be in Nalgonda district. During the peak year of paddy cultivation, each worker will get an average of about 100 days of work in the paddy field, and this could be 40 days in a lean year of cultivation. Mechanization could further reduce this to 40 days in the peak season and less than 10 days in a low year.

- Each hectare requires 215 person-days based on the data presented in the table,
- All the people will be working in rice cultivation, etc. This will give a broad idea of labor requirements and employment creation associated with rice cultivation. It is difficult to estimate the implications of mechanization of rice cultivation on labor both in the short term and long term.

However, several assumptions have been made here, such as

Mechanization and SRI

Farmers everywhere are reporting the lack of mechanization of transplantation and weeding is a major constraint. Today, farmers are spending about Rs. 3,500 per acre on both operations (which equals to Rs. 8,750 per ha). However, the harvesters seem to have reduced the cost of the cultivation significantly, indicating possibility of large-scale mechanization of remaining operations of transplanting and weeding for rice cultivation in the future. But if mechanisation of agricultural operations in India is to be sustained, the machines have to not only cost less but also be more efficient. SRI might not be the cause of mechanisation, but it might take the mechanisation to a different level. It appears that mechanisation and further spread of SRI are to some extent linked.



Dr. Biksham Gujja is Senior Policy Advisor, Freshwater Programme, WWF-International, and Project Leader, WWF-ICRISAT Project on Water Productivity.

Research on System of Rice Intensification

Initial Experiences

SRI Group

Directorate of Rice Research, Rajendranagar, Hyderabad

Interestingly, SRI is extension driven and not much research work has been done so far. So while SRI is extensively promoted, there is a need for a more extensive and systematic research to substantiate claims made on the advantages of SRI. In this aspect, preliminary trial on SRI was conducted at Directorate of Rice Research (DRR) with ten genotypes which were evaluated under 4 methods of crop establishment viz., SRI with young seedlings, SRI with older seedlings, Integrated Crop Management (ICM) and conventional method. The

While SRI is extensively promoted there is a need for a more extensive and systematic research to substantiate claims made on the advantages of the method. In this article, we bring certain observations and results of the preliminary trial conducted on SRI by the Directorate of Rice Research (DRR), Rajendranagar, Hyderabad.

varieties responded differently to SRI method. Hybrids performed exceedingly well under SRI. There were 46 to 47 percent yield advantages. Pusa Basmati variety did not do well under SRI and 35 percent yield reduction was noticed. SRI cultivation with 25 days old seedling and normal planting with wider spacing did not show any advantage over SRI thus indicating the importance of younger seedlings for planting. Results indicated that SRI with young seedlings gave 15 – 20 percent higher yield than the traditional method.





Shoot and root oven dry weight (g m³), root length density (m m³) in top 30cm soil profile at vegetative growth stage,

| Treatment | Shoot weight (g m ³) | | | | Root weight (g m ³) | | | | Root length density (m m ³) | | | |
|-----------|---|---------|-------|--------------------|---|---------|-------|--------------------|---|---------|-------|---------------------|
| | MTU | | | | MTU | | | | MT | | | |
| | 1010 | Shanthi | DRRH2 | Mean | 1010 | Shanthi | DRRH2 | Mean | 1010 | Shanthi | DRRH2 | Mean |
| ECO | 303 | 522 | 491 | 439 | 145 | 229 | 287 | 220 | 2483 | 2902 | 5356 | 3580 |
| SRI | 538 | 675 | 711 | 641 | 303 | 316 | 436 | 352 | 6604 | 5826 | 10029 | 7486 |
| CONT | 599 | 636 | 466 | 567 | 253 | 257 | 217 | 242 | 4733 | 6416 | 3799 | 4983 |
| SE± | 102.3 ^{NS} (100.4) ^{NS} | | | 58.0 ^{NS} | 56.6 ^{NS} (46.2) ^{NS} | | | 26.7 ^{NS} | 1395.2*(987.0)* | | | 569.8 ^{NS} |
| Mean | 480 | 611 | 556 | | 234 | 267 | 313 | | 4606 | 5048 | 6394 | |

*= Statistically significant at 0.05, NS= Not significant

SE in parentheses is to compare means within same treatment.

During *khari* 2005, 40 high yielding and popular cultivars were evaluated for yield performance under SRI and normal transplanting with similar fertilizer management conditions. The results revealed that grain yields were better under SRI. However significant varietal differences were observed. The interaction between the methods and varieties were also significant indicating varietal response differed under SRI. The top 10 cultivars with respect to grain yield under SRI were Sheshadri (6.3 t/ha), KRH-2 (5.76 t/ha), HRI 126 (5.57 t/ha), PHB 71 (5.5 t/ha), NDR 359 (5.44 t/ha), Pant Dhan-4 (5.29 t/ha), CORH-2(5.24 t/ha), PSD-1 (5.2 t/ha), Jaya (4.9 t/ha) and Gurjari (4.82 t/ha). Among the varieties, yield advantage in terms of percent gain in grain yield under SRI over normal transplanting was the highest for BPT 17111(146%) followed by BPT 5204 (138%), NLR 37654 (118%), NLR 145 (97%), Jaya (89%), Swarna (85%), Pusa Basmati 1(80%), DL183(79%), Giri (77%), White Ponni (63%) and Sheshadri (57%). In all, about 50 percent of the cultivars showed

more than 40 percent yield gain. It was observed that top yielders in conventional methods are not always superior under SRI. Thus there existed a wide variability in response to SRI cultivation among rice genotypes.

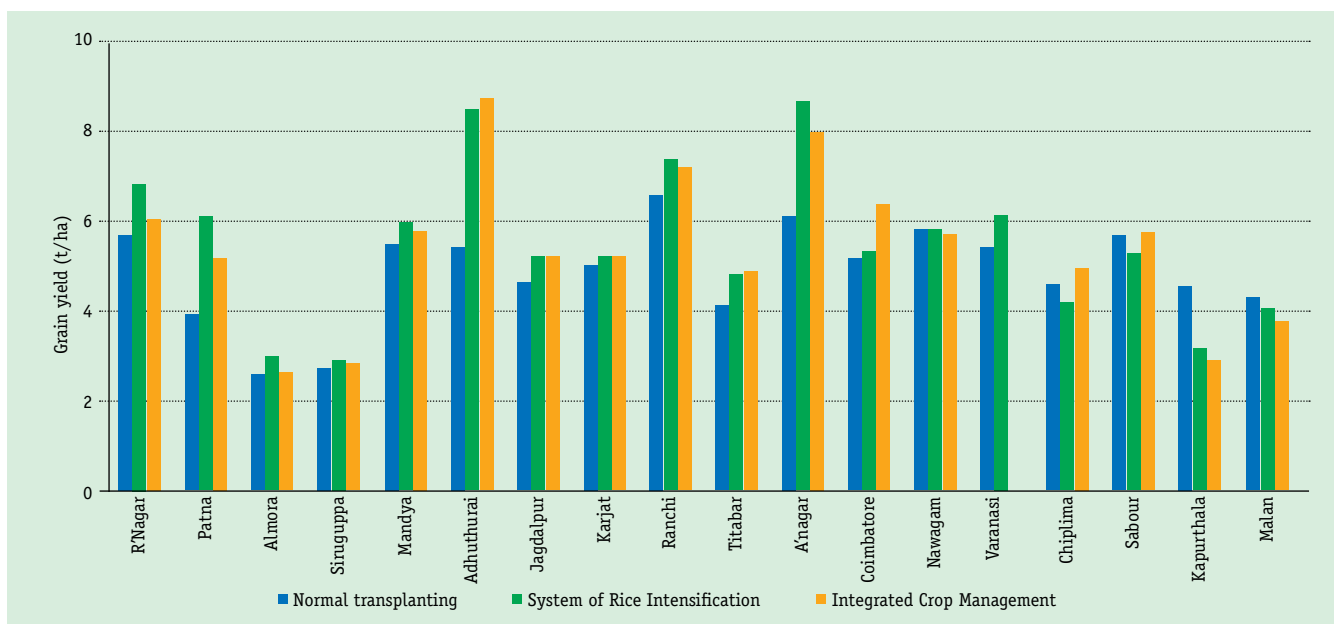
Insect and pest incidence observations that began after one month of planting revealed presence of Whorl Maggot, Rice Hispa, Yellow Stem Borer, Leaf Folder, Green Leaf Hopper and Leaf Mite. Low incidence of Leaf Folder, Whorl Maggot, Hispa. Green Leaf Hopper was seen at the tillering stage. Incidence of Leaf Mite was severe in *Swarna* variety grown under SRI method in *Rabi* season. Stem Borer incidence was found at low to medium level in both vegetative and flowering stages in both the seasons. Maximum percent white ears were recorded in Pusa Basmati 1 (20.3%) followed by KRH2 (17.7%) and Rasi (14.2%). Minimum damage was recorded in PHB 71 (2.0%) and Jaya (5.9%).

The shoot and root dry mass measured at different plant growth stages were similar across treatments

and the three cultivars. Shanthi had the biggest shoot mass and DRRH2 had the biggest root mass and root-length density and these differences were statistically non-significant. Of the two systems of crop husbandry – normal flood rice, SRI Rice and SRI Rice without fertilizers and pesticides (called Eco-SRI), the plots of the SRI Rice had biggest shoot mass, root mass and root-length density. For the root-length density interactions between cultivars and the crop-husbandry systems were statistically significant. The cultivar differences in root mass and root-length density are almost absent but the differences are largely due to the crop husbandry systems which are statistically significant. SRI plots have biggest root mass and root-length density. It will be interesting to note if the differences persist when calculated on dry mass basis.

Multilocation trials on SRI were conducted during the wet season in the year 2004-2005 at 21 locations viz., ARI Rajendranagar, Aduthurai, Almora, Arundhatinagar, Chiplima, Coimba-tore, Jagdalpur, Karimgunj,

Average grain yield recorded at different locations under three methods of crop management



Karjat, Kapurthala, Malan Mandya, Nawa-gam, Patna, Pantnagar, Pondicherry, Ranchi, Sabour, Siriguppa, Titabar, Umiam and Varanasi.

SRI method was distinctly superior to all other methods at 3 locations (ARI Rajendranagar, Patna and Almora) At 11 locations (Aduthurai, Arundhatinagar, Jagdalpur, Karjat, Mandya, Ranchi, Siriguppa, Titabar Rajendranagar, Patna and Almora) SRI gave higher yield (7-42%) as

compared to normal transplanting with a mean advantage of about 12%. ICM was better than SRI at Coimbatore and Aduthurai. Normal transplanting was found to be superior to SRI at Kapurthala and Malan. The hybrid KRH-2 performed better than the varieties under SRI method. ICM and SRI were on par at Mandya, Ranchi, Karjat and Jagdalpur (see graph). Increased yield in SRI was attributed mainly to increased panicle number and panicle weight per unit area.

Performance of SRI was better in clay loam soils than in sandy loam soils. Response to SRI was better in acidic soils (pH 5.4 – 6.5) as compared to alkaline soils (pH 7.5 to 8.1). Across the locations, SRI method recorded better yields (5.47 t/ha) than ICM (5.36 t/ha) and conventional method (4.89 t/ha).

Thus, preliminary results have indicated that this novel method has a potential to face the challenges of water crisis that threaten the rice cultivation. It may become a mantra to “produce more rice with less water”. Further, research is needed to augment the technology dissemination efforts so that the method becomes popular in the country to enhance rice productivity and production at greater pace with reduced inputs.



Dr. R. M. Kumar, K.Surekha, Ch. Padmavathi, L.V. Subba Rao, V .Ravindra Babu, S.P.Singh and B.C. Viraktamath from the SRI Group, Directorate of Rice Research, Rajendranagar, Hyderabad.



SRI: Perceptions and Suggestions

(Contd. on page 11)

selling in 30-kilogram bags because the requirement for SRI method is only two kilograms per acre.

- **Implements** like marker and weeder production and distribution should be decentralised to reduce costs as well as for easy accessibility.
- Establish a separate Extension Service Centres at the district level to guide and promote SRI method.
- Establish a state-level Authority consisting of the members from the line departments, the research institutes, NGOs and few SRI farmers from three geographic regions to promote water-saving methods like SRI. The Authority should supervise the implementation of all these new policies and strategies.
- The Agriculture Department, the university and Directorate of Rice Research (DRR) should initiate a systematic research to collect data, experiment, and improve the practices in the method.
- Some funds may be made available to enterprising farmers to conduct their own research



and come out with suggestions to other farmers.

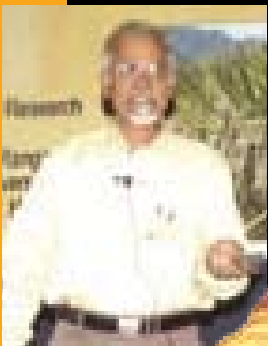
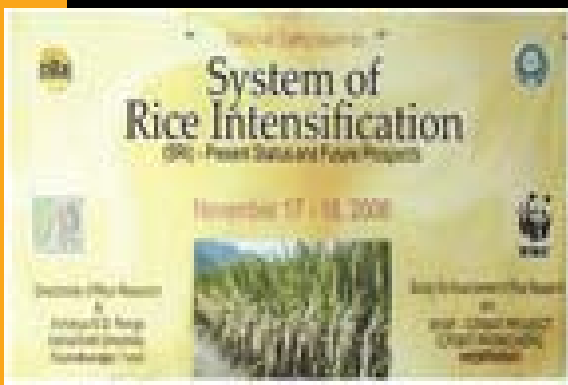
- Promote campaigning on mass media like newspapers, TV channels and video films, etc., with stories of the farmers who are successfully practicing and who can help other farmers as resource persons.
- In the canal irrigation areas, it is possible to introduce SRI method in the entire area falling under a distributary to plan water releases commonly for all in time to follow SRI practices. If some one is not adopting SRI, they have to pay double water charges, and the money thus collected should go for the repair of the canals or common works.
- SRI method is favourable to pump set irrigation. Already in the state, the ground water irrigated rice is more than canal-irrigated rice. So, the

Government, since it is extending free power, can start with a policy of free power to SRI farmers for the next five years in both kharif and rabi seasons beginning from the ensuing kharif season.

The above-suggested measures need special allocation of funds. If the Government is committed to promoting water-saving methods in the state, it should allocate adequate money to promote SRI methods and conduct research in a systematic way by involving the civil society, scientists and independent experts. In fact, scaling up SRI presents a great opportunity to get everyone together to work towards achieving food security, conserving water resources and ecosystem integrity.

*Dr. V. Vinod Goud
is Project Coordinator,
ICRISAT-WWF Project, ICRISAT,
Patancheru, Hyderabad.*

Glimpses of the First National Symposium on SRI 2006



Glimpses of the Second National Symposium on SRI 2007



Possibilities to reduce the drudgery of weeder operation in SRI

Dr. T.M. Thiyagarajan

Surveys across many SRI farmers have shown that drudgery in using the weeder is one major problem. But it is also true that small and marginal farmers realize the immense benefit of the weeder as their family labour is sufficient for the work, and they don't have to wait for contract labourers.

One of the significant changes in rice cultivation brought about by SRI is the use of mechanical hand weeders, making passes in perpendicular directions between plants that are growing in a square pattern. Simple mechanization in weed control is attractive to farmers who face labour shortages at the time of hand weeding. Although the implement is referred to as a 'weeder', because it was introduced to eliminate weeds when row planting was introduced, the purpose and effect of using the weeder has new dimensions with SRI. It is more appropriate to call this operation 'intercultivation with weeder' than to name it 'weeding' as such.



Dr. Biksham Gujja (second from right) discussing with farmers the operations of intercultivation with weeder machines

Studies conducted by Tamil Nadu Agricultural University have shown that among the SRI principles, a major impact on grain yield is brought about by the intercultivation, which achieves greater soil-surface aeration than other methods of weed control. If this intercultivation is not done while the other principles are followed, one should not expect the same degree of success as can be achieved with a full and proper use of the recommended methods.

The wider spacing and square planting that are fundamental in SRI, so that plant roots and canopy have room to grow in all directions leading to very different and more productive rice plant, permits use the weeder between the hills in both directions. Two types of weeders were initially introduced for weed control with soil aeration under SRI, viz., Cono Weeder and rotary weeder. The former is heavier than the later and thus can be used only by male labourers.

Surveys across many SRI farmers have shown that drudgery in using the weeder is one major problem. This is understandable if one labourer has to do the entire operation because with 25 x 25 cm



spacing creating four rows per meter width, to weed/aerate 1 hectare, he has to walk 40 km to cover one direction. But it is also true that small and marginal farmers realize the immense benefit of the weeder as their family labour is sufficient for the work, and they don't have to wait for contract labourers. Some SRI farmers are using the weeder in one direction only as a second-best solution. Many men and women say that they prefer using a mechanical weeder to hand labor because it does not require stressful bending over all the time and they like to work in an upright position.

The following are suggestions for reducing the difficulty of weeder use:

- Modify the weeder with ball bearings as done by one Andhra Pradesh farmer to reduce friction and make the operation easier, or have a wooden handle put on the weeder (especially a rotary weeder) to reduce the weight of the implement.
- Instead of using the weeder in both the directions at 10-day intervals, use it in one direction for the first time, and then in the perpendicular direction after

seven days, repeating this process and spreading the labour in a more even pattern.

- For some soils, depending upon the clay content, choose a weeder design (or modify a current design) to suit the conditions.
- Organize and train a team of (say 10) labourers can do the weeding in a village very efficiently and expertly under contract.
- Once farmers have confidence that additional weedings add to crop yield and know how profitable these can be, offer expert weeders a higher daily wage to reward their higher skill level and share some of the gains in productivity.
- Design and build (or if available in the market, buy) a motorized weeder. It should be possible, for example, to produce a weeder implement to be mounted on a two-wheel tractor (e.g., Kubota). Various attempts to create motorized weeders have been initiated by farmers and some entrepreneurs, but a higher efficient, not too costly model remains to be designed. Once good motorized weeders are available at an affordable price, the scaling up of SRI should raise exponentially.

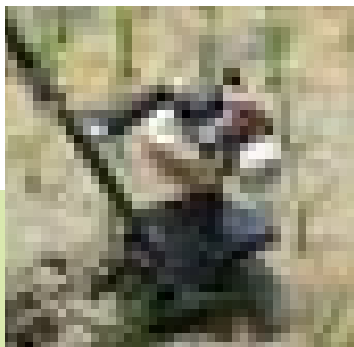
Agricultural engineers are already working hard to develop a powered weeder suitable for SRI at Tamil Nadu Agricultural University and Acharya N.G. Ranga Agricultural

Many a farmers, realizing the benefits of intercultivation have begun to reduce labor required for this operation by modifying the weeder design or materials or by motorizing it.

It can be expected that within a few years there will better, more energy-efficient implements to use for weed control-cum soil aeration.

University. The present options are:

- A battery-operated weeder first developed at TNAU. This has not been found very useful due to



A number of videos are available on the web showing the use of mechanical weeders:

- <http://in.youtube.com/watch?v=p-B558kWU0k> (Lakshmi Power Weeders LAP 201)
- <http://in.youtube.com/watch?v=KDENdr8QiuM> (motorized weeder, ANGRAU)
- <http://in.youtube.com/watch?v=tLF1kmEEH0o> (motorized weeder, ANGRAU)
- <http://in.youtube.com/watch?v=xWJDVIEeSmU> (4-row pulling weeder, Sukshethram)

the need for re-charging the batter several times to cover 1 ha. Engineers are trying to modify this design.

- ANGRAU has developed one motorized weeder which is promising, but is still rather heavy to be used on muddy soils.
- A motorized weeder is already been developed along with a Chinese transplanter (CAGRI). The author has seen this weeder in operation. It requires some simple modifications for SRI. The cost is Rs.20,000, and it consumes 5 liters of petrol per acre for use in one direction. (Contact: Rajalakshmi Implements, Chennai. Mobile: 91 94437 16507)
- If community SRI is adopted, a power-operated weeder could be handy and the shared cost would not be excessive. Cooperation and coordination would be needed for sharing the implements among farmers

Many a farmers, realizing the benefits of intercultivation, which if done more than the minimum of two times can add 1 to 3 tons per hectare to yield, through mobilization of services from aerobic soil organisms, have begun to reduce labor required for this operation, by modifying the weeder design or materials or by motorizing it. It can be expected that within a few years there will better, more energy-efficient implements to use for weed control-cum-soil aeration.

Whenever his farmer friends ask him to explain SRI briefly, he tells them that it is like a two-wheeler motorcycle which gives more mileage under ideal conditions such as the fitness of the bike, ideal air-pressure of the tyres, condition of the road, wind direction and so on, explains 50-year-old

farmer V.K.V Ravichandran

from Tiruvarur in Tamil Nadu, who has dedicated his entire 60 acres to SRI cultivation.



Ravichandran has been farming for more than two decades when he took to SRI in 2003. Such is his faith in SRI that he has committed all 60 acres of his farmland to this method of rice cultivation. As seen in the table, he has given a season-wise listing of acreage under SRI paddy.

| Year | Season | Acres |
|------|---------|-------|
| 2003 | Samba | 55.20 |
| 2004 | Samba | 55.50 |
| 2005 | Samba | 60.70 |
| 2006 | Samba | 60.70 |
| 2007 | Kuruvai | 10.00 |
| 2007 | Samba | 40.15 |
| 2007 | Thaladi | 10.00 |
| 2008 | Kuruvai | 12.00 |
| 2008 | Samba | 38.25 |
| 2008 | Thaladi | 12.00 |

“To get best results from SRI follow all the practices as laid down”

With a B.Sc. in mathematics, farmer Ravichandran heads a family of four and hails from a family of agriculturists. A keen observer, he notes that, “some important features such as transplanting young seedlings, wider spacing, controlled irrigation and application of rotary weeder were some of the practices followed in our village by my uncle, Farmer V.K. Janakiraman way back in 1970. But these practices were not carried out in synergy and were eventually given up in spite of the benefits as there were no scientific studies at that time!” He considers it a blessing for the farming fraternity that scientific interpretations are now been given for each component of SRI, thus convincing more farmers about its benefits.

If farmers are to attain most success with SRI, Ravichandran says, they must provide ideal conditions, and for this they must plan well in advance. He adds that “as rightly pointed out by Norman Uphoff, SRI is an evolving system and a work in progress”.

Farmer Ravichandran was introduced to SRI by Tamil Nadu Agricultural University (TNAU) as Integrated Crop Management (ICM). He adopted SRI in 2003 and was given training and guidance by the TNAU, SRI group. For irrigation, he uses bore well water, as well as water from the river Kaveri. His field soil type is alluvial clay. He grows paddy

varieties like Kuruvai – TKM 9, CORH 1; Samba – CR1009; Thaladi – ADT 39 and Ponni. He uses cattle farmyard manure, DAP, and Urea.

Ascribing his success to the SRI practices, he highlights the following :

- Transplanting young seedlings of 14 – 18 days
- Careful planting of single seedlings
- Wide square pattern, 9 X 9 inch²
- Intermittent wetting and drying
- Frequent weeding

Farmer Ravichandran has been making ample use of implements, sometimes even modifying them when he feels that this would improve performance or aid in problem-solving. So, while he uses the rope-marker, Leaf-Colour Card (Pambu Palagai), and a type of plank for levelling the field, he has made ‘V’-shaped ridges on the Cono Weeder to create furrows that act as bunds and that protect his seedlings from water-damage. According to him, pest attacks are less with SRI method of rice cultivation.

However, according to Ravichandran, there still remains certain constraints in SRI adoption.

- Fragmented holdings: This makes intermittent wetting and drying difficult, as irrigating and draining in one field will depend on the next field belonging to another farmer.
- Single seedling transplantation



Comparative Table

| | Conventional | SRI | Notes |
|-----------------------------------|--|--|--|
| Seed Rate (Kg/ha) | 25 Kg | 3 - 3.5 Kg | |
| Grain Yield | 8 tonnes per ha | 11 tonnes per ha (2007 Kuruvai) | Both numbers are the best yields that he got under each method |
| Total cost of wages | Rs. 4,000 per acre | Rs. 2,500 per acre | Wages (men) – Rs. 120 and women – Rs. 60 |
| Number of labourers | 10 persons (plucking) 12 -15 women (weeding) | 1 woman (plucking) 7 men and 3-4 women (weeding) | For transplantation, the same number of 15 women for 1 acre is required. For harvesting, combine is used, but it cannot be said exactly whether it would be same for conventional and SRI |
| Number of tillers | 12-14 (10 productive) | 40-45 (35-40 productive) | Under SRI, number of tillers may even go up to 60 tillers |
| Water management | 3 motors are required to run for 12 hrs a day to maintain water level in 5 acres | 2 motors are required to run for 12 hrs a day to maintain moisture in 10 acres | The numbers given here are for 155- day crop. Thumb rule is that for producing 1 kg of paddy, 2,400 liters of water is needed under conventional, while 1,200 liters only are needed under SRI |
| Water management / Flooding level | 3 inches and more for 135-140 days, after which the field is left without irrigation so that the harvester can be run after 155 days | Mere moisture is maintained until the ear head stage after which water is gradually brought up to 3 inches | 155 day crop. He has found that in overall water usage there is a 60-70 % decrease under SRI. |



Based on his own experience farmer V.K.V. Ravichandran has provided useful list of 'Do's and Don'ts' on the SRI-India Google Groups site (<http://groups.google.com/group/sriindia> which are quoted verbatim below.

Selection of Season

Paddy is grown in wet land. The initial 15-25 days after the transplantation are very crucial. As young seedlings are transplanted with a spacing of 22.5 cms, if there are heavy rains, the tender plant will submerge and perish. The rice plant should establish well before the on set of monsoon. If the plant is protected in the initial 25 days, it can withstand heavy rains. So, plan in advance the time of sowing. Don't venture into SRI planting during monsoon."

Selection of paddy field for SRI planting

As mentioned earlier, the initial 15-25 days after transplanting are very crucial. If we flood the field, the transplanted seedling will perish, and the population reduces. On the other hand, if we allow the field to remain in just moist condition, weeds will establish faster before we start cono weeder operation. The challenge before us is how we are going to tackle the two conflicting situations. In many cases, the farmer's field is situated in the middle of other farmers' fields. This is due to the fragmented land holdings in our country. If so, the farmer has to irrigate and drain his field through the other farmer's fields, and hence he may not be able to irrigate or drain at his will. This will defeat his efforts to keep the field moist, which is one of the important requisites of SRI.

Do

- Select the field where there will be less incidence of weeds.
- Dry plough the field well in advance.
- Select a field with good drainage facilities. The SRI farmer must be able to drain the surplus water directly into the drainage channel.
- Prepare small drainage channels within the SRI field with a width of 30 cms and 15 cms deep, so that any water stagnating in patches anywhere in the field could

easily and automatically drain off.

- Start preparing the main field even before raising the nursery. At any cost, transplantation should not be delayed for want of well-prepared main field.
- The main field should be levelled like a table top.

Don't

- Select a field which has an uncontrollable weed problem.
- Select a field whose drainage and irrigation depends on another farmer's surrounding fields.
- Plough the field merely using the tractor cage wheel. Use a rotavator plough so that the field is reasonably levelled. Use a levelling plank in the main field.

Sowing strategy

I experienced some problems four years ago when I took up sowing five acres (10 kg of seed material) in a single day. I was constrained to take up planting five acres on the fourteenth day. Finally, I ended up transplanting older seedlings as the required number of trained workers could not be employed in a single day. To mitigate the problem, I started sowing 2 kg a day in a phased manner. I don't agree with those who say that SRI could not be taken up in a larger area. If one takes up sowing in a staggered and planned manner, even big farmers can adopt SRI in large area. Therefore

- Do plan the sowing of the nursery in a staggered manner depending on the availability of trained transplanting labourers.
- Do not sow a large volume of seed material on a single day. The farmer might end up undertaking transplantation of aged seedling for want of adequate trained labour.

Nitrogen management

Another important lesson that SRI has taught me is the management of Nitrogen (N). I have been applying N by way of Urea as per the general blanket recommendation for paddy in the SRI field. My SRI crop was severely affected by leaf-rollers, whereas the incidence of leaf-

cannot be practiced in low-lying areas. More research has to be done on making all tillers productive.

- If it rains within the first 15

days after transplantation, then there is not much hope for the seedling. Hence, selection of season is very important.

- Labour issue: Labourers exploit land-owners.
- Today, government pressure, target-fixing, and subsidy talks are common, and SRI cannot



rollers was very much less with the same amount of N per acre applied in the non-SRI field. I incidentally noticed green leaves with darker shades in my SRI field whereas the leaves were pale green with the same amount of N application in the non-SRI counterpart. I inferred that because of the profuse root formations in the SRI paddy with just mere moist conditions, the nutrients were absorbed almost entirely as there are more roots to feed through, besides leaching through water is very negligible. I understood that the nutrition uptake efficiency is much higher in SRI. I contacted the scientists at Tamil Nadu Rice Research Station [TNAU], Aduturai. They suggested using the Green Colour Card so that N could be applied at the appropriate time with the desired quantity.

Therefore, do reduce N application not only for cost reduction but also to avoid leaf-rollers. Use the Green Colour Card to provide the desired quantity of N at the right time. Do not apply N as per the general blanket recommended dose that is given for conventional planting method. Otherwise, damage due to leaf-roller attack will be severe.

I also suggest dipping of roots in bio-fertilizers and spraying water soluble fertilizers.

Ridger attachment to Cono Weeder

In the Cauvery Delta districts of Tamil Nadu, samba rice in the Rabi season is cultivated during August to January in wet land. The main growth period is expected to invariably coincide with the North East monsoon. Due to rain and flooding of the surrounding fields cultivated by other farmers, draining the SRI field and keeping it just moist is rather difficult at times. Many SRI farmers of this region have been facing the same problem. This is one of the reasons why many farmers of this region, who want to take up SRI are still reluctant and apprehensive about it.

In my SRI field, this samba season, the single young seedlings planted with wider inter-space in the low-lying areas were severely affected. Even a thin film of water

gets accumulated whereas seedlings planted in the rest of the field established well. I just tried earthing up a few rows with my hands in the low-lying area by forming small humps around the seedlings. To my surprise, I observed that those plants not only survived the inadvertent water inundation, but also they were robust. Prompted by this, I made a slight alteration in the Cono Weeder by attaching a small 'V' shaped ridger which when operated in the row forms small ridges and furrows like in cotton and sugarcane. For these crops, bigger ridgers are used in the power tillers to form ridges and furrows to facilitate earthing up along the transplanted rows. The furrows formed by scooping the soil between the rows help in draining the surplus water, and while irrigating the SRI field, water will not stagnate in the root region. This will facilitate better respiration for the crop plant even when there is inadvertent water stagnation.

On an experimental basis, I am trying this ridger attachment in a small area. No doubt dragging the 'V' shaped ridger causes some strain to the operator, but I would recommend the ridger attachment to be incorporated in the mechanized Cono Weeders to be shortly introduced after much research.

General

At the time of uprooting the seedling from the nursery, we can dip the root in the bio fertilisers like Asospyrillum, phospho-bacteria and potash Solublising Bacteria, besides disease-controlling Pseudomonas. Though this is already a recommended practice even for the conventional method, this could not be practiced because of the huge volume of seedlings. As the quantity of seedlings to be handled in SRI is very minimal, this technology could easily be adopted. As the seed material is just 2 kg/acre, we can produce quality seed materials using breeder, nuclear seed materials which are available only in very small quantity. For the best crop performance quality seed is the basic ingredient. Through SRI we can produce excellent seed material in large quantity.

work on just incentives and reaching targets.

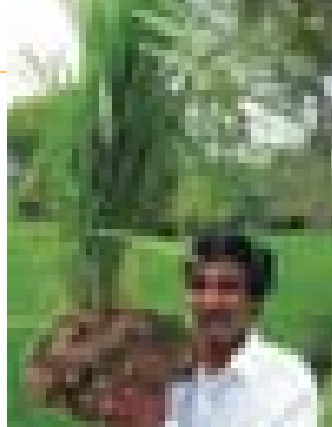
He finally says, "to get the best results from SRI, follow all the

practices as laid down". His inputs and approach have proven invaluable to the SRI community not just nation-wide but other countries too.

*Compiled and edited by
ICRISAT-WWF
SRI Newsletter team*

Where do they sell SRI seeds??

Farmer Nagaratnam Naidu in an interview with Manisha Agarwal laments the pathetic situation of SRI promotion in India.



Funny and surprising it might sound to hear the question that the title suggests. But several farmers have come to me and asked the same, and in fact I have now started to accept the question as a point to begin to detail the farmers on SRI.

It is rather sad that one has to address such questions. Plainly it is the failure of the government and the authorities to provide proper information, and more importantly, I feel, to propagate the SRI practices correctly. There are instruments to promote soft drinks and fertilizers, but none to promote SRI. How will farmers be influenced and informed on such good practices unless these are properly advertised and promoted by the Government? For food security, what kind of advertisements have we done?

I started to practice SRI since 2003 in my 3 acres field at Hayatnagar on the outskirts of Hyderabad. I was inspired by the lectures of Alapati Satyanarayana and from reading about SRI in magazines, particularly the stories from Madagascar and Sri Lanka. Later on, I began to get support from ANGRAU University and WWF.

I have not encountered serious issues vis-à-vis weeding. There were no weeders and markers available in

2002 and 2003, and we used ropes for marking and manually did the weeding. Over the years, I have realized that problems with weeding will arise only if weeding is not done on time. In 2004-2005, the yield from my SRI fields was 15.4 tonnes per hectare, that is, 92 bags per acre. During 2006, I opted for *basmati* rice under SRI cultivation and got 60 bags per acre. Usually in *basmati* the average is 50 bags, so I still got good yield. Last season I got 70 bags per acre. I used DRR seed variety and *samba masuri*.

Several farmers I know want to start, and a few have taken to SRI, but lack of proper awareness and information is causing problems and is forcing them to opt out of it.

There's a lot of difference between knowing things theoretically and knowing what the same things mean in practice. It is precisely this difference that makes all the difference for the Extension Officers, Government and others in properly understanding SRI.

From 2003 until today, it has been several years since SRI was introduced in Andhra Pradesh and India, but even today 90 % of the farmers don't know anything about SRI. Farmers think that it is a variety and ask the question of where they

can get SRI seeds. They don't know that it is simple practices that help for seed saving, and better management of resources that gives good yield.

We all know that SRI is important both for farmers and the world if we are concerned of food security. It will save our water resources.

We also know that SRI brings good yield to farmers and saves on using large quantities of seed. In conventional practice, if we use 30 kg per acre, with SRI we use just 2 kg of seeds. In one village alone, we can save tonnes of seeds; in one mandal we can save metric tones; and million tonnes of seed in the entire country.

Despite knowing all these positive aspects of SRI, it is pathetic to see the way that SRI is promoted in the country.

I have started to educate farmers on SRI and until now shared my experiences with over 5,000 farmers from various districts across Andhra Pradesh. Farmers are quite excited about SRI, but then where are the extension officers for support? Where are the markers and weeders available?

ICRISAT-WWF and some NGO's are doing their part, but that is not enough, and to expect them to address the issue across the state and nation is ridiculous.

*Manisha Agarwal
is the Communication
Officer for
ICRISAT-WWF project.*

For the benefit of the farming community

Brig. R. I. Raghunathan

National Agro Foundation is aggressively popularizing SRI adoption through frontline demonstration in Tiruvallur and Kancheepuram districts of Tamil Nadu.

India is making various efforts to improve the food grain productivity especially in Rice. Apart from using high yielding varieties, various technological interventions, practices are also being followed to improve the productivity of rice. System of Rice Intensification (SRI) is one such breakthrough which is being employed successfully. However, large scale adoption of such methods is yet to come into practice replacing the conventional method of rice cultivation. In this connection, National Agro Foundation (NAF), an NGO is aggressively popularizing the adoption of SRI through frontline demonstration in the Tiruvallur and Kancheepuram districts of Tamil Nadu.

About NAF

National Agro Foundation (NAF) is a Public Charitable Trust founded by Shri C Subramaniam, the architect of India's Green Revolution and Bharat Ratna awardee. It is actively involved in the technological dissemination for the welfare of the rural sector, especially the small and marginal farmers who are the neglected lot and who form the majority of Indian rural sector. It has set up a Center for Rural Development (a training and demonstration center) and a State of the art testing facilities for soil, irrigation water, food products, etc. for the benefit of the farming community.

Farmer Himachalam, Tiruvallur District, Tamil Nadu

Himachalam is a progressive farmer from Boodhur village of Gummidipoondi taluk in Tiruvallur district of Tamil Nadu. He was cultivating paddy under conventional method for almost 2 decades that which was not fetching him much and he was finding it very difficult. Frustrated he decided to go in for other crops. That was the time, NAF, introduced him to the SRI method of paddy cultivation. NAF not only limited it to introduction but offered him training in SRI and facilitated the inputs and tools for raising the nursery such as Cono Weeder, for weed control and aeration, for his one acre trial plot. Most importantly, the field was closely monitored for follow up advice by the field staff of NAF. The result at the end was astounding as per the following statistics:

| Particulars | SRI | Conventional method |
|----------------------|-------|---------------------|
| Yield (kg/ha) | 8438 | 5625 |
| Expenditure (Rs/ac) | 15250 | 13750 |
| Revenue (Rs/ac) | 66375 | 44250 |
| Net profit (Rs/ac) | 51125 | 30500 |
| % increase in yield | 50% | |
| % increase in profit | 67.6% | |

Today, Himachalam is happy farmer and a great motivator in his locality.

*Brig. R. I. Raghunathan
is the CEO of
National Agro
Foundation*

CWS Action Research Initiative in Andhra Pradesh

Rama Mohan and Uma Maheswar Reddy

For enhancing water productivity and conservation, and making paddy cultivation profitable to a farmer, Centre for World Solidarity and its partner NGO's are promoting SRI as part of its Action Research Initiative programme in the state of Andhra Pradesh.

Nature and civilizations thrive on water. Less than 3 percent of total water on earth is fresh water and major portion of it is in the form of groundwater. Groundwater is serving around 80 percent of the rural drinking water supplies in India and other developing countries. In the recent past, it has become the primary source for irrigation and agriculture, especially in arid and semi arid regions.

Many parts of semi-arid regions, groundwater is extensively mined for paddy cultivation. Besides, high inputs of seeds, fertilizers, pesticides and labor requirement is making paddy cultivation uneconomical. As part of Action Research Initiative in



Nursery bed preparation at Enebavi

SRI Villages and area covered

| Village | Mandal/ District | No. of farmers | Area in acres |
|----------|----------------------------------|-------------------|------------------|
| Mailaram | Chinna Koduru/ Medak | 9 | 5 |
| Enebavi | Lingala Ghanapur/ Warangal | 6 | 1.5 |

Andhra Pradesh, Centre for World Solidarity (CWS) and its Partner NGO's Nava Jyothi, Ramayampet, Medak district and CROPS, Jangaon, Warangal district of Andhra Pradesh promoted System of Rice Intensification (SRI) with the following prime objectives:

- Enhancing water productivity and conservation
- Ensuring household food security
- Increasing profitability of paddy cultivation

SRI cultivation is promoted in two villages.

Programme

Small plots of 10-15 farmers was selected from the two villages. Post exposure visit, trainings and meetings, 17 farmers begun SRI cultivation. Out of the 17 farmers, two dropped midway because of problems of irrigation and electric pumps.

The following table gives details of SRI coverage in the two villages. The plot size is 150 sq.m. to 4000 sq.m (one acre). Groundwater was the source of irrigation for all the selected fields.

The Process

An exposure visit for the 10 farmers was organized to the SRI field of Farmer Nagaratnam Naidu in Hayathnagar (outskirts of Hyderabad) in November 2007. Post exposure visit, Rabi 2007-08 season was selected for SRI cultivation. CWS supported the farmers with 2 markers and 5 weeders.

Observations

In the same villages, two years ago, an attempt was made to propagate SRI but because of lack of proper follow up and guidance it did not succeed. But after CWS and its Partner's efforts and good planning, farmers achieved good yields. Farmers in these two villages have even acquired the technique of



Post-harvest clump count taken up by farmers on their own at Enebavi



operating weeder and face no hassles in weeding operations.

The crop yield on an average was double. Inspired by the results, 31 farmers of Mailaram cultivated 30 acres of land in the kharif season 2008. In Enebavi all farmers decided to go for SRI in khariff 2008.

Other observations are

- In March - April 2008, heavy winds affected several crops in the area. According to the farmers, all crops in the area were affected by the winds except for the SRI crop. It withstood the wind velocity and hail storm.
- The post harvest clump count shows that conventional paddy has a density of clumps from 36-45 in one square meter area against the standard 16 clumps per square meter in SRI paddy.
- Post-harvest clump count taken

| Method of cultivation | Variety of seed | Tillers | Grains per panicle | Dry weight of grains per sq.m (in kgs) | yield (in kgs)/acre |
|-----------------------|-----------------|---------|--------------------|--|---------------------|
| SRI | IR 64 | 52 | 100-150 | 1025 | 4148 |
| Conventional | IR 64 | 12 | 78-102 | 580 | 2330 |

up by farmers on their own at Enebavi

- SRI paddy was found to be more pest-resistant.
- In few plots, part of fields adjacent to conventional paddy was affected by pest attack but crop itself recuperated without application of any pesticide. Where as conventional paddy was prone to diseases and pesticide granules were applied to control the pest attack.
- There is negligible amount of malformed grain (wastage) in SRI where as it was considerable amount in the conventional paddy.

Results

SRI experience of the farmers of Mailaram and Enabavi during Rabi 2007-08 helped to demonstrate that SRI is an eco-friendly and low input method of rice cultivation that maximizes production and facilitates efficient use of resources and inputs. Not only farmers benefited from the high yields but also groundwater resources conservation and soil health was taken care. The potential of SRI in meeting the food security needs of small and marginal farmers demonstrated that small initiative gave inspiration to number of farmers in the neighbouring village to adopt SRI method of rice cultivation in future.

CWS continues to strengthen the SRI movement by facilitating capacity building, demonstration, encouraging innovations and scaling-up of SRI methodology in its operational States such as Andhra Pradesh, Tamil Nadu, Orissa, Jharkhand and Bihar in future.

Comparative figures of SRI and Conventional paddy during the season

| Item | SRI | Conventional |
|-----------------------------|---|--|
| Seed per acre | 2 kgs | 35 kgs |
| Nursery period | 12 day | 30 days |
| Transplanting labor engaged | 10-15 members | 20 |
| Irrigation applied | For every two days kept the root zone wet | Every day kept the field with 3 inches of water column |
| Mechanized weeding | 6 times through out the crop period | nil |
| Weeding labor applied | 8 | 15-20 |
| Tillers per clump | 50-116 | 10-15 |
| Panicles per clump | 70-75 | 11-13 |
| Grains per panicle | 100-150 | 55-70 |
| Yield (quintals per acre) | 35-43 | 18-24 |

*Rama Mohan
is the Joint Director,
NRM program,
CWS*

*Uma Maheswar Reddy
is the Program Officer,
NRM program,
CWS*

SRI in Northeastern Provinces of Afghanistan

Ali Mohammad Ramzi

The northeastern provinces of Baghlan, Kunduz and Takhar produce most of rice in Afghanistan. Rice is both a staple food and a cash crop for Afghan farmers. Those who grow rice under canal systems fed by the Kunduz River in these provinces are suffering from water scarcity. The Aga Khan Foundation (AKF) has been seeking to improve rice cultivation in these areas through its Participatory Management of Irrigation Systems (PMIS) program, which has received funding from the European Community. The program has been working in the command areas under the Jangharoq and Proje canals in Baghlan and under Nahri Saed and Nahri Zargar in Takhar.

Before 1980, the Afghan government had strong control over irrigation, and only waterlogged areas were cultivated with rice using traditional practices; other irrigated areas were used for growing industrial crops such as sugar beet, cotton, flax, sesame and mungbean. During the war, however, the government lost much of its power, and farmers shifted more to rice growing. Both upstream and downstream areas became mostly rainfed (/lalmi/). As those in the upstream areas drew excessive amounts of water, believing that this would be beneficial to their rice crop, this created more water scarcity downstream.

Because the System of Rice Intensification (SRI) requires less water for rice production, while also giving better yield, AKF invited a SRI farmer-consultant from India, Parcha Kishan Rao, to visit Afghanistan in May 2007, to provide training in SRI's alternative methods. He trained AKF Natural Resource Management officers on SRI, and AKF established four demonstration plots, at the farm of the Baghlan Agriculture Faculty research farm and on farmers' fields in three other locations in the two provinces.

The planting was started about one month late, which is important in a




high-altitude climate with short growing season, and it was our first year using SRI practice, so the yield was not very encouraging. However, the evident root growth and tiller numbers were impressive, and this motivated us to persist.

In 2008, six SRI volunteer farmers in different villages served by Jangharoq and Kelagai canals were selected, and we started earlier than last year. The results were extremely encouraging, with one farmer, Juma Gul, having a single SRI plant with 133 tillers. Our technicians calculated his yield to be 11.56 tones/ha. The six farmers' fields were used for training other farmers in SRI methods through exchange visits arranged by PMIS/NRM staff at different growth stages of the SRI crop. Agriculture Department staff also participated in the

Local governmental staff and the SRI volunteer farmers including their neighboring farmers are optimistic toward SRI practices in the future. They have seen better yields from their SRI fields, an average of 10 tons/ha compared with 5.4 tons/ha from the control fields chosen for comparison. Jangharoq farmers say they will switch from their traditional rice cultivation methods to SRI practices, and then downstream farmers will have more access to water and the benefits will be more for everyone.

SRI and conventional yields in Baghlan province in 2008

|  | SRI methods (T/ha) | Conventional methods (T/ha) |
|---|--------------------|-----------------------------|
| Farmer plot 1 | 9.00 | 4.00 |
| Farmer plot 2 | 11.26 | 6.13 |
| Farmer plot 3 | 9.55 | NA |
| Research farm | 14.00 | 7.00 |
| Farmer plot 4 | 11.56 | 5.83 |
| Farmer plot 5 | 5.88 | NA |
| Farmer plot 6 | 9.65 | 4.08 |
| Average | 10.13 | 5.41 |

exchange visits and were involved to our SRI activities throughout.

Local governmental staff and the SRI volunteer farmers including their neighboring farmers are optimistic toward SRI practices in the future. They have seen better yields from their SRI fields, an average of 10 tones/ha compared with 5.4 tones/ha from the control fields chosen for comparison. Jangharoq farmers say they will switch from their traditional rice cultivation methods to SRI practices, and then downstream farmers will have more access to water and the benefits will be more for everyone. We hope that more and more of our farmers will follow SRI practices and get better yield from less water.



SRI Farmers Exchange visit

Ali Muhammad Ramzi is the Natural Resource Management Officer for Aga Khan Foundation, Afghanistan.

Introduction of SRI in Morocco

Lessons learnt

Francesca Antonelli and Imad Cherkaoui

SRI's introduction to Morocco has proved to be very enriching for both team members and partners. For one, SRI is not just a technique; it needs to be integrated into the local culture and practices of agriculture.

High water prices, high production costs, lack of profitability, and recent trade liberalization have driven fluctuations and a downward trend in rice production in Morocco. Anticipating increasing pressure on water resources in coming years, the need for Morocco to take up a less water-intensive method of rice farming has been becoming ever more obvious.

Following a preliminary visit in October, 2007, by Dr. Biksham Gujja of WWF to gauge the situation in Morocco, a team of two ORMVAG officials Yacoubi Khalid and Bennouna Kamal from the Regional Office of Agricultural Development, Gharb and Imad Cherkaoui, representative of WWF MedPO (Mediterranean Programme) visited India to learn and take training on SRI practices. Following these officials of WWF-ICRISAT Project, WWF MedPO and ORMVAG entered into a partnership to introduce SRI in Morocco, testing its adaptability

first in the country's Gharb region.

The partnership laid down the following specific objectives:

- Reduce water consumption in rice cultivation by at least 30 per cent;
- Reduce fertilizer and other chemical use by 25 per cent; and
- Produce the same as, or 10 per cent more, than the average rice production in Morocco over the last five years.

About 11 ha were provided by four farmers who, in turn, were offered compensation in case of any loss in yield. A research farm was also allotted for SRI demonstration. An Indian SRI farmer-trainer and a scientist visited Morocco to provide technical inputs, on-the-job training and hand-holding support.

In mid-October 2008, harvesting

was done, and on an average 5.3 t/ha yield was obtained in SRI fields. When compared to current Morocco standards, SRI plots performed lower than the normal paddy. The reasons for low production can be attributed to some facts which shall be considered as the lessons learnt from the experience:

- **Local reality:** Conditions in Morocco are significantly different from India. The experts should have visited Morocco before the onset of the season to better understand the local socio-economic and agro-ecological factors.
- **Demonstration area:** This probably should have been smaller, so that labour, time and energy could have been minimized. Moreover, it was learnt that the increase in yield was not the sole motivating factor to motivate farmers towards SRI. This is because Morocco is already witnessing higher yields compared



to other parts of the world. So, in such situations, it is advisable to restrict pilot initiatives within the research farm to control money and make efforts better. Later farmers could be exposed to these results and encouraged to try SRI method at their own expenses.

- **Nursery:** Considering the climatic conditions in Morocco, the nursery should have been prepared a little earlier than it was, to avoid delay in transplanting. [This same problem of delayed transplanting occurred also in Afghanistan.]
- **Seed shortfall:** The seed requirement for raising the nursery and subsequent transplantation fell far short of the need in many areas.
- **Organic manure:** Scope for preparation and use of organic manure and microbial solutions should have been thought about earlier, considering their non-availability in Morocco.

- **Water issues:** Similarly, much care should have been taken to measure the quantity of irrigation water by considering the various location-specific constraints.
- **Soil-related matters:** As Morocco soils are rich in clay content (70%), certain work integral to SRI, like using markers, was found to be a bit hard to accomplish inside the field. Hence, farmers found their own method of using a rope with equal-spaced-knots, much more effective.
- **Sharing of responsibilities:** Care must be taken to assign more responsibilities to local organizations.
- **SRI tools:** Considering the huge weed problem and incompatibility of Indian models of weeders, ones suitable to local situations need to be developed much in advance.
- **Costs:** The cost of cultivation must be planned with thorough

knowledge after considering all the pros and cons. Failure in doing so could result in miscalculation leading to higher costs than anticipated.

The experiences though have proved that:

- Transplanting of single seedlings does work under Moroccan conditions,
- Local farmers are receptive to the methods, and
- It is difficult to control weeds in clay soil where agriculture practices are highly mechanized.

In sum, initiating the launch of SRI in Morocco has proved to be very enriching for both team members and partners. For one, SRI is not just a technique; it needs to be integrated into the local culture and practices of agriculture. Two, it has to be designed and implemented appropriately.

After proper evaluations, listening to feed back from local farmers, and taking account of the views and comments from officials, the lessons learnt in Morocco will be integrated into improve practice for next season.



*Francesca Antonelli
is the Head of Freshwater Unit,
WWF Mediterranean Programme,
Rome*

*Imad Cherkaoui is the WWF
Freshwater Project Coordinator
for WWF Mediterranean Programme,
Morocco*

AMEF-WWF supported SRI activities in Andhra Pradesh

Dr. N.Loganandhan

A field visit to villages in Chittoor and Mahabubnagar districts revealed that SRI is popular and looking to spread. However, addressing some practical issues raised by farmers will bring greater success to an already successful endeavour.

A recent field-visit to villages in the dry land areas of Chittoor and Mahabubnagar districts of Andhra Pradesh provided an enlivening opportunity to interact with farmers practicing the System of Rice Intensification (SRI) method of rice cultivation. Aably executed by AMEF (Agriculture, Man and Ecology Foundation) with support from the WWF-ICRISAT project (June 2008-May 2009), these farmers are very enthusiastic about SRI, and freely shared their success stories as well as the constraints they face. Accompanying me were staff from AME and their partner NGOs, as we went to Konappareddipalli, Kotha-pally and K.C.Penta villages in Chittoor district, and Vattam and Appajipally villages in Mahabubnagar district. Here I bring out some of the significant insights shared by the farmers.

Konappareddipalli Village

Practicing SRI in 1 acre, farmer Damodaran harvested 45 bags (33 quintals) of paddy last season, a 50 per cent increase from his normal yield (22 quintals). He attributes much of his success to the care he takes at the nursery stage itself, by sowing seeds with wider spacing. He is aware that this helps in developing healthy seedlings with strong roots. He prefers the rope method of transplanting rather than using a marker, the reason being



Dr. Loganandhan from ICRISAT-WWF project interacting with SRI farmers at Appajipally village

that he found disproportion in markings while using the latter. The occurrence of pests like leaf-folder and the Gundhi bug are now far less in his field, and there is no presence of stem-borers. He sweeps leaves of the Ber tree along the crops to get rid of leaf-folders while also using bio-repellents like cow urine and neem oil to control pests. He needs to irrigate the field only once in three days, unlike the daily irrigation followed in conventional method. The saved water is used to irrigate other crops like tomato, maize etc.

Farmer Damodaran mentioned that although the number of weedings increased in SRI (from 1 to 3) the number of labourers involved in weeding fell drastically (from 10-15 to 2-3). Moreover, he added that the incorporation of weeds into the soil improved the nutrient status of the soil. He was enthusiastic that

paddy is going to be tried during the summer season this year, for the first time in this area. He is now eager to try SRI on more acres, as he has saved around Rs.1500/- by its use already.

Vattam and Appajipally Villages

Farmer Sharma of Vattam uses sieves for sowing seeds in the nursery, which helps in maintaining gaps among seedlings. While farmer Reddy of Appajipally practices SRI and conventional rice in 0.25 acre each, he feels that there is not much difference in water consumption because the alternate wetting and drying followed with SRI results in greater infiltration and hence larger intake of water.

It was observed by the farmers that the Cono Weeders used by them last for one season only. They requested improvements in design or construction so that the implements last for a longer period. Overall we realized that the performance of weeders and water consumption in SRI are major issues to be studied in depth so as to bring out some useful facts or products so as to convince and encourage more farmers to adopt SRI.

*Dr. N.Loganandhan is the
Visiting Scientist,
ICRISAT-WWF Project, ICRISAT,
Patancheru, Hyderabad.*



Learning about Life Forms in Paddy Eco-System

Our mobiles were ringing continuously between 15th July to 20th October 2008, sometimes at 10 PM in the night and 5 AM in the morning. Farmers and our 'SRI Vahini' (SRI Cadets (as we call our NGO staff) were calling us from different villages and fields to discuss pests, diseases and water problems.

We felt happy for three reasons. For one, it is good that they are in touch with us; two, we are generally able to help them in need and crisis situations; and three, we all are seriously and honestly working for promotion of SRI.

But soon we realized that this is not the best way we should work. Our capacity building of Sri Cadets' has to be done so as to empower them to identify various life forms in the paddy eco system; it is not enough to know how to raise nurseries, transplant seedlings, or do water management. It is also important to know about the many competitors and friends in the paddy field so that SRI Cadets can confidently help farmers on time.

Keeping all the above points in mind, we developed a need-based and demand-driven program for capacity-building of the SRI Cadets.

Since Sambhav is experimenting with 177 varieties of paddy under many challenging conditions with SRI, and as the standing crop was



still available in the field, the program held from 1st to 3rd November 2008 at Sambhav center had a small group of 22 participants who gained first-hand experience from the real-life situation.

The program's theme, "Pests, Diseases & Life Forms in Paddy Eco Systems" focused not on pest and disease control or IPM [Integrated Pest Management], but rather on "Plant Care".

At the end of the 3-day program, participants were not only more aware about the pests and diseases, but also about friendly life forms. In addition to the Sambhav team members, Prof. H.P. Mishra from

Orissa University of Agriculture & Technology facilitated in the learning process.

As the venue for the training was a farm, all got an opportunity to observe paddy fields and life forms both during the day and at night. In addition, they also picked up and learned about "Application of *Agnihotra*" in agriculture and "Vegetable Garden Design" according to Permaculture principles.

Sabarmatee

Sabarmatee is the Secretary for Sambhav, a grass roots level NGO, Orissa.

Here's more reading and video links on SRI:

Suggestions of crops suited for pollution-affected areas:

URL: <http://www.thehindu.com/2008/11/22/stories/2008112253190300.htm>



Record average productivity of kuruvai crop in State:

URL: <http://www.thehindu.com/2008/11/19/stories/2008111954900400.htm>

Farmers expect double output through SRI:

URL: <http://www.thehindu.com/2008/11/20/stories/2008112058690300.htm>

System of rice intensification picking up:

URL: <http://www.thehindu.com/2008/11/20/stories/2008112060530600.htm>

Amazing azolla acquires an alternative 'avatar':

<http://www.hindu.com/seta/2007/09/20/stories/2007092050101800.htm>

Raise paddy under SRI method,

says Collector:

URL: <http://www.thehindu.com/2008/11/18/stories/2008111858890300.htm>

New equipment comes in handy for farmers in Tirunelveli:

URL: <http://www.thehindu.com/2008/10/19/stories/2008101955230300.htm>

An experiment of new method in paddy cultivation:

URL: <http://www.thehindu.com/2008/11/05/stories/2008110553540300.htm>

Samba cultivation nearing completion in Tiruvarur:



This photograph shares WASSAN organization's experience with Azolla in SRI. It gives a glimpse of how it spreads in SRI fields. In the village Nagireddipally, farmers observed substantial contribution of Azolla to fertility in SRI fields when it is incorporated into the soil. It only takes to spread small Azolla mass into the field when it is puddled. It spreads fast into the entire land (depending on moisture) by the next season. This could potentially reduce fertiliser needs in the SRI paddy fields after a few seasons. If any one has further details of nutritional addition please pass it on to **A. Ravindra**, Director, WASSAN, Secunderabad, Andhra Pradesh at sriindia@googlegroups.com



URL: <http://www.thehindu.com/2008/11/09/stories/2008110954190300.htm>

More Rice with System of Rice Intensification (SRI)
Workshop for International System for Rice Intensification (SRI) Network:
<http://www.jointokyo.org/en/programs/catalogue/sri/>

Going organic, better late than later:
 By Ma. Ceres P. Doyo
 Philippine Daily Inquirer
 First Posted 23:29:00 11/12/2008
<http://opinion.inquirer.net/inquireropinion/columns/view/20081112-171861/Going-organic-better-late-than-later>

Manufacturing a Food Crisis by Walden Bello:
<http://www.thenation.com/doc/20080602/bello>

Short video of Azolla in SRI fields in one of the tanks in Kottur village, Bomraspet mandal of Mahabubnagar district in Andhra Pradesh where SRI is practiced in 100 acres. This was filmed by Janaki Rama Rao from WASSAN:
<http://in.youtube.com/watch?v=6lGgt94QUJI>

Selecting Field for Cultivation SRI:
<http://in.youtube.com/watch?v=aBN6I-3GHgA>

SRI, ideal technology for farmers: Collector:
 URL: <http://www.thehindu.com/2008/10/27/stories/2008102759540600.htm>

Paddy yields raised by 2 t/ha with SRI in tamil nadu state

The Financial Express reports that harvest results from several districts in Tamil Nadu state indicate that average yield in the most recent rice-growing season may have reached 7.5 tons/hectare, compared with the previous highest yield for the state of 5.4 t/ha, a 40% increase (see article). The Ministry of Agriculture, which reported that SRI methods were used on 430,000 hectares in the 2007-08 samba season, has projected SRI use on 750,000 hectares by the end of 2008, out of a total rice-growing area of 2.1 million hectares. Increased yield was attributed primarily to the spread of SRI methods in the state, noting that costs of production were not increased or even lowered with these methods, also reducing water requirements. This result will add to the significance of the 3rd National SRI Symposium being hosted by Tamil Nadu Agricultural University in Coimbatore, December 1-3, with sponsorship from WWF and a number of major Indian government and non-governmental institutions (see Symposium details). Also available on the SRI-India website is the first edition of the SRI Newsletter spearheaded by the ICRISAT WWF-Project.

Research finding: growing rice under unflooded conditions found to reduce arsenic and also increase other mineral uptake

Research published in the journal Environmental Science and Technology reports that rice grown under flooded conditions has higher arsenic content than the same variety grown in aerobic soil, as with SRI. At the same time, the more aerobic rice has higher content of zinc, copper, manganese and magnesium, suggesting that it has more nutritional value. This finding warrants more systematic and wider testing before firm conclusions are drawn. We hope that such a number of evaluations will be done both carefully and widely to establish whether demonstrable health benefits can be obtained from using SRI method.
<http://ciifad.cornell.edu/sri/listservs/sriupdate1008.html>

Association formed to promote SRI method:
 URL: <http://www.thehindu.com/2008/10/19/stories/2008101951180300.htm>

World Bank team inspects water sources:
 URL: <http://www.thehindu.com/2008/10/19/stories/2008101950240200>

Neglect of Farming Led to Rice Crisis:
 by Marwaan Macan-Markar
<http://www.commondreams.org/archive/2008/04/26/8546>

Paper to curb weed onslaught:
 URL: <http://www.thehindu.com/2008/10/15/stories/2008101550090200.htm>

Resource material on SRI



- System of Rice Intensification in India – Innovation History and Institutional Challenges (English), 2006 by WWF, Hyderabad and X1M, Bhubaneswar
- More Rice with Less Water, SRI – System of Rice Intensification (English), 2007 by WWF

WWF-ICRISAT Project, ICRISAT, Patancheru, Hyderabad

- Farmers' Experience – Case Studies from Different States of India (English) 2008
- Fact Sheets on SRI – India and few states, 2008
- Newsletter – Issues I, II & III, 2008
- More Rice with Less Water - Small State, Big Results – Revised Edition 2008, Department of Agriculture, Tripura, WWF-ICRISAT Project, ICRISAT, Patancheru, Hyderabad

WASSAN-ICRISAT Dialogue Project

- Realize Full Potential of Paddy Plant - SRI Method of Paddy Cultivation (English, Telugu, Hindi and Oriya versions), 2008
- More Rice with Less Water - Small State, Big Results – Revised Edition 2008, Department of

Agriculture, Tripura, WWF-ICRISAT Project, ICRISAT, Patancheru, Hyderabad

Acharya N G Ranga Agricultural University, Hyderabad

- Booklet on “System of Rice Intensification” (Telugu and English), 2004
- Manual on “SRI – A Revolutionary Method of Rice Cultivation” (English), 2004
- Booklet on “SRI vs Conventional Rice Cultivation” (Telugu and English), 2006
- Manual on “SRI Paddathilo Vari Saagu – Karadeepika (Telugu), 2005

- Manual on “SRI Vari Saagu – Rythula Anubhavaalu” (Telugu), 2005
- Farmers Experiences in SRI Cultivation (English), 2007

Centre for Sustainable Agriculture (CSA), WASSAN, WWF, et al, Secunderabad.

- Manual on “SRI Paddathilo Vari Sedyam – Var Mokka Digubadilo Purthi Samarthiam” (Telugu), 2005, Revised 2006
- Manual on “Chirantan Krishi Nimanthae SRI Ba Sadhan Dhanochsho Padhathi” (Oriya), 2005
- Taking Roots; Experiences with System of Rice Intensification in Andhra Pradesh (English)

WASSAN, Secunderabad.

- System of Rice Intensification; Weeders - A Reference Compendium (English), 2006 .

(There are many other publications and websites available on SRI, but because of space constraints we have put only a few names here.)

A few websites

www.sri-india.net
www.wassan.org
www.tropantag.de
www.farmingsolutions.org
www.ciifad.cornell.edu
www.wikipedia.org
www.ikisan.com
www.cropscience.org
www.echotech.org



Editors: Dr. Biksham Gujja, Manisha Agarwal
 Editorial Committee: Dr. Norman Uphoff, Dr. T.M. Thyagarajan, Dr. C. Shambu Prasad, Dr. V. Vinod Goud
 Technical Support: Sraban Dalai Design: Akshakala

For feedback and information contact: Manisha Agarwal, Communication Officer, ICRISAT-WWF Project, ICRISAT, Patancheru, Andhra Pradesh - 502 324
 Tel: +91 40 30713760 Fax: +91 40 30713074 / 75
 Email: m.agarwal@cgiar.org, manisha.manvi@gmail.com

The views expressed in the bulletin are those of the authors and do not necessarily reflect the views of the ICRISAT-WWF project and SRI partners.