19-21st June 2014

An International Workshop

Changes in rice production and rural livelihoods: New Insights on the System of Rice Intensification (SRI) as a socio-technical movement in India

Rice Production and Rural Livelihoods:
Future Prospects and Policies for a post Green Revolution World

VENUE: National Agriculture Science Centre (NASC), Complex, PUSA Road, New Delhi

ORGANIZED BY:

NATIONAL CONSORTIUM ON SRI (NCS)

SUPPORTED BY

Contents

ABOUT THE WORKSHOP

The international Conference on "Changes in Rice Production and Rural livelihoods: New Insights on the System of Rice Intensification as a socio-technical movement in India" was jointly organized by the National Consortium of SRI (NCS) the Wageningen University (WUR) and the Xavier Institute of Management Bhubaneswar (XIMB) during June 19-21, 2014 in the NASC complex, New Delhi. As a part of the conference, a one-day policy workshop was organised on 21st June 2014. The effort brings forth the current challenges for food security and livelihoods in India and understands the role and significance of agro-ecological innovations in meeting these challenges. The focus was on a specific alternative to agricultural intensification widely spreading in recent years, i.e. the System of Rice Intensification (SRI). SRI comprises a set of ideas and agronomic principles for rice cultivation, targeted at increase in productivity with low use of external inputs and sustainable use of water and nutrients. These innovative practices have resulted in significant savings in crucial inputs: seed, water and agro-chemicals besides proving option for climate resilience.

Over the past four years, a research programme of Wageningen University, the Netherlands, and XIMB studied SRI as a social-technical movement in India looking at different dimensions of agricultural transformation, gender and labour issues, water management, political economy and socio-economics of SRI. SRI has also been studied by different researchers in India with Indian researchers being prominent in world research on SRI. The policy workshop was to explore the implications of these studies for food security and rural livelihoods in India. This workshop helped NCS continue its engagement with policy actors on the science, practice and policy of SRI in India. The workshop aimed to get the research on SRI linked to policy actors in agriculture and rural development departments along with other actors in the SRI ecosystem such as grassroots based civil society organisations, and donors including NABARD that have been involved in SRI programmes in the country.

The research workshop that preceded the policy workshop discussed in-depth the research findings on SRI with a unique opportunity for researchers to share their work across regions and compare and contrast their work and arrive at broad generalisations on both the agronomy of rice production and its socioeconomic impacts. The studies presented in the workshop addressed the social and technical changes in cultivation practices as well as the wider institutional dynamics set in motion with the introduction of SRI in India as well as internationally. The prime movers behind the elaboration and spread of SRI methods have been farmers, field – level agronomists and extensionists, and CSOs rather than the formal institutions of rice science. The overall question is to understand and explain the spread of SRI as a socio–technical phenomenon and driver of agrarian change. By utilising the synthesis of the diverse set of studies and perspectives, the workshop aimed to create a wider understanding of critical issues of food production and rural livelihoods in India, creating new opportunities for science as well as policy paradigm.

The research findings are expected to be of direct relevance for policy. The workshop thus also addressed what policy makers and agricultural research institutions can learn from the SRI experiences about the dissemination of novel scientific knowledge and agricultural practices. Findings from premium studies on the scientific validation of principles and processes of system of crop intensification including SRI, will add more confidence to a variety of stakeholders.

By linking a diverse set of studies and perspectives, the workshop aimed to create a wider understanding of food production and rural livelihoods in India, creating new opportunities for science as well as policy paradigm.

This report presents summarises some of the discussions of the workshop and also some points for action that emerged during a meeting of the NCS held on 20th July (Appendix 1) as well as some initiatives and events that preceded the workshop (Appendix 2). The list of participants with their contacts is presented in Appendix 3. A detailed conference website has been maintained at all stages of the project and the conference presentations of all the three days have been uploaded for future use by scholars, CSOs and policy makers at http://www.sri-india.net/event2014/presentations.htm. Some photographs of the workshop are available at http://www.sri-india.net/event2014/photogallery.htm . A CD with the edited talks and photographs of the meeting is ready for future use by scholars and as record of the event by partners.

PROGRAMME SCHEDULE

21st JUNE 2014

Rice Production and Rural Livelihoods: Future Prospects and Policies for a post - Green Revolution World

NASC Conference Hall, DPS Marg, PUSA, New Delhi - 110 012

WELCOME	
9.00 – 9.30 AM	▪ Registration of New Participants
9.30 - 9.40 AM	▪ Welcome B C Barah, IARI / NCS
Theme 1: Research on SRI: Rethinking Agronomy and Research Practices Chair: T.M. Thiyagarajan, Former Director and Dean, TNAU, Tamilnadu	
09.40-11.30 AM	▪ Main Findings of the India-Netherlands research programme – Harro Maat (Wageningen University) and Dominic Glover (IDS) ▪ "Agronomy, Rice Production and India's Agricultural Policy - Do Knowledge and Evidence Matter?" - Rajeswari S. Raina, NISTADS, CSIR ▪ Research on "SRI in India - Prospects and Challenges" –Dr. HS Gupta, Director, IARI ▪ SRI and Research Policy Challenges and Prospects - C. Shambu, Prasad, XIMB ▪ Incorporating Complexity, Adaptive and Multi-component ideas in SRI research: Some recent insights - Willem Stoop, Netherlands Amod Thakur and Janice Thies discussants on future of SRI research
11.30 -11.45 AM	**Tea Break**
Theme 2: Beyond Production and Yields: Food Security, Livelihoods and Intensification Chair: Peter Kenmore, FAO, India	
11.45 AM - 1.00 PM	▪ FAO's policy advice on Sustainable Rice Intensification and Experiences of Field Implementation in Asia - Jan Ketelaar, FAO, Regional Office Asia and Pacific, Bangkok, Thailand ▪ Transforming Agriculture Livelihoods - The Experience of Livelihood Missions - T. Vijay Kumar, Aajevika (National Rural Livelihood Mission) ▪ System of Rice Intensification (SRI) Implications for Indian Development Policy: A Global Perspective and some specific suggestions - Norman Uphoff, SRI Rice, Cornell University

	Discussant: Biksham Gujja, AgSRI followed by Q&A
13.00 - 13.45 PM	**Lunch Break**
Theme 3: Newer Policy Directions: Opportunities in Rainfed Rice Chair: Ravi Chopra, PSI	
13.45 - 15:00 PM	▪ Irrigation System Reforms: New Policy Opportunities with System of Rice Intensification - A. Ravindra and Debashish Sen, WUR and WASSAN / PSI ▪ Building an SRI Institute - Private Sector and CSR Initiatives on SRI – Yezdi Karai, Usha Martin University ▪ Area Approach to SRI Extension - Emerging Lessons from a convergent program on scaling up SRI in Andhra Pradesh - S. Bhagyalaxmi, WASSAN ▪ Policy issues for SRI adoption: Dr.RM Kummur, CGM, NABARD Discussants: Zulfiquar Haider of Bharat Rural Livelihood Foundation and Anil Verma of PRAN, Bihar.
Theme 4: Panel Discussion on Assessing SRI in the Future: Chairs: Harro Maat & Dominic Glover	
15.00 - 16.00 PM	▪ Agricultural transformations in SRI: Beyond yields, changes in work routines, farmer attitudes, collective action by Panelists : Sabarmatee, Anil Verma, Debashish Sen ▪ What does all this mean for assessing SRI in future: Closing comments by Panelists: D.N. Reddy, A. Ravindra, B.C. Barah, Rob Schippper
16.00 PM	**Vote of Thanks** – D Narendranath
16:10 PM	**Farewell Tea**

Introduction

The policy workshop's design was based on a combination of policy related abstracts received for the conference as well as invitations to key policy actors in agriculture and rural livelihoods and grassroots experiences of civil society and other organisations working on SRI. The workshop was split into four broad panels and themes of the research on SRI, the linkages of SRI with food security and rural livelihoods; newer policy mechanisms and ideas on SRI and a panel discussion on challenges in assessing SRI within a broader perspective that would look beyond yields and explore other dimensions such as adaptations; collective action; farmers empowerment etc.

Dr Harro Maat and Dominic Glover shared some of the insights of the ongoing study on SRI as a socio-technical movement in India that has involved three PhDs and two post-doctoral researchers. Some of the salient findings were:

a. **Institutional Variations:** The studies found that there is considerable variation in how different organisations in different parts of India present SRI and promote it to farmers. One axis of difference is the way the institutions are involved that between government organisations and non-governmental organisations (NGOs) and other civil society organisations and networks. Differences in the promotional methods used, the intensity of trainings and follow-up visits, and the use of different channels of communication create further variation in the way different farmers understand/interpret and practice SRI in different places.

b. **Institutional and technological 'lock-in':** Rice farming is connected to wider institutional and technological structures that have limited flexibility. These structures constrain the adaptable space for farmers to implement recommended SRI principles. A clear example is water distribution regimes, typically a combination of social and organisational arrangements and hydraulic infrastructure, which determine or limit the time window for transplanting of paddy, which restrict, reduced or provide intermittent irrigation. Other restrictions can be imposed by labour arrangements or financial arrangements (e.g. subsidies for farm inputs, such as electricity for pumping).

c. **Agro-ecological and livelihood patterns:** Features of landscapes and climate shape the patterns in local farming practices, which are not easily transformed. This is particularly evident in hill areas, where farming systems are more complex, and SRI is typically practiced on a minority of rice fields and adjusted in various ways to fit with other systems of rice cultivation, other crops, and additional income-generating activities.

d. **Historical precursors to SRI:** Historical research indicates several elements of SRI like work with historical experiences with the 'Japanese method' of rice cultivation introduced in India prior to the Green Revolution as well as strands of research by scientists on SRI-like principles and practices that have been ignored by rice researchers since the Green Revolution.

Theme 1: Research on SRI: Rethinking Agronomy and Research Practices

The rice plant in India has adapted itself to diverse ecosystems from the lowlands of the coastal areas up to 3050 metres high above sea level, in acidic and alkaline soils, in sandy and heavy soils, in dry, semi – dry, wet and completely submerging conditions. It can be direct seeded, transplanted and the seedlings can also be thrown and established. The seedlings ranging from eight to eighty days old can be transplanted. The principles of system of rice intensification (SRI) create a more favourable above ground and below ground environment for rice cultivation, allowing for the greater genetic expression of the rice plants, resulting in increased productivity of grains, straw, water, labour and nutrients from planting to harvest. Conventional rice research has not sufficiently explored the potential of synergies that occur below the soil, especially in conditions that are created by the different management practices of SRI. The discussions on the future of research on rice and SRI in the workshop had four presentations with two discussants and an open discussion on rice agronomy and the tangible and intangible benefits and costs of SRI.

The chair Dr TM Thiyagarajan, India's first researcher on SRI, highlighted how farmers have conducted several informal researches on the practices and modified the tools suited for SRI since its introduction in 2002. Currently there is more focus on transplanting and motorised weeder. Initially there was very low and limited involvement of scientists, although there is a change of interest in research on SRI science of late.

Some of the major unanswered questions he indicated that might interest researchers are:

- Why there is a sudden spurt of tillering after inter-cultivation?
- Why the crop is greener, even at physiological maturity?

- Why there is lodging resistance?
- Why there is grain size enlargement?
- Why there is a reduction in crop duration?
- Why there is no rat damage?

Agronomy, Rice Production and India's Agricultural Policy – Do Knowledge and Evidence Matter? : Dr Rajeswari S. Raina, NISTADS

There have been shifts in the understanding of science that require capacities to nurture science policy to respond to what farmers know and adapt. An explicit example of farmers being affected by the theory of change is the Green Revolution. The question to be addressed is why change is so difficult in our system. What is its implication on policy regimes and what is their relationship with science that undermines the possibilities for change?

Rice requires a decentralised research and governance to make it economically viable and ecologically sustainable. Many of the specializations that were a part of agronomy have been divided into different disciplines that does not allow for good integration that can be applied in practice. The moot question is how to make a change in the rainfed agricultural systems, in SRI, in organic agriculture by utilising a whole range of available alternatives. What are the kinds of structures that are needed? What kind of policy relationships that are needed? Any alternative that is proposed today is labelled as political, what exists in the mainstream is considered neutral. What is required is a discursive and responsive agronomic system. As the methods of SRI emanate from farmers' fields; would not go very far if we do not question the systems that we work within.

Key Messages

- The capacity to meet the demand for change, access to knowledge and supportive evidence is lacking in India's agricultural policymaking and administration domain.

- Formal centralized and consolidated S&T is denied the expertise (capacities to understand and engage vs. experts trained in particular disciplines) - decentralized location specific ways of knowing and governing rice production.

SRI and Policy Challenges and Prospects: Is India a reluctant leader? Dr. C Shambu Prasad, XIMB

India has the potential to *be a leader in agro ec*ological innovations. With increasing evidence, this conviction has increased. However, the question is why India is such a reluctant leader?

The available evidences show that multiple benefits accomplished due to adoption of SRI. These include increased yields, better soil health, saving seed and irrigation water. Area under SRI in India covers roughly 1.76 million hectares and, 3.5 million farmers. The level of adoption at present is modest to good (2% rice area) despite poor public investment (whereas hybrid rice 6% after 25 years). It may be noted that the spread of SRI has involved innovations in the institutional mechanisms. The extension has been not public/ private, but community-led. SRI has overall led to greater choice for farmers (good response from indigenous varieties), better adaptation to drought and climate change. The Civil Society Organisations (CSOs) have led the promotion of innovation and incubation, SRI has spread through networks, experiments in different crops, varieties, implements etc. as a holistic farming system rather risky mono-crop system. Women played important roles often through community-based institutions in several states. There is a shift in gender engagement in different crop operations with preference to ergonomic aspects.

The implication for research policy is, "How should research actors work with other stakeholders, including practicing farmers, who are till now treated as outside the research establishments?"

The system demands a higher level of knowledge, which has manifested itself in different forms. A survey of peer reviewed journal articles on SRI shows that India contributes to around 38% of the total journal articles on SRI in the world. Within India, despite many activities in Bihar and Jharkhand, there has been very little research emanating from these regions. The state agricultural universities have been extremely active in the southern part of India, but not so in the northern regions of Punjab, Haryana and Uttar Pradesh. The lack of basic research within the main corridor of production hindered the spread and advocacy. All of this begs the question why is the Indian research establishment not seizing the opportunity to be a world leader in this evolving multi-disciplinary approach to enhancing food security when some of its own researchers have been at the forefront?

Incorporating Complexity, Adaptive and Multi- Component ideas in SRI research: Some recent insights, Dr Willem Stoop

a) **SRI / SCI: Empirical Origin:** The assessment of the status shows that a lot of the experience in SRI / SC*I has come fro*m field experiences and communication with farmers. On the one hand, there *are* field level empirical experiences and on the other hand little knowledge coming from science, theories and technology i.e. the modern agriculture. These two give very different results.

b) **Adaptation to local contexts**: The concrete messages on the local context are extremely different, varied, and diverse and therefore the linear transfer of technology is a very problematic issue.

c) **Up – Scaling of SRI / SCI, the need for a learning process:** Technology is something that is passed on to the extension agent who in turn passes it on to the farmer. The process involves much more in SRI, which is a learning process, not only for farmers but also for development agents.

d) **The Public – Private Partnerships: Aiming for factories like efficiency:** It is often felt that the private sector can bring more dynamism, but it should not be forgotten that we work in diverse situations, with diverse men and women, with living plants and animals. There is a conflict of interest between what the private, public sector would like such as concrete constraints and problems, simple, and easy solutions, technology transfer in a linear manner and above all, everything under control, which need not, resulted to a productive outcome. Whereas in the farmers' reality, there are diverse and varied communities and fields, dynamic responses, improvising and adaptation and flexible responses to uncertainties.

Why the superiority of SRI / SCI? Higher yields at reduced costs of external inputs (for seed rates, fertilizers and pesticide applications) under SRI/SCI leading to large efficiency gains as compared with many modern farming practices increasingly recognised as inefficient: stunted individual plants

(Excessive seed rates (stunted roots → poor uptake moisture and nutrients → dense leaf-canopy → poor utilization of solar radiation)

The way forward: SRI/SCI has essentially some simple principles that can be agronomically or scientifically explained, but need to be combined with institutional mechanisms of Farmer experimentation through Farmer Field Schools (FFS) and one need to be open to understanding and encouraging farmer adaptation and adoption

Research on "SRI in India – Rethinking Agronomy and Research Practices": Dr H S Gupta, Director, Indian Agricultural Research Institute

Dr Gupta responded to the presentations. SRI is an idea and there are numerous advantages of SRI such as higher productivity because of higher tillering, higher nutrient (N, P, K) uptake efficiency, profuse root growth, better crop canopy etc. Until now, the contemporary research concentrated on the above ground growth of the plant, but there is a need to focus on the root growth of the plant, particularly in SRI.

However, some constraints need to be addressed. First being the way to upscale. SRI is well accepted among small and marginal farmers who occupy almost 80 – 85% of the land under rice in India. They have poor resources, but surplus labour and therefore labour intensive activity works well with them. After the green revolution, the food bowl of the nation is concentrated in North – Western and Central India, which contributes almost half of the rice produce and almost two – thirds of other cereals in the country. These states have not adopted SRI, which is a major concern. The reason is lack of mechanization due to which large farmers dominated areas are not able to adopt SRI due to issues of labour availability and the wages are ever increasing. There is a need to explore the possibility of mechanization.

As the total biomass can be increased in SRI, and the dwarfing genes continue to be introduced, which is likely to provide a net gain in grain production. More research needed to find out how to improve the nutrient uptake efficiency, how the crop canopy is better, to understand the phenomena of profuse tillering etc. in SRI. A major challenge among scientists is to contribute to increase productivity of small and marginal farms in their tiny plots. Any technology that is labour intensive would be adopted faster by the small and marginal farmers, and enhance larger social well-being.

Increase investment in agriculture Research and Development is required. Currently raise the investment accounted for around 0.8% of agricultural GDP, which recommended to at least 2%. Unless this investment is made, new knowledge will not be generated and delivered to the targeted population.

Central Questions:

- How can SRI be adopted in India and why is it essential, especially after the Green Revolution.
- How should we go forward?

Future of SRI Research: Discussants – Dr Janice Thies and Dr Amod Thakur

Microbes rule the life system. They will determine the health of the soil, the health of the plants, the health of the ecosystems and the health of human bodies. Nevertheless, these are ignored uniformly in almost everywhere that we do. In understanding how they perform in various ecosystems and in the environment, they are responsible for decomposing organic matter, liberating nutrients that can be recycled and taken up by plants. These can be in the form pathogens, which transform nutrients into forms that can end up being pollutants in the environment. For example, the emission of methane gas from paddy fields that require attention. That is a direct consequence of microbes feeding in an anaerobic environment, producing methane. A change in water management in SRI, lower methane production. SRI can therefore be seen as climate smart agriculture in terms of the reduction in GHG production.

An understanding the role and significance of climate smart agriculture help controlling microbial activities such that we get the best possible outcome with regard to the products of nutrient cycling.

Within the SRI paradigm, there are variation of a few of the principles that allow farmers to adapt their management in their own production condition, and issues particularly with regard to how they manage the fertility and water management. SRI influences the changing function of roots and therefore it is critical to understand what causes a larger root system (longer root, larger volume). There is, however, need of major research on the physiology of the plant as the system function differently and are changed with SRI methods.

Although the Green Revolution has been beneficial in several ways, but at the same time we are also paying the price in terms of adverse externality of chemicalisation into the environment, in terms of the soil health, air and water quality and also the food quality. We need to see whether this approach is conducive to resource conservation and sustainability.

With SRI methods, it is likely to have a lesser dependence on the agro–industries for the inputs. In addition, it is a resource conserving technology benefitting humans as well as the environment. In case of the existing relationship between science, technology, extension and technology transfer, the technology transfer is top down disempowering farmers as irrelevant. This is a disincentive for adaptation and experimentation. Farmers must be given the chance to experiment as their environment fit. The same set of principles might not be the same as practiced. Farmers know how their land behaves and different ideas can be applied to best suit the environment. The SRI approach, thus provide opportunity to increase production and empowering for farmers.

Roots would be the key to the second Green Revolution, which has been ignored in the past. It is unfortunate that agricultural R&D systems underestimated the potential of the rice plant. Before SRI, the rice plants were grown in very sub optimal conditions. It is essential that scientists go to high performing fields and understand the science behind such cases so that they can be replicated. For location specific better results and at every stage multi party collaboration is desirable, not only at the farmer and researcher level, but also at the policy level.

Earlier the technology was transferred from the lab to the land, but SRI has reversed it and also shown that it should not be unidirectional.

Theme 1: Open House Discussion

- Village level institutions need to be promoted in order to achieve sustainability. Local production and local resources
- There is a need for an all India coordinated research program on SRI involving multi-disciplinary group of scientists. This is one way of bringing the second Green Revolution through sustainable agronomy.
- The scientific community must codify what must be the protocols for SRI under both irrigated conditions and rainfed conditions. Farmers are willing to practice SRI in Western UP; however, there are no agencies willing to support the work there due to the bias towards rainfed area.
- We need to re look at the Green Revolution and can it provide food and nutrition security. In addition, there is a need to look at the cost of per capita availability of food grains. The cost of per capita availability of food grains has increased due to inflation and because there is a gap of 10 million tonnes of nutrients that we have mined but have not replaced.
- Research must be conducted on labour issues and if we are able to come up with scientific results stating that SRI in certain respects and principles is labour responsive and labour saving, then we can have a clear focus to introduce SRI in those areas where labour is an issue. Similarly, research must be undertaken for understanding that SRI practices help improving soil status and health, and then clearly SRI is asset creating also and the option for sustainability.

Theme 2: Beyond Production and Yields: Food Security, Livelihoods and Intensification

This panel was chaired by Dr Peter Kenmore of Food and Agriculture Organisation and involved three presentations.

FAO's policy advice on Sustainable Rice Intensification and Experiences of Field Implementation in Asia, Jan Keetalar, FAO Regional Office for Asia and Pacific, Bangkok, Thailand

- Rationale for sustainable crop in*tensification and concepts of yield and nature gaps.*

- Recent FAO policy developments and initiatives in support of closing of yield and nature gaps.
- Suggestions for the way forward, including importance of ecosystem-literacy training for smallholder rice farmers.

According to FAO (2013) out of 854 million undernourished people in the world, two – thirds live in Asia. Rice is among the most important cereal crops in the world. Rice is the major staple crop for about 33 countries, 15 of these in the Asia and Pacific region. Harvested area is currently increasing at a rate of 0.4% per annum and global average yield (or farm yield) at close 4.3 t/ha is increasing at a current rate of 1% per annum.

The greatest opportunity for boosting the present level of low yield lies in hastening the closing of yield gap, of the existing technology and BMP while reducing indiscriminate use of chemicals. For instance, Rice plant hopper outbreaks, allegedly due to pesticide (and N-fertilizer) overuse, have occurred at an unprecedented frequency during the last decade. The challenge is how to intensify production in a sustainable manner. Supportive policy is vital. In the developing world, large investments are required in infrastructure, institutions, RD&E and training.

Closing the Nature Gap:

- Understanding ecosystem services & "eco-engineering" vital for local adaptation and responsible management
- Supportive policies, reducing subsidies on chemical farm inputs
- Investments in research and ecosystem-literacy training for smallholder rice farmers

Very recently, the FAO formulated a Regional Rice Strategy (RRS), with the main aim of this strategy is to provide evidence-based strategic guidelines to member nations to help them (1) develop and adjust their rice sector strategies in the light of broader regional and global trends and national priorities and (2) choose among key strategic options while considering the implied trade-offs (or consequences). So far, the Government of Myanmar has been using the Regional Rice Strategy to develop their own rice strategy at country level, and Indonesia and Laos are expected to follow suit.

The Vision for the Rice Economy in the region is:

"Food-secure, better nourished and prosperous rice farmers and consumers in the Asia/Pacific region who benefit equitably from a vibrant, innovative and transformed rice sector that is more productive, efficient and environmentally sustainable by 2030"

Transforming Agriculture Livelihoods – The Experience of Livelihood Missions: T Vijay Kumar, National Rural Livelihoods Mission

The National Rural Livelihood Mission's strategy envisaged to reach out to around 82 million households and stay engaged with them to help remain substantially above the poverty line and aspire to a much better quality of life. The tremendous potential that exists would be harnessed when they are organised and willing to be organised with the help initial catalytic agency to trigger this change. NRLM and SRI are similar – both believe in maximizing the innate potential.

The nurturing women's organisations, especially SHGs and federations are considered critical for sustaining the efforts. The basic challenges are; how do we trigger the formation of these institutions, how do we ensure that nurturing happens, how we ensure that these organisations are self-sustaining; how do we ensure that they are self-reliant. It is believed that in the extension system, anyone whose practice is recognised by others, as being good, become the change agents. This is the basic difference followed in the extension system of NRLM vs. any other program.

The creation of community financial institutions helps granting more access to finance to the poor round the clock. In NRLM, livelihood financing is also added which takes care of the value chain financing. In livelihoods, the program is looking at sustainable livelihoods, reducing risks, and the bottom 20% (the landless poor) are the focus.

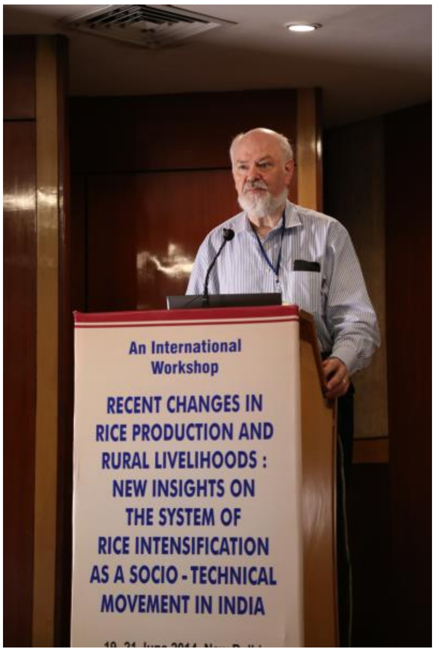
This model has been successful with 30000 families in Andhra Pradesh and is now being taken up in other states like Jammu and Kashmir, Chhattisgarh, Jharkhand, Madhya Pradesh and Rajasthan.

Social mobilisation, institution building and financial support, building a cadre of service providers and professionals and generating community best practices, lay the foundation. This would help them to improve their livelihoods in a sustainable manner.

System of Rice Intensification (SRI) Implications for Indian Development Policy: a Global Perspective and some specific suggestions, Prof Norman Uphoff, Cornell University

Green Revolution technology from the 1960s has contributed to meeting food needs in the *20th century*, but it is becoming less and less relevant to the conditions of this 21st century. The key elements of GR technology have been development and use of new varieties, intensive use of external (purchased) Inputs, and provision of more and more reliable water and agrochemical means of crop protection

However, gains in productivity have been encountering deceleration in recent years as the negative environmental externalities deteriorated soil health and water quality. The seeds + fertilizer + water strategy has been experiencing diminishing returns.



SRI represents a paradigm shift for agriculture (relevant to more than just rice, also SCI) with major policy implications and opportunities. In order to make this happen in reality, India, however needs to act in different directions from current Green Revolution technologies, investments and policies.

- **Reduced Input Dependence** – which has important agronomic, economic, environmental, social, budgetary, and political implications

- **Less Genocentricity** (fixation on varieties) - more concern with gene expression studies in the burgeoning field of epigenetics, and valuing the contributions of the plant-soil microbiome.

Organisations and agencies have been slow to respond to SRI opportunities. However, knowledge and experience are accumulating for more rapid, more economical, more eco-friendly, and more equitable agricultural development. Several Indian states with the help central government support have been proactive, making India one of the most responsive and innovative countries regarding SRI opportunities. The current estimate for China: 3 million farmers, 1 million ha; India: at least 3.5 million farmers adopted SRI in 1.7 million ha. India is now a world leader on SRI, and on SCI, but national and state policies not capitalizing on this fully.

It has been proven with extensive evidences that increase in Crop Yield and higher Factor Productivity is not the only reasons to extend SRI use.

- **Water Savings** – meta-analysis shows an average reduction in total water requirements of 22% and more, and in irrigation water requirements of 35%
- **Fiscal Savings**– reductions in expenditure for electricity and diesel subsidies. Large reductions in fertilizer subsidies without any loss of yield.
- **Climate Resilience–** greater tolerance for biotic and abiotic stresses -- pests and diseases; and drought, storm, temperature extremes, etc.

Theme 2: Open Discussion& Comments

- SRI intervention is more of an empowering intervention, specifically for women.
- SRI / SCI is a spiral growth path of the new production system. It is important to demystify things and keep them simple.
- With regard to community resource persons and transfer of technology, what can be the institutionalising mechanisms for conducting the business, where community resource persons can become knowledge resource persons and are given their due place in society? It requires strengthening of the capacity of the extension workers and provide an opportunity to gain the necessary skills and motivation. The field school trainers could take up this initiative.
- Because of the impending energy crisis, ground water depletion, the need for reforms in irrigation system etc., there is a need to look at opportunities SRI can provide at the macro level.
- An objective analysis is needed for this a socio–technical movement. Most agronomists look at achieving higher yields without thinking about the cost. Farmers cannot afford to do that. They have to think of the net benefits. For them, resource balance is crucial.

- It is important that the information be given to the policy makers. There are many data available, but it has to be put together.
- There have been attempts in the past to include discussions with the International Rice Research Institute (IRRI) and even host a workshop where experiences from across countries and regions on SRI can be held. We think it is time for FAO to take a lead on this and organise such an interaction where cross-country experiences can be shared and lessons learned.

Theme 3: Newer Policy Directions: Opportunities in Rainfed Rice

Dr Ravi Chopra from PSI moderated this theme. There were four presentations followed by two discussants – Zulfiquar Haider of Bharat Rural Livelihood Foundation and Anil Verma of PRAN, Bihar.

Irrigation System Reforms: New Policy Opportunities with System of Rice Intensification A. Ravindra and Debashish Sen, WUR and Wassan / PSI

Learning from SRI and Water saving

- Increases Yield (10 to 25% on an average) – much higher, if the base productivity is low.
- Net returns increase
- Adaptable across diverse agro-ecologies
- Reduces water use. Its potential, however, is marginally utilized in the field

Realizing the larger potential of SRI in water saving mainly requires:

a) **Reorganisation of**:

- Work/ task groups and their re-organisation across skills, farms, wage rates and gender
- Timing of operations

b) **Reformation in the systems of water application**

- Timeliness of water availability and
- Better control & management of irrigation systems

Rice and Water: Typologies for a Policy Framework:

1. Rainfed
2. Rainfed with local irrigation systems (farm ponds, diversions, tanks. etc.)
3. Groundwater/ energy based (bore wells, lift irrigation systems)
4. Large canal/ gravity systems
5. Conjunctive systems – ground water & surface

There is a need to maximize the potential of these water systems.

Constraints

a) **Rainfed**

- Low soil-moisture retention capacity
- Drought Spells & Uncertainty
- Flooding: not willing to drain soils

b) **Rainfed with Supplementation**

- Long drought spells

c) **Groundwater/ energy based**

- Ground water scarcity/ aquifer depletion
- Uncertainty of electricity supply
- Energy costs & Increasing burden of subsidies (macro issue)
- Flooding: as a result of 'perception' and uncertainty

d) **Large canal/ gravity flow systems**

- Lack of drainage
- Irrigation/ water release schedules' irregularities
- Salinity
- Absence of Field channels / delivery – at plot level
- Flooding: due to un-controlled irrigation & lack of farmers' control

e) **Conjunctive systems – ground water & surface:** (mix of above)

The practice of flooding is persistent in almost all communities, even where there is a water scarcity. Flooding is a matter of perception, flooding is a consequence of several constraints, and therefore needs a system level solution (not just a farmers' choice). It is a systemic problem. There is a need to reform the irrigation systems with SRI as an instrument.

Enabling SRI as part of irrigation reform

1. Soil organic matter improvement.
2. Local water harvesting systems must be a part of the SRI promotion package.
3. Monitoring tool, for farmers to trigger irrigation (AWD- FMT).
4. Improving farmers' capacity to understand the relation between rice crop and water. Farmers have a belief that water is required and this belief is not challenged.
5. Irrigation Systems Reform (Specifically for Canal Systems):
    - Institution development;
    - Participatory irrigation scheduling;
    - Infrastructure investment on irrigation distribution network and control up to plot level;
    - Adequate drainage infrastructure;
    - Soil problem amelioration.

Building on SRI Institute – Private Sector and CSR Initiatives on SRI, Yezdi Karai, Usha Martin University

Total Village Management Model which transforms beneficiaries to become producers, entrepreneurs and customers. The Public Private People's Partnership Model, which converges private fund, public fund and people's contribution to undertake several activities.

The social capital group is formed for developing a safe domestic ecosystem of sanitation, infrastructure, health, education etc. SRI becomes a part of the economic development of a village.

- **What are the Strategies for scaling up**

Undertaking a Playbook Approach in which one looks at different situations that require resources.

- **What would the SRI Institute have**

It will be a community led centre. It will be open to anybody who wants to be a part of the centre. It will not only have research, but also a total resource for Knowledge, Solutions /Services, Training, Network Linkage etc.

Yezdi Karai invited the members present to contribute their ideas on the SRI Institute and present their wish list, which the new university with KGVK will try to implement.

Area Approach to SRI Extension – Emerging Lessons from a convergent program on scaling up SRI in Andhra Pradesh, S. Bhagyalaxmi, WASSAN

The AP SRI Consortium is an association of interested civil society, research, extension, media, funding organisations, individuals and government departments formed with the objective of pooling of experiences, expertise and resources for the promotion of the System of Rice Intensification in the state of Andhra Pradesh. The objective of the AP SRI Consortium is to synthesize and pool experiences, expertise and other resources on SRI, accumulated over time with various associate organisations and individuals for providing active support to promote SRI on a large scale in Andhra Pradesh.

Constraints

- Delays in fund release when working with the Department.
- Dedicated Secretariat within the agriculture department required. Currently the Secretariat is with WASSAN.

- If public investments are to be utilized, there is a need to get involved in such programs like NFSM in which 0.5 area has to come under NFSM and farmers will get Rs. 7,500 per ha.

Policy issues for SRI adoption, Dr R.M. Kummur, CGM, NABARD

- Delineation of the SRI area in the country: SRI can lead to higher productivity. Although it started as a civil society initiative, it cannot be scaled up until the government, which has the mandate and the budget comes forward. It is important to understand the scope of bringing a particular rice growing area under SRI in each state looking at the topography of the state.
- Convergence of Govt. Programmes: There is a scope for Public – Civil Society Participation (PCP) because the civil society has brought it to a stage where the public sector has to take it forward. Even within the government, overhauling of certain systems has to take place.
- Mechanization to suit both Irrigated and Rainfed conditions for weeding, transplanting etc.: Where labour is a constraint, mechanization should be introduced.
- Organic Input Production: whatever time is being saved in SRI, it must be used for green manuring.
- Increase in SRI cost of Production: The banking system needs to be informed of the scale of finance required for SRI cultivation.

Open House Discussions

- We have proved water use efficiency at the plant level and farmer level, but we have never proved water use efficiency at a larger level. The traditional approach of institutional mechanism will never work. Local community involvement is very important. One model can be the community - collaborative water management in which women are involved and taught water budgeting.

- Mechanisation is needed, but it is also essential to develop capacities of SHGs for transplantation.
- PRIs' involvement is very essential for making SRI a mass movement.
- How much of the SRI generated economic benefit has resulted in additional yield – a research must be conducted at the national level.
- A very smart communication model on SRI should be developed.
- With the help of NABARD's regional offices in the 13 states, the Project Implementing agencies and the involvement of the national consortium the potential should be assessed, a feasible plan should be made which can be implemented in the next five years.
- One of the reasons for disadoption is uncertainty of rainfall. Farmers do not get the time for preparing the field.
- There is a need to reach out to political leaders and getting the directions through them.

Panel 4: Panel Discussion on Assessing SRI in the future

Agricultural Transformations in SRI: Beyond yields, changes in work routines, farmer attitudes AND What does all this mean for assessing SRI in future: Closing comments by panellists: A. Ravindra, B. C. Barah, Rob Schipper, Sabarmatee, Anil Verma, Debashish Sen

The important features that we need to understand about SRI are not to do with yield only, but also why farmers and communities find it beneficial and other dynamics that are going on.

- Whenever we discuss agricultural technology, we centre our discussions on yields. Several other variables in the field contribute to the yield. Yield is only the outcome. The assessment parameters for conventional rice and SRI would not be the same. When we try to understand technologies getting adapted in the field, we should not go with any pre assumptions. The aspect, which is never discussed, is the ability of the farmers to impact/shape technology.
- When we talk about a set of principles and practices, it does not end there. Farmers may adopt a few of the principles/practices and not all, but we just label it as non-SRI. In addition, when we talk about training programs, it is not the end, but its follow up in the field is required.
- In our discussions, we bypass the important role of women. In SRI as in case of conventional rice also, weeding and transplanting, the two most important operations are done predominantly by women. They also need to be involved in our discussions.
- The trigger for Green Revolution was in finding productive genes. Today's challenges are soil, water and climate. Can the whole paradigm of SRI be looked as an agro – ecological and economical innovation? It is time that we re- look at the processes, which are slowly being accepted by the farmers. Can we build an entire architecture of investments and institutions? This assemblage may potentially have answers to the current problems that we are facing in soils, ground water depletion, climate change etc.
- SRI is bringing food security and is adding quality of life for the common farmer. There is a need to build cadres of local people for its promotion. We must only promote the principles and let the farmers decide what to do and what not to do. We must have a vision and dedicate ourselves to the vision.
- The two main aspects seen by farmers beyond yields are risk aversion and to get maximum out of farm diversity. In terms of policy and upscaling SRI among farmers, we need to support them in these two aspects. The need of farmers may vary depending on their individual requirements. Whether SRI or non-SRI is a problem for us, but for farmers it is just about growing rice.
- SRI has helped farmers in getting together. Over the last 20 years, farming has become more an individual operation. In SRI, the operation of raising smaller nurseries gives the scope of collaboration among farmers. Those farmers who do not have the time to raise individual nurseries can simply give the seeds to other farmers to raise seedlings for them. Farmers look at SRI as a complementarity to the existing methods.
- The research community must come up with guidelines for conducting impact assessment along with farmers. In addition, it is important to understand the methodologies adopted in the studies undertaken and learn from them, and build a common database.

- We must evaluate SRI and other rice cultivation as part of the farming system, as diversity is very important.
- We are talking about a producing society and not a benefitting society. Our emphasis has been on production. We have to go beyond production to make the whole system understandable to the producers. We need to talk about production for social benefits. Our assessment methodology has to be different. Can we quantify ecological services, which is not an easy task?
- We need to have a unified system. Presently, all knowledge and information is scattered.

Areas for Policy Interventions and Recommendations

Water

In the irrigation sector, there are many discussions amongst water boards, water associations and water user associations about sharing of water. It is time now to insert in these discussions the issue of crop water requirements. The critical question is how rice can be grown with less water. This area requires involvement of irrigation engineers, agronomists and producers. The scientific community needs to codify what must be the protocols for SRI under irrigated as well as rainfed conditions.

Considering the energy crisis and ground water depletion, irrigation systems need to look at opportunities that SRI can provide at the macro level in this context. Water use efficiency at the plant level and farmer level has been demonstrated, but we have failed to deliver water use efficiency at a basin or sub-basin level. The traditional institutional mechanisms may not be sufficient. Local community involvement is very important. A possible model can be community driven collaborative water management in which women are involved, taught and supported for water budgeting.

Dealing with Organic Material

The organic material is a crucial element of soil fertility and is more widely advocated for rice plants in SRI and SRI kind of methods. A lot more can be done to increase the organic material in the fields and make it available to the plants. In agricultural research and agricultural policy, organic material is not given much recognition. There is a need to see it as a resource. Not only the animal manure, but also all kinds of organic material available in the environment are beneficial for fields.

Pests and Diseases

There is a need to understand the factors responsible for diseases, pests and physiological disorders in the plants. When and why does the immune system of plants fail to work? In addition, In SRI, how and to what extent, immune systems are built up helping the plants to grow more holistically and give more yields.

Cross Institutional Exchange and Cooperation

In the policy as well as research fields, disciplinary silos and orientation of researchers does not allow for sufficient integration and is a major impediment not only for policy research. This also has a direct impact on farmers' fields. Because irrigation boards do not work with agricultural institutions, there is a lot of loss in terms of what otherwise could be achieved in terms of water saving and agricultural produce.

FAO could be asked to organise an International Workshop on experiences and learnings in SRI. This would help in mobilising public opinion and resources. SRI is currently completely dependent on established institutions whose doors are not yet open. There is a need for an All India level Coordination Program to decide actionable strategies based on given suggestions.

The Government of India spends roughly around Rupees 1 lakh crores annually on rural development initiatives in the country. The question is on what components government money can be invested. What are the lessons that can be learnt from earlier initiatives that have failed?

In terms of convergence of various concerned line departments and Ministries, the experience has been rather poor. The only logical and effective point of convergence can be a Gram Panchayat. How do we strengthen that mechanism? What is the role that local governance can play because that is the only legitimate system that has an inbuilt accountability aspect and they must not be ignored? The Constitution of India mandates decentralized participatory planning, and SRI methods can be promoted through these systems. We seem to believe that a strong technological argument is the most important factor determining policy direction, which is probably not only true. Often a few people sitting in a room land up deciding the direction of a policy initiative. Can we do better policy advocacy through more strategic ways in terms of understanding negotiations, the politics of policy making and advocacy.

There has been a demonstration effect in areas where people are more organised. The image of government departments is such that they can only provide seeds and fertilizers. There is a need to deconstruct the image and build alternative institutional mechanisms where farmers can have a positive environment.

Current Policy Regime

There has been a significant stagnation in incremental response to input use and the growth rates of rice and wheat production in the given conventional system. It is not because of science not contributing but mainly because there has been no agricultural policy in the country. For the first time, a policy document was prepared in the year 2000, but it has still not been presented in the parliament. For science and technology, there have been several policies. For industry, several documents have been tabled in the parliament and discussed. Nothing like this has happened with agriculture.

The ways in which excessive centralization has affected the central research system needs to re-examine and there is a need to have greater involvement of the State Agriculture Universities. Why is there is a rigid centralized system which is incapable of doing the kind of agronomy that is needed at the decentralized level?

No silver bullet solutions – policies, approaches, production systems & management practices need to be tailored according to agro-ecological regions and local smallholder farmers' needs, opportunities & challenges.

The simplest and cheapest way to accelerate SRI adoption would be to make provisions so that farmers receive 10% premium for SRI paddy. SRI paddy, when milled produces 10-20% more polished rice because of less chaff (fewer unfilled grains), and less breakage of grains during milling.

With SRI methods, hybrid varieties have been reported to give higher yields in terms of quantity, but not necessarily higher grain quality. Policy should not promote hybrids at the expense of rice biodiversity, displacing & losing local varieties. India's staple food needs can be met with a mix of hybrid, improved, and traditional varieties. Let the market and consumer preferences decide the balance. Policy should be guided by factors like conservation of rice biodiversity, nutrition etc. rather than simply yields and profitability.

Indian food policies must give thought to the effects of Climate Change. Water saving and drought-tolerance are becoming more and more important. Pest and disease hazards are likely to increase, so crops' resistance to these is becoming more urgent. Reductions in greenhouse gas emissions from agriculture will help to buffer global warming effects. Currently, irrigated rice is a major source of GHGs. SRI can reduce GHG emissions.

There is currently no level playing field in the way agricultural subsidies operate. They are all serving current systems that are resource degrading instead of providing incentives for agro - ecological innovations like SRI. Artificially low prices of fertilizers, promotion of hybrid seeds, plus subsidization of electricity and water, all create large fiscal burdens of government.

Extension Services

What is required is supply of inputs to the farmer at the right place at the right time along with the required technology at the doorstep. The right price must be given to them. Today, the biggest weakness of the system is extension services. Agriculture is a state subject in India. The Federal Government is in a supporting role only and has limited responsibilities. Extension is the responsibility of the State Government. Before the Green Revolution, the transfer of technology happened from person to person since ICT did not exist. Today, despite having ICT in abundance, we are not able to reach to the farmers. The State Government really needs to come forward to put people for extending support to farmers. Until we bring prosperity amongst the rural masses, we cannot bring prosperity in India.

In the extension domain, it is important to reorient tasks and responsibilities of extension personnel from just promoting inputs and promoting their sales; to communicate, refining and applying ideas and knowledge. This needs different orientation for facilitators more than as advertisers or promoters. More support for farmer-to-farmer extension activities for the horizontal diffusion of innovations rather than emphasizing top-down promotion, which lacks precise local applications and credibility.

With regard to community resource persons and transfer of technology, what can be the institutional mechanisms so that this can become part of the way business is conducted? What can be the mechanisms through which community resource persons can become knowledge bearers, given their due place in society? There has been a lot of struggle in the entire farmer field school movement that FAO has been involved in and there are various models of institutionalization across Asia. If extension workers are provided with the opportunity to gain the necessary skills and see how it benefits them, they will be motivated to adopt the practices. In Philippines, there are farmer field school trainers who have taken up this initiative.

Research

India is a world leader by default and not by design. It should not be a reluctant leader. There is hardly any other country doing as much research on the System of Crop Intensification (SCI). There is a high potential for research. Little research in key states with high SRI presence has been done till now. The quality of research on SRI can be repetitive and poor if not connected with the larger research community and is done in an isolated manner. At present, there is very little opportunity for the researchers to come together. ICAR has not had even a single conference on SRI / SCI. The bigger challenge is that we should be doing research differently. Interdisciplinary teams need to be formed and working together. Can research management be done collaboratively? There is a case for greater investments in research. There is a need for an all India coordinated research program on SRI and all scientists must come together for the same. This is one way of bringing the second Green Revolution through better agronomy. How much has SRI contributed to economic benefit through additional yields – a research must be conducted at the national level?

Sustainable production is knowledge intensive – investments in agricultural research are required for development and capacity building for ecosystem-literacy training. Reduce the social and other distances between 'lab' and 'land' and support two-way communication, with more farmers' participation in framing research questions and in conducting and evaluating in-field research.

On-station research may not always be giving the most appropriate results, particularly because the contributions of the soil biota (which are always location-specific) are usually ignored in most current agronomic research.

Strengthening Community Based and Community Led Institutions

Village level institutions need to be promoted in order to achieve sustainability. SRI is more of an empowering intervention, especially for women.

In India 85%, farmers are small and marginal and face resource constraints. How policies and research can frame their agenda based on the perspective of these farmers, particularly the deprived sections. Science should address the need of society and culture. If we look at the FAO's strategy on rice, there are various chapters on rice policy. Building sustainable farmers organisations is crucial because this whole effort of knowledge dissemination, marketing and policy advocacy require grassroots farmers' organisations. Under NRLM, along with building generic SHGs and their federations, there will also be value chain institutions. This intervention was lacking. Earlier cooperatives were meant to do this kind of work, but this has not worked. SRI / SCI is a spiral growth path of the new production system. It is important to demystify practices/technologies and keep them simple.

How can we build farmers' institutions that can handle issues like reorganising work and time issue, reform water applications, build participatory irrigation systems and follow water scheduling etc. The question is who is going to create these farmers institutions. What is the degree of knowledge and understanding that we have in our country for establishing robust and strong democratic farmers' institutions in our country. The amount of work done till now is not sufficient for SRI to be scaled up. Academicians must collaborate with practitioners to develop knowledge and build human resources who can take it forward. PRIs' involvement is very essential for making SRI a mass movement.

Food Security

We need to re look at the Green Revolution and see whether it has achieved food and nutrition security. In addition, there is a need to look at the cost of per capita availability of food grain. The per capita availability of pulses has gone down because more area under irrigation has been taken over by rice and wheat. However, with renewed efforts, over the last few years, the pulse productivity has increased. The cost of per capita availability of food grain has increased due to inflation. There is a gap of 10 million tonnes of nutrients, which we have mined but have not replaced. The total factor productivity has started to increase. Closing both yield and nature gaps is vital for global food and nutrition security.

Labour Issues

The most binding constraint in agriculture is not land and water, but labour. India can still increase its irrigation potential. By 2050, only 20% of the total labour force will be working in agriculture. While increasing the total production and productivity of land and water, we also need to increase the labour productivity several times. There are serious issues related to labour in Indian agriculture.

Research must be conducted on labour issues. If we are able to come up with scientific results that show SRI in certain areas is labour responsive and labour saving, then we can have a clear focus to introduce SRI in such areas. Similarly, research must be undertaken to check whether SRI works better in nutrient poor soils, then we can promote it as an alternative for farmers. A multi-disciplinary project group is recommended to take up research on processes.

Labourers become both more skilled and more productive with SRI and they should be remunerated appropriately, receiving a fair share of the value-added by their skilled labour. Training should be given to agricultural labourers, with appropriate arrangements for surplus sharing, or premium added to labourers' daily wages. Whether SRI is labour-intensive or labour saving depends on the prior degree of intensity.

In areas where there are labour shortages, mechanization should be invested in. There is a need to have better implements and tools for SRI/SCI in order enhance (1) labour productivity, (2) reduce drudgery, and (3) reduce labour requirements. Tools must be developed with farmers' participation, which are less costly and more effective (through open design competition**,** rather relying on design contracts). Motorized weeders and mechanical transplanters can significantly reduce labour requirements; also do direct seeding or broadcasting/thinning.

NRLM can give labour credits to SRI / SCI as labour is an important element, which takes time to adapt. Meaningful employment can be created with such a system. There is a big controversy whether SRI is labour intensive or labour saving, but the fact is both depends on where we start. Sorting this out with documentation is very important for the policy makers and others as well.

Infrastructure

Because there is social as well as the economic value of water saving in SRI, one should invest in improving land levelling and water harvesting structures so that farmers can grow more food with less water. In addition, fertile soil should be regarded as agricultural infrastructure. There is a need for building up soil organic matter as a national priority and productive use of unskilled labour. In addition, farm-to-market roads and storage facilities can and should be improved, for marketable surpluses.

Marketing

Along with the hardware of marketing (facilities), one should develop market software (organisation). SRI methods can produce superior quality rice (organic. This needs its own marketing channels so that both farmers and consumers benefit. In addition, SRI can raise the yields and profitability of local/traditional/heirloom varieties of rice. There should be specialized market channels so that both farmers and consumers can benefit. Marketing systems should be organized to accept and reward better quality, eco-friendly grain.

Is it possible for us to get the best brains in marketing and advertising to come together? It is an investment worth making looking at the kind of pay off we are talking about. A very smart communication model on SRI should be developed.

Prices

The biggest challenge that we are facing in India is that growth is driven by prices. On Indian agriculture, we have reached a dangerous situation where if the real prices of agricultural commodities go up, then the growth rate accelerates and if the prices go down, the growth rate decreases. Over the last several years, the average cost of production has been increasing and that is why we now need a paradigm shift from growth to efficient growth, which is accompanied by a reduction in the average cost of production. A shift in production function is needed and SRI represents a different kind of production function.

Physical yield gap is of no meaning when prices are so important. Therefore, it is important to look at the economic yield gap. It is important to understand how we can make this a socio – technical analysis. Most agronomists look at achieving higher yields without thinking about the cost. Farmers cannot afford to do that. They have to think of the net benefits. We have not given enough attention to economics. At the end of the day, the resource balance has to be considered. It is important that correct information be given to the policy makers. There are many data available, but it has to be put together.

Technology

Any technology requires a particular environment or context to be accepted. It may be having great merits, but if the environment for its acceptance is not conducive, then that technology will not be accepted. In the last 30 years, the focus of developing countries was on growing food grains in whatever manner possible. Sustainability was not a serious consideration. However, things have changed. India has moved from scarcity to food security and many developing countries are moving from self-sufficiency to surplus. The environment in India and many other developing countries for acceptance of SRI is much more favourable now.

We need to be very careful to select the parameters to compare two sets of technology. Until now, the parameters selected for comparing SRI with conventional rice have been those, which give advantages to conventional technology. If a technology has some strong merit, it is accepted. In SRI, even if the economic benefits are small, natural and social resource benefits are high. There is a need to publicise these benefits and publish them in journals that have a wider readership.

RESEARCH ABSTRACTS

Shifting intensification: Findings from Socio-technical research on SRI in India

Harro Maat, Knowledge, Technology and Innovation (KTI) Group, Wageningen University, Wageningen, the Netherlands

The paper presents results of the four-year research programme investigating the System of Rice Intensification (SRI) in India as a socio-technical movement. Social movements are commonly defined as collectives or organizations, which focus on specific political or social issues in order to instigate, resist or undo social change. The social issue the SRI movement addresses fits the overall development agenda to resist and undo growing social-economic inequalities, in particular inequalities between farmers in the rural areas of India. Calling SRI a socio-technical movement highlights the role of material factors in social change. This also implies that a focus on socio-technical collectives and organisations, rather than the opportunity for the individual farmer to grow more rice with less external inputs. The introduction of SRI caused a rearrangement of rice farming as a socio-technical practice through a reconfiguration of task groups, inputs, seasonal calendars and cultural institutions. These rearrangements go beyond the fields where SRI is practiced and have an impact on the entire farming community, the various ways in which rice is cultivated, cropping patterns, additional agricultural activities and off-farm income sources. The socio-technical movement character further expresses in the challenges SRI poses to wider institutional arrangements, for example irrigation system management, agricultural research or markets for inputs and agricultural commodities. These changes lead to various patterns of intensification, the

major ones being labour intensification to rice, input intensification to rice and distributed labour intensification. It is concluded that in order to reach its goals in undoing social-economic inequalities, SRI, as a socio-technical movement requires further flexibility and experimentation to serve the various patterns of intensification.

Understanding dynamics of labour in System of Rice Intensification (SRI): Insights from grassroots experiences in Odisha, India

Ms. SabarmateeTiki, PhD student, Knowledge, Technology and Innovation Group, Wageningen University, Netherlands

Rice culture and agriculture is a function of coordinated efforts of men and women, having diverse relations where their division of work depends largely upon embedded social prescriptions, terrain characteristics and technological options. When a technology changes, it is likely that the technology affects end-users, that is men and women labourers, in turn, they also affect the technology. Around 2000, a new agro-production technology called System of Rice Intensification (SRI) that evolved in Madagascar entered into the rice landscapes in India. SRI prescribes major modifications in practices like transplantation, weeding and water management for yield enhancement, which require a new set of skills that challenge the age-old rice-growing methods leading to different gender ramifications. In this situation, labour plays a crucial role in implementation of SRI, which is diverse, heterogeneous and complex in nature.

In the initial stage after introduction of SRI, like many other production strategies, focus centred on yield and adoption. Until now, scholarly articulation on SRI focuses mostly on biophysical aspects of rice-growing and socio-economic aspects of cost and adoption dynamics where issues like labour-technology interactions from gender perspectives is inadequately addressed. Wherever it is addressed, labour is mostly treated like economic unit instead of social entity. This paper attempts to understand the interaction between labour and technology from a gender perspective taking the weeding and skilling as examples. It elucidates the gendered dimensions of weeding and weeder use, and the process of skilling, in the new equilibrium.

Multiple parallel case study design is adopted for the overall study. Three villages were selected purposively in Odisha in India having diverse agro-ecology, ethnicity, labour and wage systems, rice-growing practices, extension architecture and SRI history. General observations of rice-growing practices were done in 2011-12 and 20 households from each village were selected randomly (from SRI farmers list of 2011) for intensive observation in 2012 who cultivated rice in 545 plots during Kharif (June-December) season. A combination of tools like Focus Group Discussion, individual interviews, story-telling, field-level observations including taking weights and measurements of materials and spacing, photography and Rapid Comparative Pain Assessment method were used for data collection which informed various aspects of labour.

Varied weeding patterns emerging from recommendation of frequent weeding with mechanical weeders in SRI pose new challenges to traditional gender roles and bodies of labourers. Introduction of specific models of weeders enabled both genders to undertake mechanical weeding, mainly in family farms. This change, however, could not yet influence deep-rooted gender-specific wage asymmetries although both do equal work and ensure men’s participation in manual weeding. Degree of participation of men and women in mechanical weeding and pursuit of weeding schedules depend upon factors like natural environment, extension strategies, household-level gender roles, negotiations among household members, age of the labourer, livelihood strategies, ownership, availability, accessibility and adequacy of weeders. Not only users, women's groups also emerged as managers of weeders where it is consciously facilitated by the extension agencies. Reduction in work time, change in posture and participation of men produce different bodily experiences for men and women. Bodily experiences play a determining role in use/rejection/acceptance of models of weeders.

Extension agencies arrange some modicum of training for the farmers where number and proportion of men and women depends upon the extension strategies. Next to nothing is available for agricultural labourers although smallholders are also labourers. Often sending farmers for exposure visits to SRI fields or conducting training programs is equated with skilling and agricultural labourers, mostly women, are generally excluded from even such a semblance of skilling through exposure. It was found that social learning, individual learning is continuous and integrated in the lives of the labourers, and hardly any mechanism is there to facilitate this.

This study emphasises that weeding schedules, gender-wise work participation and bodies are affected by agricultural technologies in their social-material context, which also affect technologies in turn. The study suggests integrating gender and physical issues with interdisciplinary approach in agricultural technology evaluation, for involving men and women in choice, design/development and application of gender-sensitive technologies, and for steering innovative extension and scaling-up strategies for better organisation of labour.

User Adaptations in Rice Farms of Uttarakhand: Landscape and Farm Level Interactions

Debashish Sen, Peoples Science Institute (PSI)

System of Rice Intensification (SRI) is said to have been evolved by farmers of Madagascar during 1980s. In spite of the persisting scientific debate, the system is claimed to have spread in more than 50 countries. Past studies have not paid much attention to the meanings that farmers have given to the system in different agro-ecological contexts. Adherence or deviations from recommended practices and mixed performance of the system have been reported, overlooking farm diversity and dynamics of human relations. My research therefore explored how farm households adapt SRI according to local biophysical and socio-cultural context. This paper in particular presents farmers' strategies in crop establishment and water management practices by exploring farm and landscape interactions, and social organizations around rice farming.

The study was conducted over three rice seasons (2011 to 2013) and focused on three contrasting villages situated in Bhilangana sub-basin of Uttarakhand, India. The study followed an ethnographic approach using a mix of tools: participant observations of all rice plots of 30 randomly selected farmers (10 from each village), focus group discussions, and semi-structured interviews with key informants. All SRI plots with transplanting patterns were mapped for two seasons. Study of transplanting groups, plot level measurements of transplanting characteristics and daily water depths of randomly selected SRI and non-SRI plots along with semi-structured interviews clarified farmers' strategies.

Scattered layout of irregular small sized plots, varying soil conditions and elevations, diverse cropping patterns, a predominantly cascade irrigation system, and limited labour and draft made it difficult to practice SRI as a standard package. Hybridization of existing practices and SRI elements led to emergence of array of rice cropping systems across farms. Technological adaptations were accompanied and complemented by institutional reconfigurations in task groups undertaking specific activities, along with changes in socio-cultural norms guiding rice farming. Farmers preferred to follow SRI in middle reach of perennial canals with early transplanting of young seedlings and reduced planting density. Water depth was increased gradually from crop establishment to flowering up to grain filling, but was kept considerably less than for existing methods. Farmers with an unreliable water supply used old seedlings, permitting the common flooding practice, though plant spacing was still widened.

The study highlights that socio-technical assemblages around crop management are contextual, complex, contingent and negotiable. Their meaning varies across space and time. A standard package of agricultural practices as in SRI therefore may not be workable for all farm households. Yet, farmers might benefit from individual components of SRI such as wide plant spacing. Reduced water depths as under SRI also indicates a large potential of water saving. Based on our research the relevance of the standard concepts of “adoption-disadoption – non-adoption” that are popular in the agricultural development sector, could be questioned. In the past, quick and superficial assessments done soon after SRI’s introduction have bypassed important features of progressive adoption of SRI practices also occurring in existing rice systems. The study thus calls for collaborations between agronomy, irrigation engineering and social sciences to arrive at viable crop management options.

Groundwater Irrigated Rice: A Techno - Economic Exploration of the possibilities of producing "More Rice with Less Water"

A. Ravindra, WASSAN and Rob Schipper, Wageningen University

Purpose: Rice cultivation has been expanding into water-scarce semi-arid areas. An absence of water pricing and policies that supply electricity at free or flat rates leave little incentive for farmers to save water and constrain scaling-up of water-saving measures such as Alternate Wetting and Drying (AWD). Using tools developed for ‘safe-AWD’ by IRRI, the present on-farm research makes comparisons of System of Rice Intensification (SRI) and conventional rice cultivation. It explores whether SRI integrated with ‘safe-AWD’ can provide a better incentive to farmers for practicing water-saving measures, i.e. ‘producing more rice with less water’.

Approach and methods: A random sample of 41-paired rice plots (SRI and conventional methods) studied within seven villages in two semi-arid districts of Andhra Pradesh, India provided the data. Daily water level observations from AWD- ‘field water tubes’ installed in the farmers’ plots were used to develop a Mean Daily Inundation Index (MDI), as an indicator for irrigation water use. Agronomic and yield data were collected from field samples and structured surveys provided data on input use. Descriptive statistics, Cluster Analysis, Principal Component Analysis, and Linear Regression models were used in the data analysis.

Key results: In spite of serious water scarcities, farmers could maintain water level in the fields just at saturation levels. Comparison of MDI against the safe-AWD standard of -15 cm indicated potential water savings ranging from -3 to -6 cm MDI. Paired sample differences showed a statistically significant yield advantage with SRI at 12% (6.5 q per ha) over conventional practice, while cluster analysis showed a yield advantage of SRI with square planting over conventional methods at 22%. Regression results confirmed the positive influence of SRI in explaining yield variation and insignificance of MDI at vegetative and reproductive phases in explaining yield variation.

Synthesis and application: The results point towards potential reduction in water use while achieving a yield increase ranging from 12 to 22% in the study areas. Integration of safe-AWD tools with SRI principles can potentially provide a policy lever for effective scaling-up of water-saving measures. Synchronising water and energy policies with the promotion of 'safe-AWD integrated SRI' will be much more effective.

Evaluating Water Use, Water Savings, and Water Use Efficiency in Irrigated Rice Production with SRI vs Standard Management

Pratyaya Jagannath, Hemant Pullabhotla, and Norman Uphoff

A meta-analysis was done of data from 29 published studies comparing SRI and non-SRI methods of irrigated rice production that gave results from a total of 251 comparison trials. The purpose was to assess differences in total and irrigation water use associated with SRI vs. non-SRI rice crop management practices, evaluating water savings achieved with SRI management and calibrating differences in water use efficiency.

A SRI characterization matrix was used to assess the degree to which specific trials represented SRI or non-SRI management, based on the number and extent of specified agronomic practices used. This avoided purely nominal classification.

Descriptive statistical analysis showed a clear advantage in water use and water productivity for SRI management compared to use of more standard cultivation methods. The mean water use with SRI management reported from the studies was 12.03 million liters ha^{-1}, compared to 15.33 million liters ha^{-1} when more conventional non-SRI methods were used with continuous flooding of rice paddies. This represents a 22% average total water savings of about 3.3 million liters of water ha^{-1}.

Since the average paddy yield per hectare with SRI methods in these trials was 5.9 tons compared to 5.3 tons using more conventional practices, the higher yield was achieved with less input of water. As the rainfall was similar for both methods of management in all trials, the water savings in terms of irrigation water applied were relatively even higher with SRI methods. Analysis of trial results showed an average reduction of 35% in irrigation water applications associated with the higher grain yield.

Total water use efficiency (TWUE) was found to be 52% greater with SRI methods since the mean productivity for SRI across the various trials was 0.6 gram of grain per liter of water, compared to the 0.39 gram of grain per liter produced with non-SRI methods. In terms of irrigation water use efficiency (IWUE), SRI trials had an even greater advantage as these methods produced on average 1.23 grams of grain per liter of irrigation water, compared to 0.69 gram of grain per liter produced with non-SRI crop management, an advantage of 78%.

Further analysis showed that these advantages of water saving and water productivity with SRI management were manifested across different contextual conditions for rice production, considering variations in cropping season, in climate, in soil texture and pH, and in rice variety planted (length of crop cycle). These improvements were confirmed by multivariate regression analysis.

Many interests will be served by being able to reduce water requirements for paddy cultivation. SRI is an innovation presently available at little or reduced cost that can benefit producers, consumers and the environment by enhancing food production and the economic returns to farmers at the same time that it reduces demand for water in the rice sector.

Revising agronomic and socio-economic paradigms for crop improvement: Findings from SRI research globally

Norman Uphoff, SRI-Rice, Cornell University, USA

Most agricultural research aims at making incremental additions to the body of scientific knowledge. From time to time, however, an accumulation of new knowledge first challenges and then changes the way that phenomena, natural or social, are understood and are acted upon, in what is characterized as a paradigm shift. This builds upon incremental research findings, but it requires most importantly some new vision and re-conceptualization. Progress in science depends more upon such shifts than upon piecemeal accretions of knowledge. Indeed, these additions are themselves conditioned (and constrained) by whatever constitute the prevailing paradigms. These depend upon simplifying assumptions that screen in some information and screen out other information; further, they are limited and even biased by the methodologies and measurements that they prescribe.

We are seeing that after 15 years of research and over 400 published articles (http://sri.ciifad.cornell.edu/research/index.html), and with demonstrations of efficacy now in over 50 countries (http://sri.ciifad.cornell.edu/countries/index.html), the ideas and methods of the System of Rice Intensification (SRI) -- and its derived/expanded version, the System of Crop Intensification (SCI) – have been taken up by >10 million farmers on as many as 4 million hectares in over 50 countries.

This spread has been fuelled by higher crop yields that are achieved with reduced inputs and with lower costs of production, and there are enhanced resistance to biotic and abiotic stresses and other advantages, which make SRI/SCI attractive. These features derive from making SRI/SCI changes in the management of plants, soil, water and nutrients.

Researchers and farmers have not expected that it would be possible to ‘produce more with less,’ because the prevailing paradigm for agricultural research and application has assumed that higher yields require new varieties (better genotypes) and more inputs: higher seed rates, more fertilizer, more water, and more agrochemical protection. This thinking does not take into account, however, the dynamic biological factors of (a) root growth and functioning and (b) positive contributions from the plant-soil microbiome. These factors make it possible for SRI management to produce ‘more with less.’ Although the Green Revolution paradigm enjoyed considerable success in the 1960s, 70s and 80s, particularly in India, its progress and its productivity plateaued in succeeding decades as the paradigm has encountered diminishing returns.

This paper reviews research findings that support the proposition that existing crop genotypes, for rice but also for some other crops, have more productive potential, i.e., can produce better phenotypes, than are now achieved with standard plant, soil, water and nutrient management practices. The SRI approach to agriculture has succeeded not only because it has worked outside the 'box' of the current agronomic paradigm, but also because it has shifted the prevailing paradigm for research and extension, which privileges formal scientific knowledge and training over farmer observation and experimentation.

SRI introduces a more farmer-centered strategy for making further agricultural improvements. This will not displace or derogate more formal science-based research. However, its emergence suggests that a new synthesis should be sought between formal and farmer knowledge/activity, especially to cope with the hard-core challenges of continuing hunger and poverty, on the one hand, and adverse climatic changes, on the other.

Comparative performance of System of Wheat Intensification (SWI) and other methods of wheat cultivation in north western plain zone of India

Shiva Dhar, Principal Scientist, Division of Agronomy, Indian Agricultural Research Institute, A K Vyas, Assistant Director General (HR), Indian Council of Agricultural Research and B C Barah, NABARD Chair Professor, Indian Agricultural Research Institute, New Delhi

A field experiment was conducted during winter season of 2011-12 to 2012-13 at Indian Agricultural Research Institute, New Delhi in randomised block design (RBD) with three replications using wheat variety 'HD 2967' to know the performance of different methods of wheat cultivation. The experiment consists of six treatments, viz., Conventional Improved Practices (CIP), Furrow Irrigated Raised Bed System (FIRBS), System of Wheat Intensification (SWI)-direct seeded (SWI-D), SWI-transplanted (SWI-T), modified CIP with irrigation as scheduled in SWI (MCIP-I) and Modified CIP with 20x10 cm spacing (MCIP-II). The wheat yield was found to vary from 4.07 t ha-1 for SWI-T to 7.93 t ha-1 for SWI-D in 2011-12. In the repeat trial, the results was identical, wherein yield ranged from 3.68 t ha-1 for SWI-T to 6.94 t ha-1 for SWI-D in 2012-13, which was less favourable year for wheat. The reduction in grain yield of SWI-D was to the extent of 12.5% attributed to impact of climatic variation, while it is more being 22% for CIP and 31.4 % in MCIP-I. Along with grain yield, production of total biomass yield was also high (20.46 and 18.03 t ha-1) in SWI-D during 2011-12 and 2012-13, respectively. There was general reduction in yields ranged from 9.6 to 31.4 % due to weather effect in 2012-13, but SWI performed best during both the years as compared to other treatments indicating that SWI-D is reasonably resilient to weather aberrations. The yield attributing characters like number of spikelet earhead-1, grains earhead-1 and 1000 grain weight were significantly superior in SWI-D, however, number of effective tillers were significantly higher only during favourable year of 2011-12.The higher root length and root volume were also recorded from the SWI-D as compared to other treatments. Soil test values after harvest of crop show a higher build-up of N, P and K in SWI-D. The available nitrogen increased in the range of 25-41%, phosphorous by 2.9-4.9%, and potash more than 9.0- 9.3 % in SWI-T followed by SWI-D and other conventional methods. In the contrast, the nutrients level depleted for all other conventional treatments. Mean Net returns Rs. 83.0 thousand ha-1 were obtained from SWI-D as against Rs. 61.2 thousand ha-1 from the CIP. The findings showed that SWI outperformed the conventional improved methods based on growth, yield, soil nutrient status and net returns. Thus, the System of Wheat

Intensification (SWI-D) is a promising innovation having the in-built capability of productivity enhancing as well as climate-resilience.

Interpreting Changes in Soil Quality and Root Health in the System of Rice Intensification

Janice Thies, Department of Crop and Soil Sciences, Cornell University, USA

The demand for food to feed the growing world population is increasing rapidly, while the land and water resources needed for crop production are decreasing globally. These realities motivate the current focus on 'sustainable intensification' of crop production; that is, growing more food on the same or less land, while also conserving system resources. The principles underpinning the System of Rice Intensification are aimed at helping farmers produce more rice using less water and other inputs. When transitioning to SRI, we must understand that changes in soil redox potential that accompany changes in water use patterns will lead to important changes in soil biogeochemistry that will affect root health, soil quality and how carbon, nutrient elements and metals are cycled and sequestered by soil microorganisms. Changes in water management will also change fluxes of greenhouse gases and the associated loss of nutrient elements from these systems. Some of these changes are predictable, in part, based on current knowledge. However, specific interactions between soil factors at a site will determine which nutrients or chemical conditions will be limiting when water availability changes. We also need to keep in mind that, as soils drain, indigenous populations of pathogens held at bay by flooded conditions may become active. Root-feeding nematodes and fungal pathogens are both stimulated by more aerobic conditions. It is not yet practical to predict if or what types of pathogens will constrain production at a given site. It is safe to say that findings from one soil type or site are unlikely to be successfully applied to another soil type or site unless there is a mechanistic understanding of the rice genotype by environment (GxE) interactions possible. Soil quality and root health 'indicators' are a means to begin to understand potential site constraints so that they can be addressed more explicitly and in a more integrated way in rice producing systems. Examining the 'health' of roots grown in site soils under the intended moisture regimes is a critical first step. Frameworks have been developed and used successfully to monitor changes in soil quality in temperate cropping systems. Research is needed in rice cropping systems in order to develop means to address the constraints imposed by pathogenic soil biota and likely changes in nutrient cycling under SRI management to assure long-term soil fertility and sustained rice production globally.

Developing Location - Specific Management Practices for Agricultural Resource Conservation and for 'Climate Proofing' of Rice Cultivation using SRI

Abha Mishra, Asian Center of Innovation for Sustainable Agriculture Intensification (ACISAI), Asian Institute of Technology (AIT), Thailand

The purpose of this study was to explore the avenue for sustainable intensification of rice using system of Rice Intensification (SRI) principle under rainfed condition involving smallholder farmers who face food insecurity along with degraded natural resource base and climate change variability.

Participatory action research study was established in three provinces of Thailand for three years involving farmers, researchers, traders, and government and nongovernment organizations. Using conventional management practices, indigenous knowledge and SRI principle, different types of innovative agronomic crop management (IACM) practices were defined and tested to address the location-specific challenges. Working through an inclusive process of dialogue, observation and diagnosis, participants made a thorough analysis of the current management practices and various tested IACM practices for their productivity and profitability along with reduced input use.

The results of three seasons and from all three provinces confirmed the potential of IACM practices in enhancing crop and water productivity along with soil fertility in relation to existing crop management practices under rainfed condition. It was also evident that significant increases in yield and higher net farm income could be realized with relatively low inputs (seed, water, and fertilizers) using IACM practices. However, factors that include: (1) the age of the farmers and (2) off farm employment opportunity and (3) lack of incentive for good management practices and (4) lack of effective marketing linkages are the key drives that affect the crop management decision-making process.

As a part of recommendation, it was suggested that exploration of value added production alternatives; favourable policy along with effective marketing linkages are required to sustain environmentally friendly IACM management practices that can benefit farmers, consumers and the environment with reduced climate forcing.

These positive results at plot scale studies and emerging scenario for dealing with climate change and food security issue of Asian rice farmers created impetus for scaling up the SRI action at the regional level involving various international, regional, national, local, government and non-government organizations. A regional effort in the Lower Mekong River Basin countries, i.e., in Thailand, Cambodia, Laos and Vietnam is underway to develop further knowledge and understanding on low cost alternative crop management practices that reduces input use and carbon footprint and contributes towards the food security.

Integrated System of Rice Intensification (ISRI) for enhancing Crop and Water Productivity under Changing Climate

Amod Kumar Thakur; Rajeeb Kumar Mohanty; Ashwani Kumar, Directorate of Water Management (ICAR)

Enhancing crop production under increasing water constraints and greater climatic variability is a major challenge in agriculture. In many rice-growing areas, cultivation depends mainly on seasonal rainfall and unreliable rainfall distribution results in either flooding or long dry spells, causing environmental stress and low productivity. Therefore, climate-resilient upland rice production systems are needed under which the productivity of both land and water can be enhanced. The critical plant morphological factors that stand out in this respect are the roots and root systems of individual plants.

A 2-year field experiment was conducted in Odisha, India, evaluating four alternative rice cultivation systems: (i) conventional rice cultivation methods under rainfed conditions, (ii) System of Rice Intensification (SRI) methods adapted to rainfed conditions, (iii) rainfed SRI methods with supplementary pump-irrigation and drainage, and (iv) SRI methods utilizing harvested rainwater for aquaculture and horticulture crops, also providing supplementary irrigation for the rice crop during dry spells.

Compared with conventional rainfed rice cultivation, adaptations of SRI practices like younger seedling (12-days) with low planting density (single seedling, 20x20 cm spacing) resulted into significant improvements in the morpho-physiological characteristics of rice plants. Phenotypic improvements include; plant height, greater tillering, more number of leaves, and expanded root systems. These changes were accompanied by improvements in physiological functions like greater xylem exudation rate, higher light interception by the canopy, more chlorophyll content, greater light utilization, and higher photosynthetic rates in the leaves during flowering. These factors were responsible for improvement in yield-contributing characteristics and for higher grain yield (53%) compared with conventional production methods. The profuse, deeper, and more functional root systems of SRI plants are able to cope with flooding/drought stresses. All of these features along with grain yield and water productivity further improved by providing drainage and supplementary irrigation to the crop. Further, integrating aquaculture and horticulture with SRI management, utilizing harvested rainwater, increased rice productivity, net water productivity and net income per unit of water used.

Reduced plant densities under SRI, leading to remarkable increases in root development, are seen to alleviate the risks of unreliable rainfall, while leading to increased grain yields. Utilization of harvested rainwater for aquaculture and horticulture and for SRI rice crop though supplementary irrigation looks promising for improving food security under unreliable and erratic rainfall conditions.

The System of Rice Intensification in India: Results of surveys in 62 villages in Andhra Pradesh, Odisha and Uttarakhand

Robert A. Schipper, Development Economics Group, Wageningen University, Sabarmatee, Bhubaneswar, Odisha, India, Debashish Sen, People Science Institute, Dehradun, Uttarakhand, Ravindra A., WASSAN, Hyderabad, Andhra Pradesh and Ezra Berkhout, Development Economics Group, Wageningen University

In the framework of the research project ‘The System of Rice Intensification as a socio-economic and technical movement in India’, a survey was held in 2012 in 62 villages in a number of districts and sub-districts in the states of Andhra Pradesh (Mahabubnagar & Warangal districts), Odisha (Ganjam, Kandhamal & Koraput districts) and Uttarakhand (TehriGarwal district). The aim of this Rapid Rural Appraisal (RRA) was to study the spread and performance of the System of Rice Intensification (SRI). The chosen districts were seen as relevant for the conditions in each state regarding the way rice cultivation is cultivated and the occurrence of SRI. Furthermore, villages in each sub-district were stratified into SRI and Non-SRI villages; from these strata, the villages to be surveyed were selected. Each of the selected villages was visited by a small team of at least two researchers; during the visit group interviews were held about general themes related to location and accessibility of the village, population and households, types and availability of lands, distribution of land holdings over households, water use and availability, land use and crops, institutions and facilities. However, the major emphasis was placed on different ways of rice cultivation. Such group interviews during a RRA can give a general picture of a village. However, it does not give insight into the differences between households within a village. Therefore, later the village survey was followed up with a survey of 10 farm households in each of the selected villages; results of this survey will be reported in a separate paper.

The paper presents village descriptive results under the headings of general data, land characteristics, rice cultivation practices, institutions and facilities. Due to the large differences between the three states, all results are presented per state. After the descriptive results, different 'forms' of SRI as they are observed in the survey are shown. Is it possible to define the most common ones and contrast these with an ideal type of SRI? Furthermore, it is attempted to explain the occurrence of (different forms of) SRI in each state, followed by a discussion of problems encountered in rice cultivation in general and in SRI in particular. Finally, to the extend the data permit; the yield performance of SRI in comparison to conventional rice cultivation is evaluated.

SRI Cultivation in Andhra Pradesh: Positive Evidence on Yield and GHGs Effects but Problems of Adoption

D. Narasimha Reddy and M. Venkatanarayana, National Institute of Rural Development (NIRD), Hyderabad

Rice is one of the most intensive staple food-grains and by far the most irrigation – intensive crop. It is increasingly being extended to groundwater based irrigation areas raising concerns of water use efficiency and emission of greenhouse gases (GHGs) in the context of climate change. While concerns of food security require attention to methods that would reduce costs and increase productivity, the challenges of GHGs call for new methods and technologies that would reduce energy use and mitigate the adverse effects associated with rice production. The System of Rice Intensification (SRI) is widely advocated as one such emerging method of rice cultivation that would answer these concerns. As a part of the efforts to gather scientific evidence from different parts of the rice-growing world, a study was undertaken in some parts of India to examine the GHGs effects of SRI and the extent of adoption of the method. The first part of the paper presents evidence on costs, yield and GHGs effect of the SRI in Andhra Pradesh and the second part discusses the efforts made towards the extension of the area under SRI in the state. The results based on a field survey of SRI in Andhra Pradesh, with the conventional HYV as a control group, show that SRI uses less of water, less of labour, generates less CO_2, involves lower costs, and brings higher yields. The soil derived Methane (CH_4) generated per tonne of rice is much lower in the case of SRI, but the Nitrous Oxide (N_2O) produced is much higher.

Andhra Pradesh is one of the states that initiated the adoption of SRI cultivation more than ten years ago. Efforts to promote SRI cultivation in the state were made by public agencies like NABARD, Krishi Vignan Kendras (KVKs), Community Managed Sustainable Agriculture (CMSA), research institutions like Acharya Ranga Agricultural University and ICRISAT, civil society organizations like Centre for Sustainable Agriculture and WASSAN, and several progressive farmers. These efforts were based on the evidence from farmers' field experience of better yield, early maturation, better cyclone and flood withstanding capacity, and better quality of grain of SRI method compared to traditional practices of rice cultivation. Many farmers in the state also contributed to promote SRI practice by improving the tools for weeding and marking. Yet the progress in the adoption of SRI in the state has been very low. The paper analyses some of the reasons for the slow adoption rate and suggests possible ways, which could help in the spread of SRI over a wider area.

SRI: An Analysis of Adoption Levels across 13 States, India

K. Palanisami, Principal Researcher, IWMI, Hyderabad

A macro level study covering 13 major rice-growing states was undertaken during 2010-11 to analyse mainly the adoption level of the SRI components. The results indicate that fields with SRI have higher average yield of 8.5 quintals per ha (q/ha) or 22%, than the average yield of 37.9 q/ha of non-SRI fields. Out of the four core SRI components typically recommended, 41% adopted one component (low adopters), 39% adopted two to three components (partial adopters) and only 20% adopted all the components (full adopters). Full adopters recorded the highest yield increase (31%) compared to yield increase under partial (25%) and low adopters (15%). Thus, 80% are doing only the modified SRI practices with yields higher than their conventional practices. The SRI and modified SRI fields had a higher gross margin (Rs 7000/ha) and lower production cost (Rs 178/q) compared to non-SRI fields. The transaction (managerial) cost, even though accounted for only an additional 2-3 % of the total operational cost is reported as the key constraint for adopting SRI and modified SRI practices, where non-availability of skilled labourers at crucial times of operations, poor water control and poor soils are the other major constraints. The drivers of adoption of SRI and modified SRI practices are: a) Selection of appropriate SRI components to suit the region, b) geo-mapping of the potential regions with suitable soils, crop seasons and irrigation sources, c) introduction of machine transplantation, d) availability of user friendly conoweeders to farmers at affordable price, and e) intensification of capacity building programs to farmers on selective SRI components.

System of Rice Intensification (SRI) and Household Food Security: An analysis of dynamics of adoption and disadoption process of SRI in Rainfed areas in eastern India

B C Barah, Shipra Singh, and Amit Kumar

The System of Rice Intensification (SRI) is an agro ecological innovation, appropriate for small and marginal farmers. It has gained more popularity and wider acceptance among the farmers and other stakeholders due to increasing production potentiality with lesser inputs, reduced cost and climate resilience properties. In order to understand the dynamics of adoption process, a carefully designed longitudinal farm survey was conducted during 2011-12, 2012-13 among the 715 SRI farmers in selected SRI districts in Bihar, Odisha, Chhattisgarh and Jharkhand. The farmers were selected using stratified random sampling procedure representing three distinct groups, viz, practicing SRI farmers including new adopters (SRI farmers including old SRI farmers as well as newly adopted farmers), farmers discontinued SRI at a point time (Disadopter) and farmers who never practiced SRI (Non SRI farmers as control). A specifically prepared questionnaire schedule was propagated in the door-to-door interview. The farmers' perception on SRI was also elicited and FGD conducted. The finding of survey is interesting. Survey clearly brings out that the adoption of SRI appears faster within a short span of time as compared to that in case of green revolution technology. The survey reveals that the major factors encouraging farmers to adopt SRI, are increase in productivity, reduced cost and improved food security. Almost all farmers are satisfied with SRI and experienced more availability of homegrown food. As high as 43% farmers reported 9 to 12 months of additional food availability of food due to SRI. More farmers experienced 3 to 8 months of additional food availability. The input saving such as seed, water, fertilizer and labour has attracted more adoption. Survey also ring out tremendous dynamism in gender participation due to SRI. However, a small stint of disadoption was observed. The extent of disadoption was found to be in the range of disadoption was 6-13 per cent during the period. The farmers unanimously reported that the disadoption of the type is not voluntary in nature as it occurred mainly due to external factors, such as unfavourable weather conditions like droughts and occasionally flood within crop season. For instance, Bihar and Jharkhand experienced severe droughts in a row in previous two years and Odisha had drought (weather failure got the highest Garret rank of 99% followed by inadequate availability of inputs, lack of knowledge and labour issue). A small proportion of farmers expressed inability to perform operations due to personal health, family problem and lack of handholding. Therefore, provision of protective life-saving irrigation for enhancing climate resilience emerged, as the effective policy need. Interestingly, farmers observed that even in unfavourable weather, SRI performs well as compared to conventional method of cultivation, albeit there is generally reduction in production. The farmers also emphasized the need for access to technological knowledge. As the SRI is a knowledge innovation, proper information of practices and processes including initial handholding assistance and supply of newer implements, is needed for innovating farming. Evidences derived in the study provide a powerful basis for deriving strong institutional architecture and proper advocacy mechanism that suits the local conditions for wider up scaling.

Modern intensified agriculture: a product of public-private collaboration - Some insights based on the “System of Rice Intensification”

Willem A. Stoop

For many years, starting from the 1950/60s, agricultural research and the development recommendations based on it, have focused on mostly technocratic approaches in combination with introducing new, fertilizer-responsive, crop cultivars emanating from centralised (national and international) crop breeding programs. This has constituted the basis of the “Green Revolution” and the modern industrialised forms of agriculture. In that context a general “intensification” doctrine has evolved, that is widely taught at universities and that is at the basis of many (modelling) efforts to formulate productive and profitable crop systems. These systems are mainly based on packages of the following bio-technical components: 1) new, high-yielding, short-statured varieties (improved seeds), 2) high seed rates / high plant densities, 3) liberal use of mineral fertilisers, nitrogen in particular, 4) optimised soil water regimes through irrigation/drainage, and 5) use of crop protection chemicals to control diseases, pests and weeds. Notably absent from this intensification package are major factors such as: soils, roots, root systems and soil biota.

The conventional –best practice—technological packages depend in many critical ways on external inputs that are provided by the private sector agro-industries and that at global scales represent huge commercial interests.

Starting in the late 1990s the “system of rice intensification (SRI)” –largely a grassroots development—has progressively and increasingly been providing fundamental challenges to this mainstream intensification approach. The often spectacular results of SRI in many rice growing areas of the world support the notion that grain yields (not only for rice) can be raised substantially through relatively simple agronomic practices suitable for any type of farmer; simultaneously expenditures on external inputs (seeds and chemicals) are considerably reduced. Notably, it shows that seed rates could be reduced to 1/5th even 1/10th of the conventionally recommended rates.

The paper explores various ramifications of the SRI findings for agricultural research in general and the complex set of factors (bio-technical, commercial, political and psychological) that are fundamentally affecting the scaling-up processes for SRI.

System of Rice Intensification (SRI) Evaluation for its potential to enhance the productivity of rice (Oryzeasativa L.) and its impact in different agro-ecological situations in India

R Mahender Kumar, , K. Surekha , ChPadmavathi , B.Sreedevi , B.Gangaiah, N. Somashekar , M.S.Prasad, V.Ravindra Babu, P. Raghuveer Rao, P.C. Latha, L.V. Subba Rao, B. Sailaja , Sudhakara. T.M. Santhappa. D, P.Muthuraman, Shaik. N.Meera, B. Nirmala and B.C. Viraktamat, Directorate of Rice Research (DRR), ICAR

System of Rice Intensification (SRI), developed in Madagascar, a systems approach to increasing rice productivity with less reliance on expensive external inputs, is gaining momentum all over the world including India, which needs to be evaluated in Indian conditions. Directorate of Rice Research under AICRIP has conducted a total of 147 experiences across India from 2005 until 2013 to evaluate SRI methods, assessing their potential and the effects of individual SRI principles for enhancing productivity under different agro-ecological conditions compared to standard normal transplanting methods.

SRI recorded significantly higher grain yield (6.22 t ha-1) followed by integrated crop management (ICM) (6.07 t ha-1), standard practice of transplanting (5.60 t ha-1), and direct seeding with drum seeder (5.13 t ha-1). Further, hybrids registered significantly higher grain yield with SRI methods (6.77 t ha-1) followed by medium-duration and long-duration genotypes (6.24 and 5.97 t ha-1, respectively).

There was no significant difference in grain yield overall between transplanting 10-day and 15- day old seedlings with SRI practices; however, 10-day seedlings recorded higher yield during kharif (5.9 t ha-1), while 15-day seedlings gave higher yield in rabi (5.04 t ha-1). Among the crop establishment methods tested, SRI @ 25x25 spacing recorded 5% and 14% more yield, compared with ICM @ 20x20 cm and standard transplanting @ 20x10 cm, respectively, irrespective of time of transplanting.

The effect of cono-weedings indicated the superiority of four times cono weeding (@ 10, 20, 30 and 40 DAT) followed by 2 times cono weeding (5.7% less) and herbicide application (11.8% less) during kharif season. Application of 50% inorganic + 50% organic N was comparable with 150% and 100% of recommended dose of fertilizer (RDF) and recorded with grain yield increase of 37 %, 39 % and 43 % respectively over control indicating saving of N with organic fertilizers.

By taking in to account all the factors that determine the adoption of SRI such as proper locations, soil conditions, water control facilities etc., it may be possible to cover about 10% as total rice area i.e., about 4.0 m ha which can bring about tremendous benefits for the country. There could be enormous saving in seed as we require only 5 kg seed per hectare as compared to 25 kg/ha in the traditional system, saving 80,000 tonnes of seeds annually which means saving of RS.200 crores per season. Additional yield of 1.0 – 1.5 t/ha will add another 4 – 6 in tons of rice to our food basket and meet the challenges of enhancing the rice production. The system also helps us to save about 30% water, which is equivalent to 2,200 million m^3. Besides, soil health improvement, which would be a biggest bonus in adopting SRI.

Based on multi-location testing over a decade, indicated that SRI has the potential to enhance the productivity of the rice with reduced inputs and significant impact in different agro-ecological situation and soil types across the country.

Comparative performance of rice varieties grown under System of Rice Intensification (SRI) and traditional puddlled transplanted at the experimental station

S S Parihar, B C Barah, Ravinder Kaur, Radha Prasanna, Nivedita Jain, Manol Khanna, Pankaj Singh, Dinesh Kumar, Subhash Chandra, Bishan Dev, Indian Agricultural Research Institute (IARI), New Delhi

Experiment was conducted during *kharif/rainy* season of 2013-14 at the Indian Agricultural Research Institute, New Delhi. The aim is to evaluate the relative performances of various improved varieties with alternative methods of rice cultivation viz, SRI innovation and conventional improved method (CMP) and to validate the principles of SRI. Five improved IARI varieties viz, Pusa 44, Pusa 834, Pusa 1401, Pusa 1509, PRH-10 were tested in split plot design with three replications. The experiment was aimed to examine the inter-varietal comparative performance under both methods. An innovative experimental design protocol has been developed in consultation using innovative participatory approach. Various stakeholders including research leaders, policy makers, civil society organization and farmers are involved. Quality seed is selected with Brine method. Before nursery, sowing the seed is inoculated with ***Pseudomonas fluorescence.*** Raised wet bed nursery (10 cm above the ground level, 1-meter wide and length as required) with channels all around was formed. Before the sowing of seed, soil was mixed with vermin compost or well decomposed manure @1kg/sq. meter and level the surface (preferably the 2:1 ratio of soil and compost). Transplanting of single seedling per hill was done with plant-to-plant-square pattern spacing of 25x25cm. Results were encouraging. The yield of rice under conventional method was found to vary from 6.81 ton/ha of Pusa 44, 5.94 ton for Pusa 834, 6.05 ton for Pusa 1401, 5.76 ton in Pusa 1509 and 6.69 ton for PRH-10. The corresponding yield under SRI was 7.48 ton, 6.42, 6.41 ton, 6.13 ton and 7.40 ton respectively. It gives a clear yield advantage of SRI to the extent of five to six quintal for all the five varieties. The yield could have been even better if rainfall would have been normal. There was excess rainfall above the normal uniformly throughout the season by week by week. The normal rainfall for the season in IARI farm has been 708mm, while actual total rainfall was1565 mm. Thus, water management could not be done properly for SRI. The other yield attributes such number of tillers per hill and plant height is also measured after 62 days of sowing and found significant difference under two methods as summarized in the table below.

Growth of number of tillers per hill in growth stages for 62 DAS for selected varieties				
	Pusa 44		**Pusa 1509**	
	# tillers	**Plant height(cm)**	**# tillers**	**Plant height (cm)**
SRI	71	92	63	93
CMP	21	90	18	91

Another significant finding is that the SRI substantially reduced infestation of nematodes. The population of rice root nematode *Hirschmanniell aoryzae*was high in conventional method compared to SRI. Amongst varieties, there was difference in nematode population and Variety P-1401 showed the least infestation compared to others.

Infestation of *Hirschmanniellaoryzae* *(Nematodes population(#) per 200 cc soil, study by Dr. Pankaj)*					
	Pusa 44	**Pusa 834**	**Pusa 1401**	**Pusa 1509**	**PRH-10**
SRI	220	165	102	252	466
CMP	371	855	180	461	505

The weed population is also found almost negligible in SRI plots because of large volume of root inter-locking the space. Similarly, water use pattern also showed encouraging results. Irrigation water was measured using volumetric meter and found that water saving to the extent of 31-35% reduction in water use in SRI as compared to the conventional fields. The quantity of Irrigation varied from 1288 mm to 1370 mm under CMP, while same for SRI varied from 845-940 mm.

Treatment	**Gross Irrigation (mm)**		**Water saving (%)**
	SRI	**CMP**	
Pusa 44	940	1370	31.4
Pusa 834	867	1315	34.1
Pusa 1401	890	1320	32.6
Pusa 1509	845	1288	34.4
PRH 10	910	1330	31.6

Economic returns also suggested that SRI across the varieties varied from Rs. 63.0 thousand ha^{-1} for Pusa 1509 to Rs. 85.2 thousand $ha^{-1}$for Pusa 44. The corresponding figures under CMP varied from Rs.59.0 thousand ha^{-1} to Rs.60.8 thousand ha^{-1} having gain in yield in the percentage difference of 40-42% of SRI over the CMP method.

Net return and cost (RS./ha)					
	Gross revenue Rs./ha		**Return Rs/ha**		**% Diff. over SRI**
	CMP	**SRI**	**CMP**	**SRI**	
Pusa 44	98521	117316	60856	85160	40%
Pusa 834	85934	100481	48269	68325	42%
Pusa 1401	87553	100976	49888	68820	37%
Pusa 1509	83372	96026	45707	63869	39%
PRH10	96710	116102	59045	83946	42%
	Output price: Rs.1250/qtl				

The findings showed that SRI outperformed the conventional improved methods on the basis of growth, yield, yield attributes, saving in input such as seed (nearly 80%), water saving, less agro chemical, etc., reduction of pest and disease and water saving including nematodes and net returns. Thus, the System of Rice Intensification (SRI) is a promising innovation having the in-built capability of productivity enhancing as well as climate-resilience.

The System of Rice Intensification (SRI) in India: Historical Antecedents and Future Perspectives

Dominic Glover, Research Fellow, Institute of Development Studies at the University of Sussex, United Kingdom

The System of Rice Intensification (SRI) is generally reported to have been discovered or invented in Madagascar quite suddenly in the early 1980s, developed there during the ensuing decade, and spread from there to other rice-producing areas of the world since the mid-1990s. The conventional story of SRI also says that agronomic principles of SRI were developed out of a chance discovery made by a French Jesuit missionary and agronomist, based on his attentive observation of both rice plants and paddy farmers. This style of inductive, experiential, field-level agronomy is usually contrasted favourably with the top-down, abstract, deductive methods of formal rice science.

This paper presents newly uncovered historical evidence, which establishes that this traditional story is incomplete and partly inaccurate. Documentary material shows that rice cultivation methods very similar to modern SRI – with respect to both individual techniques and whole systems that closely resembled SRI – were practised by farmers, investigated scientifically by agronomists, and promoted by agriculture officials in various locations across South and Southeast Asia during several decades before the Green Revolution, in some cases more than 100 years ago.

This historical record shows that SRI stands on a firm foundation based on farmers' practices and scientific knowledge. Both the direct lineage of the SRI methodology, as well as the existence of several close analogues from different times and places, reveal extensive interactions and exchanges of knowledge and practice between colonial agricultural science, extensionists and farmers' practices. There have been repeated historical episodes in which certain characteristic growth habits of rice and other grain crops were noticed, generating considerable excitement about how their potential could be exploited by rice farmers to improve and increase rice production. Each time, agronomists and farmers grappled with similar challenges in developing and applying cultivation methods that were practical and affordable.

The fact that SRI is less a new discovery than a re-emergence of older methods makes the system even more intriguing than if it were genuinely unprecedented. How and why did these cultivation principles come to be overlooked or forgotten? Where did they go? In addition, why have they reappeared in recent times? SRI appears to reflect a revival of the way rice cultivation used to be thought about and practised, as well the kinds of scientific approaches and experiments that used to be pursued by researchers. These approaches may have been marginalised and neglected by the juggernaut of the Green Revolution, but may now be re-emerging because of contemporary ecological and rural crises, such as water scarcity and migration from rural to urban areas.

Uprooting Rice Science to building a Research Community: Research Policy Challenges and Prospects of SRI in India

C. Shambu Prasad, XIMB, Bhubaneswar

This paper provides an overview of the scientific controversies around SRI at three levels. First, it traces the different phases of the SRI controversy indicating the changes in the nature of the discussions over the years. Using a science and technology studies perspective wherein controversies have been studied extensively in the global production of knowledge, we show how different actors involved in the controversies have followed different strategies over the course of the controversy. Only some of it is represented in journals where this battle has been fought with knowledge being promoted and contested in other forums beyond specialised journals, which too have been asymmetric in their handling of the controversy. We show how Indian journals and researchers have played an important, though under-appreciated, role in providing a different perspective on the controversy on SRI from within science, even as networks of researcher- civil society collaborations have broadened the understanding of the controversy outside formal research spaces.

An analysis of the journal articles on SRI indicates Indian researchers leading the world in contributions even as this leadership is not reflected in research programmes or policy on agro ecology in India. The paper provides an analysis of SRI journals in India from 2002-2013 and avoids a strictly scientometric study. We suggest how newer tools like GIS can be used for research planning purposes, engaging, and building a research community of practice on SRI. A few recommendations to strengthen the emerging research network and its policy implications are suggested. We show that there is indeed a potential of transforming rice science as often suggested through the writings in the scientific controversies. However, this requires a shift towards following the controversy to building a research community as newer possibilities and prospects of a different rice science emerge the research of a large number of researchers on SRI who, prima facie, even in India are not sufficiently aware of each other’s works. Pursuing research that is inter-disciplinary, not crop-specific, that allows for farmer and civil society experimentation is indeed possible as some of the SRI experiences in India show, but institutional rigidities seem to prevent the emergence of a vibrant community of practice.

Minutes of the National Consortium Meeting at Delhi, June 20, 2014 Annexure-I

Members present: Ravi Chopra (PSI), B C Barah (IARI/NCS), Narendranath (PRADAN), Shambu Prasad (XIMB), Debashish Sen (PSI), Ravindra, Nemani, Bhagyalaxmi (WASSAN), Sabarmatee (Sambhav), TM Thiyagarajan, Biksham Gujja (AgSRI), Anil Verma (PRAN), Jacob Nellithanam (Riccharia campaign), Baharul Mazumdar (JDA, Govt of Tripura), R Mahender Kumar (DRR), BJ Pandian (WTC, TNAU)

The meeting was held to utilize the opportunity of the international conference on SRI in New Delhi organised by NCS (in collaboration with Wageningen and other partners) to take stock of NCS and plan. This report provides a brief summary of the views discussed by members.

Dr Barah apprised the members of the discussions with the Minister of Agriculture, Radha Mohan Singh and other policy makers in ICAR as part of the preparations for the conference. He mentioned the need to have a clearer structure of NCS that can help in communicating with external stakeholders.

Dr Ravi Chopra shared his meeting with the Minister and suggested a follow up on the Minister's interest to visit SRI areas in different parts of the country (in the central and eastern region). He felt that it would be useful to have a few established scientists accompany the Minister rather than NGO representatives alone. Dr Chopra also suggested that it would be useful to have a few MPs to talk about SRI at relevant forums.

Ravindra reflected on this question, suggesting that while SRI has gained acceptance in many quarters, it needs to be institutionalized as part of public policy. As an idea it is happening with NFSM having a blanket allocation on SRI (funds apparently allocated for 2% under SRI), it will take up in NRLM, we now have greater clarity on SRI having to follow an area approach. Some directions in which SRI can be taken up are SRI in irrigation systems to increase their efficiency, enhancing soil fertility in rice cultivation, some discussion on the mechanisation of SRI (its appropriateness).

Ravi Chopra suggested that at the policy level, there could also be more discussions on rainfed areas and their contribution to rice production/livelihood systems. He also suggested that the policy should not be just for the government, but also on corporate now with the new Companies Act, that mandates greater investment in CSR activities. Biksham Gujja suggested that the saving of seeds and water could be computed to make policy suggestions.

Dr TMT reflected on the question of what is it that NCS can do? Physically to work on research and extension aspects. "Can we suggest that the KVKs (Krishi Vigyan Kendras) can engage half their time in SRI promotion?" In many areas of upland rice, even if not all principles can be used we should encourage farmer adaptation of the principles and play a facilitating role.

Jacob spoke about the need to have a national symposium on SRI, the need to look at SRI in millets as well as millets in the PDS. Sabarmatee raised the issue of follow up on Soumik's work on seeds, how to take it further? Can we have a workshop on issues beyond yield yields to look at issues related to water, labour and weeder issues for women? How do we focus on issues relating to skills "If yield is the mantra, skill is the sutra"?

Some future directions for NCS

Based on the discussions the following ideas emerged.

a. NCS structure: It is best to keep NCS structure small with a small core (Dr BC Barah, Narendaranath, Ravindra, Shambu, Mahender, and Debashish Sen), a smaller advisory group of (Dr TMT, Ravi Chopra, Biksham Gujja, Norman Uphoff etc.) and others to engage on specific issues and be part of the general body. Ideas and action plans that emerge can be shared with the JaiSRI e-group for suggestions and comments and it is likely that the members present at the meeting would contribute more. NCS can continue in its flexible mode for a while until the larger issues of both resources (human and financial) are taken care of. Members expressed their gratitude to PSI for facilitating the admin related aspects of the conference and enabling NCS to take its work further and wanted PSI to continue in that role.

b. NCS would undertake the following activities in the coming year or two

    a. Engage in studies and research on SRI covering different dimensions of policy and practice. This could also include approaching NABARD for support for research.

    b. Work towards organising a symposium either at the national or regional level. Yezdi Karai of Usha Martin University offered hosting this in Jharkhand as part of their new SRI Institute. NCS needs to follow up with both ICAR and Arvind Kaushal for a possible international symposium with Cornell that they had agreed upon (Norman and NCS to work together on this). FAO organising a symposium on SRI is another lead worth pursuing and this might happen in the next few months. While it might be difficult to have one big national symposium covering all aspects, it surely should be possible to have thematic based meetings in different places.

    c. Advocacy and lobbying for SRI: An immediate follow-up that is required is to plan the visit of the Agriculture Minister to different SRI areas. Another possible area to also be explored on an opportunistic basis

    d. Action research on weeders, exploring SRI as part of the farming systems approach, how to avoid public systems to be blindly promoting SRI without looking into building human capacities etc. need to be pursued.

Other events preceding the workshop Annexure-II

June 07th 2014	Dr. BC Barah and Pratyaya Jagannath extended a formal invitation to the Honourable Minister for Agriculture Mr. Radhamohan Singh for the policy workshop. In this meeting, he was apprised about SRI and he was keen to know more about it.
June 12th, 2014	Dr. Norman Uphoff, Dr. Marguerite Uphoff, Dr. BC Barah and Pratyaya Jagannath had a meeting at ICAR with Dr. Arvind R. Kaushal (Additional Secretary (DARE) & Secretary (ICAR)] and Dr. Swapan Datta [Deputy Director General (Crop Science), ICAR], and to appraise on the SRI policy workshop
June 12th, 2014	Dr. Norman Uphoff, Dr. Marguerite Uphoff, and Pratyaya Jagannath had a meeting with Dr. Jayram Ramesh (Former Union Minister for Rural Development) to appraise about the workshop and possible coalition with MGNREGS and SRI
June 12th, 2014	Dr. Norman Uphoff, Dr. Marguerite Uphoff, Dr. BC Barah and Pratyaya Jagannath had a meeting at IARI with Dr. HS Gupta (Director) to formally invite and apprise about the workshop. A formal invitation was extended to Dr. Norman Uphoff to hold a seminar on SRI amongst the Scientists, Deputy Directors and Professors from all the centres in IARI.
June 12th, 2014	A dinner was hosted by Ms. Rita Sharma (ex- Secretary, Rural Development), which was attended by many bureaucrats (currently serving and retired) to appraise about the workshop and garner goodwill.
June 13th, 2014	Dr. Norman Uphoff gave an interview to Latha Jishnu (Down to Earth) on the current state of SRI and the policy issues that can be discussed during the workshop
June 14th, 2014	A workshop was organised by Odisha Learning Alliance on SRI at Xavier Institute of Management, Bhubaneswar. This was attended by the SRI practitioners and technocrats of Odisha
June 16th, 2014	A workshop was organised by the Peoples' Science Institute, Dehradun on SRI. In this, Dr Norman Uphoff and Dr Willem Stoop updated the Uttarakhand partners on the recent developments on SRI.
June 17th, 2014	A dinner was hosted by His Excellency Dr.Tejendra Khanna (ex- Lt. Governor-Delhi), which also was attended by Dr. HS Gupta (Director, IARI) to appraise about the workshop and recent developments in Punjab.
June 18th, 2014	Dr. Uphoff delivered a seminar at IARI on "New Ideas for Crop Science: Coming from SRI Experience and Research". All the department heads of IARI and senior scientists and professors attended this. Dr. HS Gupta, Director, and IARI chaired this.
June 19th, 2014	Dr. Norman Uphoff and Dr. Ravi Chopra met the Honourable Minister for Agriculture Mr. Radhamohan Singh to apprise about SRI and its potential in India. He was informed about the revolution, and the minister is keen to visit SRI fields this year.
June 19th and 20th	A research seminar was held at the NASC complex, which was led by researchers from Wageningen University. This was supplemented with presentations by Indian researchers. http://.sri-india.net/event2014/home.htm

Attendees in the workshop **Annexure-III**

	Name	Organisation	Email
1	A Bandyopadhyay	Amity University, Noida	
2	Abdul Mannan Choudhury	PRADAN, Chaibasa, Jharkhand	abdulmannan@pradan.net
3	Achintya Ghosh	Director, Kabil, New Delhi	achin.pradan@gmail.com
4	Ajit Kanitkar	Ford Foundation, New Delhi	a.kanitkar@fordfoundation.org
5	Alay Barah	ICCO India, New Delhi	Alay.Barah@icco-cooperation.org
6	Amit Kumar	PRADAN, New Delhi	dru@pradan.net
7	Amod Thakur	Directorate of Water Management, Bhubaneswar	amod_wtcer@yahoo.com
8	Anchal Dass	Division of Agronomy, IARI, New Delhi	anchaldass@iari.res.in
9	Anil Verma	Preservation and Proliferation of Rural Resources and Nature (PRAN), Bihar	anilvermaprangaya@gmail.com
10	Aravind Boddupalli	Intern- Cornell University, Ithaca, New York	aravindboddupalli@gmail.com
11	Arvind Sahay	KGVK, Ranchi, Jharkhand	arvind.sahay@kgvk.org
12	Azhad Ali	ICCO India, New Delhi	
13	B C Barah	Indian Agricultural Research Institute - National Consortium on SRI (NCS), New Delhi	barah48@yahoo.com
14	B.J. Pandian	Director and Nodal Officer (TNAU-TN-IAMWARM), Water Technology Centre, TNAU, Coimbatore	directorwtc@tnacu.ac.in
15	Baharul Mazumdar	Joint Director of Agriculture at Department of Agriculture, Government of Tripura	imbaharul@gmail.com
16	Bhagyalaxmi	Watershed Support Services And Activities Network (WASSAN), Secunderabad	bhagyawn@gmail.com
17	Biksham Gujja	AgSRI, Hyderabad	bg@agsri.com
18	Chandrakant Pradhan	Aga Khan Foundation, New Delhi	chandrakant.pradhan@akdn.org
19	D. Narendranath	Professional Assistance for Development Action (PRADAN) - NCS, New Delhi	naren@pradan.net
20	Debashish Sen	Wageningen University, Netherlands	debu_manu@yahoo.co.in
21	Dhananjaya BN	GIZ, India, Bengaluru	dhananjaya.bn@gmail.com
22	Dinesh	Farmer	
23	DN Reddy	National Institute of Rural Development (NIRD), Hyderabad	duvvurunarasimha@gmail.com
24	Dominic Glover	Wageningen University, Netherlands	D.Glover@ids.ac.uk
25	Florian Moder	Climate Change Knowledge Network in Indian Agriculture,	florian.moder@giz.de

	Name	Organisation	Email
		German Society for International Cooperation (GIZ), New Delhi	
26	Govind Kumar Rai	Young Professional (livelihoods), Bihar Rural Livelihood Promotion Society, Patna, Bihar	govind_yp@brlp.in
27	Harro Maat	Wageningen University, Netherlands	harro.maat@wur.nl
28	HS Gupta	VC and Director, Indian Agricultural Research Institute, New Delhi	director@iari.res.in
29	Ila Hukku	The Revitalising Rainfed Agriculture Network, New Delhi	ila@rainfedindia.org
30	Inder	imentor, New Delhi	
31	Jacob Nellithanam	Richaria Foundation, Chhattisgarh	farmersrights@gmail.com
32	Jan Willem Ketelaar	FAO Regional Office for Asia and the Pacific, Bangkok, Thailand	Johannes.Ketelaar@fao.org
33	Janice Thies	Cornell University, Ithaca, New York, USA	jet25@cornell.edu
34	Jawed Quamar	Srijan, New Delhi	
35	John Varrieur	Program Quality Manager, Livelihoods, Catholic Relief Services, New Delhi	John.Varrieur@crs.org
36	KS Rana	Head, Division of Agronomy, IARI, New Delhi	ksrana@iari.res.in
37	Latha Jishnu	Down to Earth, New Delhi	latha@cseindia.org
38	Mahendra Singh	People's Science Institute (PSI), Dehradun, Uttarakhand	
39	Man Singh	Principal Scientist and In charge, Farm Operation Service Unit (FOSU), IARI, New Delhi	mansingh@iari.res.in
40	Manjunatha	Srijan, Karnataka	manjunatha@srijanindia.org
41	Marguiritte Uphoff	SRI Enthusiast, Ithaca, New York, USA	muphoff@twcny.rr.com
42	MS Vani	Development Centre for Alternative Policy, New Delhi	devcentreap@gmail.com
43	Natasha SK	Syracuse University, New York, USA	koshy.natasha@gmail.com
44	Navin Kumar	KGVK, Ranchi, Jharkhand	Navink2003@rediffmail.com
45	Neha Joshi	PRADAN, New Delhi	nehajoshi@pradan.net
46	Nemani Chandrasekhar	Watershed Support Services And Activities Network (WASSAN), Secunderabad	chandrasekharnemani@gmail.com
47	Nirupama Das	Vrutti, Bhopal, Madhya Pradesh	nirupama@vrutti.org
48	Niveta Jain	Indian Agricultural Research Institute, New Delhi	nivjain@iari.res.in
49	Norman Uphoff	Cornell University, Ithaca, New York, USA	ntu1@cornell.edu

	Name	Organisation	Email
50	Pankaj	Principal Scientist, Editor-in-charge, IARI, New Delhi	pankaj@iari.res.in
51	Peter Kenmore	Food and Agriculture Organisation, New Delhi	peter.kenmore@fao.org
52	Pramod Sahu	AKRSP, Ahmadabad	agriculture@akrspi.org
53	Pratyaya Jagannath	Kabil, New Delhi	pratyayj@gmail.com
54	R Mahender Kumar	Directorate of Rice Research, Hyderabad	kumarrm213@gmail.com
55	R.M. Kummur	Chief General Manager, NABARD, Mumbai	rm.kummur@nabard.org
56	Rahul Kumar	Asian Development Bank, New Delhi	kumarrahul80@gmail.com
57	Rajbir Singh	Principal Scientist, NRM Division, ICAR, New Delhi	rajbirsingh.nrm@gmail.com
58	Rajesh Patidar	Reliance Foundation, Nagpur	Rajesh.Patidar@reliancefoundation.org
59	Rajeshwari Raina	National Institute of Science, Technology and Development Studies (CSIR-NISTADS)	rajeswari_raina@yahoo.com
60	Rajiv Siwach	NABARD, New Delhi	
61	Ram Avtar Prasad	Social Worker, Bihar	
62	Ramanujam Karunakaran	International Water Management Institute (IWMI)	krkaruna@gmail.com
63	Ramesh Kumar Singh	Division of Agronomy, IARI, New Delhi	
64	Ravi Chopra	People's Science Institute (PSI), Dehradun, Uttarakhand	psiddoon@gmail.com
65	Ravindra A	Wageningen University, Netherlands	raviwn@gmail.com
66	Rob Schipper	Wageningen University, Netherlands	Rob.Schipper@wur.nl
67	RP Singh	People's Science Institute (PSI), Dehradun, Uttarakhand	
68	RS Rana	Division of Agronomy, IARI, New Delhi	
69	S.M Fajal	imentor, New Delhi	
70	Sabarmatee	Wageningen University, Netherlands	sabarmatee@gmail.com
71	Shambu Prasad	Xavier Institute of Management, Bhubaneswar, Odisha	shambu@ximb.ac.in
72	Sharon Ahmed	Independent Consultant, New Delhi	sharon.ahmed2000@gmail.com
73	Shipra Singh	Access Assist, New Delhi	shipralko@gmail.com
74	Shiva Dhar Mishra	Indian Agricultural Research Institute, New Delhi	drsdmisra@gmail.com
75	SS Parihar	Indian Agricultural Research Institute, New Delhi	ssp_wtc@rediffmail.com
76	Subir Ghosh	Independent Expert, Mumbai	ribus@hotmail.com

	Name	Organisation	Email
77	Sudhanshu Singh	Agronomist, IRRI, South Asia, New Delhi	sud.singh@irri.org
78	Sudhir Gupta	Drishtee, Noida	Sudhir.g@drishtee.in
79	Sudhir Paswan	KGVK Agro Limited, Ranchi, Jharkhand	sudhir.paswan@gmail.com
80	Suman Sahai	Gene Campaign, New Delhi	genecamp@vsnl.com
81	Sumita Kasana	PRADAN, New Delhi	sumitakasana@pradan.net
82	Surendra	People's Science Institute (PSI), Dehradun, Uttarakhand	psifinance123@gmail.com
83	Syed Mohammad Yunus	imentor, New Delhi	yunus@imentor.in
84	T Vijay Kumar	National Rural Livelihood Mission, New Delhi	tvijay.kumar@nic.in
85	T.M. Thiyagarajan	Independent Expert, Ex- Director, Research, Tamilnadu Agricultural University	tmthiyagarajan@gmail.com
86	Willem Stoop	Stoop Consult, Netherlands	willem.stoop@planet.nl
87	Yezdi Karai	Usha Martin University, Ranchi, Jharkhand	prochancellor@ushamartinuniversity.com
88	YN Mahadeviah	NABARD, Mumbai	yn.mahadeviah@nabard.org
89	Zulfiqar Haider	Bharat Rural Livelihood Foundation, New Delhi	zulfihaider@yahoo.com

An International Workshop

19-21st June 2014, New Delhi, India

Recent Changes in Rice Production and Rural Livelihoods: New Insights on the System of Rice Intensification as a Socio-Technical Movement in India

WORKSHOP ORGANISING TEAM

1.	Dr Harro Maat	Harro.Maat@wur.nl
2.	Dr C Shambu Prasad	shambu@ximb.ac.in
3.	Dr B C Barah	barah48@yahoo.com
4.	D Narendranath	naren@pradan.net
5.	Debashish Sen	debu_manu@yahoo.co.in
6.	Dr Ravi Chopra	psidoon@gmail.com
7.	Pratyaya Jagannath	pratyayj@gmail.com
8.	Nemani Chandrasekhar	chandrasekharnemani@gmail.com

PARTNERS