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Inside

From the Editorial Team

This special issue of *News*R*each* is on the System of Rice Intensification (SRI), different from the earlier issues we have brought out on the subject. This issue summarizes the proceedings of a one-day national seminar held in New Delhi under the aegis of the National Consortium on SRI (NCS), an informal association of practitioners, academicians and policy makers interested in the growth of SRI in the country. The seminar was attended by representatives from civil society, scientific establishment and government. Introduced in the early part of this millennium, SRI in India is already being practised by about 2 million farmers. Even as farmers, civil society organizations and experts vouch whole-heartedly for SRI, the response of the scientific community, barring a few enthusiasts, has been uniformly guarded. Thus, when a few farmers recently claimed world-record yields from SRI, the reaction from various quarters was mixed–that of awe and scepticism, both not founded on sound research. Yields, productivity, etc., need not be matters of opinion; there are well-established scientific protocols by which these variables can be studied and conclusions drawn. The NCS has always advocated rigorous scientific engagement on SRI. Dr T.M. Thiyagarajan and Dr. Biksham Gujja are two researchers and activists, who have been in the forefront of making SRI popular in the country. They have been involved directly or indirectly in many studies and publications that have sought to explain the phenomena of SRI in simple terms. The release of their new book, *Transforming Rice Production with SRI: Knowledge and Practice,* was the major highlight in the seminar. We present a review, of this exceptionally educative publication, by Dr Ravi Chopra of People's Science Institute, himself a votary of the scientific temperament and a pioneer of SRI in the country.

The seminar also saw the presentation of a few well-informed studies that highlighted different aspects of SRI related to science, practice and policy. The study by Amit Saha and Amit Kumar looked at the initiatives taken up by few state governments in scaling up SRI, and the comparative merits and demerits of these initiatives. The attempt was to discern patterns, if any, and draw up recommendations for designing effective extension mechanisms, to scale up agro-ecological innovations among small and marginal farmers. Soumik Banerji studies the performance of a large number of indigenous paddy varieties under the SRI method and discovers remarkable results, which, if confirmed through more studies, could have a game-changing impact on the national seed policy itself. In addition to discussions, on these studies, the seminar also witnessed a number of learned presentations and deliberations. A summary of these discussions is also presented here. We are happy to present this issue to all of you, as an update of the discussions on the subject today. We look forward to your comments and inputs.

Policy Consultation on System of Rice Intensification: Learnings and Strategies

A summary of the deliberations on SRI among various stakeholders, organized by the NCS, highlighting the importance of engaging the scientific community in proving the rigour and robustness of SRI as a method of crop management.

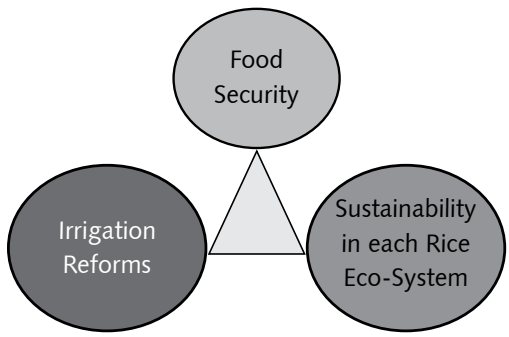
CONTEXT AND OBJECTIVE

In the current state of the Indian economy, with rising overall prices, the food and nutrition security of households, specifically of small and marginal farmers, has become critical to achieve inclusive growth. With a continuous decline in the total factor productivity, attaining sustainable food security is becoming a challenge in itself. In this scenario, the System of Rice Intensification (SRI) is fast emerging as a sustainable alternative to enhance productivity even as natural resources are preserved. Some of the state governments have proactively supported the practice, with major initiatives from civil society organizations and indeed the farming community has accepted this practice in large numbers across India. However, as is the case with any new initiative, SRI too is being questioned along various dimensions on its scientific veracity. It is, therefore, critical for multiple stakeholders to deliberate together and come to a consensus about how to enhance scientific understanding of the technology, streamline the practice including capacity strengthening and educate policy makers for developing focussed actions around SRI. Against this backdrop, the National Consortium on SRI (NCS), which is a network of like-minded institutions and individuals engaged in promoting SRI, conceived this policy consultation. This consultation was organized with three major broad objectives:

1. Update stakeholders on the activities and achievements of the National Consortium in the past three years, with support from the RRA network.
2. Reach out to policy makers and explore ways of evolving partnerships with the agriculture ministry in the central and the state governments, especially in the rain-fed areas.
3. Strengthen linkages with the stakeholders and expand the Consortium.

INTRODUCTION

One of the objectives of this consultation has been to invite the scientific community to discuss and throw more light on the science of SRI. Dr. B.C. Barah, NABARD chair professor, pointed out that the success of SRI is beyond doubt; however, it is yet to be validated by the scientific community. Many of the questions raised about SRI can be addressed by the scientific community, to prove the rigour and robustness of SRI as a method of crop management. This will also provide an opportunity to discuss ways and means to ensure food security of small and marginal farmers through SRI.



Today, SRI has generated considerable debate globally, particularly with regard to its potential to enhance rice yields. The average rice yield production with SRI is double and practitioners and promoters of SRI claim it can be increased three to four times. Whereas the opponents say that high yields in SRI is due to a measurement error, it is true that scientific support and validate the claim is missing. Despite this, the increase in the number of SRI adopters in India, has been higher than any other agro-ecological innovations within a short span of time.

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The three pivots of SRI are food security, irrigation reforms and sustainability in each rice eco-system. Each of the pivots has different objectives, and different kinds of research programme are required for each of these pivots, in different geographical locations, involving different actors.

India is primarily an agrarian society with more than 70 per cent of the population living in the rural setting and engaged in agriculture for their livelihoods. India requires a system of cultivation that produces a higher yield, to feed the rising population and conserve resources for future generations as well. It is believed that a method of agriculture similar to SRI existed among farming communities as early as 1911 in India; however, owing to maybe the push of input-oriented agricultural practices, it went out of common practice. SRI is an opportunity for India to address the three immensely volatile 'Es'—economy, employment and environment. SRI seeks to address the food security and the economic growth of the country. Owing to its inherent nature of water conservation and soil preservation, environmental factors are also covered. Some states such as Tamil Nadu, Bihar, Jharkhand, Odisha and Tripura have already adopted SRI on a large scale, with its resultant growth in output, and soil and water conservation.

Policy Imperatives

SRI is practised in almost 30 countries across the globe; and in India almost two-thirds of the states, covering 2 million farmers, has already adopted this system, informed Dr. Rita Sharma, Member Secretary, National Advisory Council (NAC). SRI addresses two fundamental dimensions—it saves water and reduces the

use of seeds while catering to the needs and requirements of small and marginal farmers. The National Food Security Bill, will create a legal obligation on the state, to provide subsidized food cover to almost two-thirds of the population of the country. It will increase the need for a larger quantum of food procurement by the government. There is great applicability of SRI technology in the sustainable intensification of agriculture. Through the practice of the SRI technology, water is conserved, soil preserved and there is an increase in yield, which consequently will help in addressing the critical aspect of food security of the nation.

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Taking SRI to the policy level is a timely strategy to mainstream SRI as a national policy that will help cater to the food security needs of the country today. A pragmatic consideration will be to garner existing schemes such as MGNREGS with SRI, to address the two-pronged objectives of generating wage days and using these wage days to facilitate transition of small farmers to SRI. MGNREGS is an almost forty thousand-crore programme catering to small and marginal farmers, with a distribution today of 12 per cent and 88 per cent work on individual and community lands, respectively. This distribution must be reversed or, at the least, brought to a level of 75 per cent of works happening on individual lands. This will hugely transform the impact of MGNREGA and promote technologies like SRI.

The opposition to SRI is mainly from some sections of the scientific community. The scientists should now, instead of just speculating, engage in exploring and verifying the veracity of the technology. What is SRI? What contributes to the increased production? Is there a science behind it? Take up rigorous studies with proper controls and educate the world. That is what the scientists must do rather than just reacting to what practitioners claim. Another area of work requiring attention is the capacity building of practitioners, and others. SRI is not uniform, and local-level modifications according to requirements are practical and to be appreciated. There may be a lack of attention to details among the farmers and the practitioners that can only be dissuaded by scientific rigour. At the same time, delay in making SRI a part of the agriculture policy will be a setback; therefore, whereas 'nay-sayers' could carry out their experiments in the field at the policy level, SRI could be introduced to answer the food security and environmental issues of the country.

Prof. (Dr) R.B. Singh, President of National Academy for Agricultural Sciences (NAAS), emphasized that food security at the household level is crucial for small farmers, sub-marginal and marginal farmers, who are also the major focus population of NAAS. Scientific explanation is all about the rigour of the findings as it crosschecks multiple times before proposing or validating any system or experiment. That the farmers are still hungry even when they are the ones who produce food is ironical. Also, water is an important resource, and water-security and preservation are an urgent need of the time as ecological balance has to be maintained alongside economic growth. Water security needs to be addressed to achieve a green economy. SRI detractors mainly fault the system on the lack of availability of technologically refined tools such as weeders, but that is missing the point. There are two aspects that need serious reflection: whether SRI works better with advanced, new seeds or it is more effective with indigenous seeds. These need to be

addressed in order to avoid controversies that may arise about which kind of seeds are better suited to SRI principles. Similarly, another aspect that needs to be determined is does SRI mean only organic or is it amenable to inorganic inputs?

There are two aspects that need serious reflection: whether SRI works better with advanced, new seeds or it is more effective with indigenous seeds

As a spill-over effect of SRI, sugarcane intensification and wheat intensification have also emerged. This gives rise to semantics issues, which can easily be avoided by referring to these as crop intensification.

In the wake of the recent media story, in which a farmer in Bihar claimed to have produced 22.4 tonnes of rice per hectare, a meeting of some of the farmers practising SRI was convened in Patna. Interestingly, each of these farmers had a different understanding of SRI. There did not seem to be a standard methodology in what they described as SRI. This is where the role of the scientists comes in—to make sense of this variety. The scientific community must engage in appropriate research experiments to study the claims of the SRI community. It is important to not let the confusion multiply. The scientific community should be engaged rigorously and judiciously, to explain the science of SRI and mitigate the controversies upfront.

NAAS proposes to bring out a position paper on SRI within the next 6 months that is by the year end. This is important for giving guidance to state governments and Government of India-sponsored programmes such as National Food Security Mission (NFSM). The Government of India needs to engage with the Consultative Group on International Agricultural Research (CGIAR) to validate SRI. We must work to come out with a position paper on SRI in another 3–6 months. Scientific research must build on innovations on the ground, to produce a judicious system. Innovations include the perceptions and knowledge of the people and not just technology.

Dr. Biksham Gujja, a senior advisor to Worldwide Fund for Nature, said that one of the major concerns of the water fraternity is to explore a system in which rice production needs less water. Conventional methods of rice cultivation require a lot of water. SRI was taken up as a research experiment with 232 farmers, wherein the productivity aspect and water usage were observed. Rice production increased to around 20–30 per cent, and used 30 per cent less water. No other technology has been able to match this performance. There is a very interesting phenomena associated with SRI. Here is a method by which farmers have produced results and yet they are being asked by the scientific community to explain the science behind the method. Vast sums of money are being used for rice research across the world; why then is the scientific community not taking up more extensive research on SRI? More than 2 million farmers are using SRI at this point of time in India.

SRI is not about establishing records; it is about producing more with less input and this is the real issue. Most of the SRI farmers lie at the bottom of pyramid and are struggling for food security. This system could produce a greater yield with lesser quantity of water intake. Rice cultivation in India consumes almost 60 per cent of the water allocated for agriculture; therefore, it is important to explore mechanisms that could lower water consumption and increase crop production. SRI yield is almost 25 per cent higher. Clearly, although more labour-intensive, SRI requires less input, less water and produces more output. NGOs and the other supporters of SRI, on the other hand, must stay away from making any exaggerated claims and pitch for SRI in simple terms.

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View from the NCS

India today faces three major crises, according to Ravindra A. from WASSAN; one is the *food security crisis,* which is less about production and more about access. The prime focus here are the small and marginal farmers and how they produce and eat. The second crisis is the *ground water crisis*. Rice production in the conventional way consumes large amount of water. The third crisis in the making is the *soil crisis.* SRI could help in production enhancement and water management.

In all the SRI-related debates today, we are mixing the technology of SRI with the diffusion of SRI. A study of all the latest published articles on SRI reveals an increase of around 30 per cent yield due to SRI, which is more than what the hybrid seeds are able to achieve. Scientists are still reluctant to study these phenomena and are not ready to engage with SRI, to see if there is science behind it. NAAS can possibly also establish evidence from already published works from both national and international documents, and arrive at its own logical conclusions.

Need for Scientific Rigour

Dr. Alam, NAAS, spoke of the experiment commissioned on SRI by the University of Srinagar on cool water rice, which found that seed is definitely saved and that check-row planting helps in the inter-culture of a crop, yielding good dividends. Any inter-culture in a crop is good management practice. That SRI produces more yield by weeding is not surprising. However, the problem arises when people make lofty claims, and forget scientific rigour and practicality. A workshop was organized in Patna for farmers. Each farmer practised a different version of SRI, which is very labour intensive and suited only for small and marginal farmers who have their own family labour. Large farmers cannot adopt SRI because it is difficult to arrange for the labour. Mechanical options are needed in order to be able to adopt SRI on large plots. Otherwise, the advantage made in the yield gets lost in the labour. SRI needs assured irrigation facility, which is very costly; most of the farmers don't have assured irrigation water and so the farmers cannot practise SRI. SRI definitely increases yield and can go up 50 per cent under good management practice. Scientists need to look at the process and then validate SRI.

Seed Testing in the Local Area

A common problem arising in the field of indigenous paddy seed testing, informed Dr. Mahindra, ICAR, is of validation because verifying the seed in scientific laboratories away from its natural habitat affects the results adversely. Therefore, it was suggested that validation of the crop variety of indigenous nature could be done in the respective state centres, which the ICAR system has across the country.

SWI Trial by IARI

Dr. Shivdhar Mishra and Dr. B.C. Barah spoke of the experiment conducted at IARI under the PPP model, wherein IARI collaborated with NCS and commissioned an on-station study of experimenting with the System of Wheat Intensification (SWI) through intensive farmer-practitioner-scientist interaction. The protocol for SWI, as practised by NCS partners, was shared with the scientists before initiating the experiments. Principles such as seed treatment, dibbling two seeds per hill, wide spacing, alternate wetting and drying, regular

weeding, manure compost are the key to the success of SWI technology. Farmers from Rajasthan, Uttarakhand and Bihar participated in this experiment. Broadly, the findings so far in the study are similar to what has been found elsewhere. Wider spacing maximizes the use of air and energy for plant growth noticeably. The use of mechanical weeding offers soil aeration for enhancing soil biota and root growth. Compost manure helps create a more enabling environment to soil biota and plant cell development. Using the variety HD 2967, developed at IARI, the yield of SWI was 7.96 ton/ha, whereas the conventional experimental plot gives 6.1 to 6.6 ton/ha. There is also perceptible improvement in other plant and root characteristics due to SWI practices, such as plant dry mass, thousand grain weight, plant height and grain per panicle. The significant build up of available nutrients (NPK) and carbon at post-harvest state was observed. The highest production was observed in SWI (direct seeded achieving around 8 tonnes per ha).

The data need to be analyzed further for understanding the economics of cultivation, using different means.

Experience of IAMWARM Project

The Irrigated Agriculture Modernization & Water-bodies Restoration and Management (IAMWARM) project has been initiated with an objective to improve irrigation service delivery and productivity of irrigated agriculture with effective integrated water resources management in a river basin/ sub-basin framework in Tamil Nadu said Dr. B.J. Pandian from Tamil Nadu Agriculture University (TNAU). This will be achieved through investments for modernizing irrigation infrastructure (including system rehabilitation, on-farm works, technical and managerial upgrading of institutions involved in irrigation development, operation and management, diversification of agriculture with appropriate extension measures and marketing linkages, promoting public-private partnerships, piloting innovative irrigation infrastructure development and management options), and re-orienting and strengthening institutions and instruments required for integrated effective water resources management in the state (including unbundling resource management from service delivery institutions).

The project is a six-year experiment that began in 2007 and will end this year in 2013, with a total outlay of Rs 2,400 crores in 63 sub basins in three phases. At the initial stages, the challenges faced by the project were: farmers' traditional mindset, lack of awareness, skill upgradation of labourers, lack of regulated irrigation, and timely availability of implements. To address these challenges, the project devised certain innovations in the field, which helped them disseminate awareness and acceptance about the system. Some of these were exposure visits, rural artisan training, popularization through publications and training to labourers. The project is nearing its end. The major lessons learned are: SRI improves productivity, reduces cultivation expenditure, saves seeds, saves water, ensures better functioning of the root system, and the plants are non-lodging during aberrant weather. The recommendations from the study are:

a. Niche areas for SRI need to be identified because SRI promotion should be based on the suitability of soils, season and water source.
b. SRI components need to be standardized to suit each region of practice, and allow local modifications in SRI practices, to achieve the principles of SRI.
c. A mechanical transplanter needs to be

developed or modification of the existing transplanter needs to be carried out to suit SRI principles; a low-cost, user friendly weeder needs to be developed for adoption.

d. Intensive capacity building and exposure visits need to be undertaken, to understand SRI principles and change the mindset of the farmers.

e. Favourable policy support from government needs to be advocated to promote SRI.

State Initiatives at SRI Scale-up: NCS Studies in Bihar, Jharkhand, Chhattisgarh and Odisha

Amit Saha and Amit Kumar, independent consultants, recounted that, in Bihar, SRI started in 2007, through the collaboration of Civil Society Organizations (CSOs) with Bihar Rural Livelihood Project Society (BRLPS). For the initial two years, it was limited to BRLPS and a few leading CSOs such as PRADAN. The collaboration with the state government began later, and 2011 was declared 'Year of SRI'. The plots for demonstration cover approximately 5 lakh ha. There are almost 1 lakh SHG members in 8,673 ha across 55 blocks in 9 districts. Currently, the CSOs engaged there are PRADAN, BASIX and AKRSP, which are actively involved in spreading SRI with more than 30,000 households. Input support is a major component in government-supported SRI, which is approximately Rs 3,000 per acre per farmer. The main observations from the field are: grass roots-based institutions like SHGs are effective; there is a need to improve the quality extension resources in the communities; and mass awareness has positive results in information dissemination. The challenges faced are: input distribution

Table 1: Yield Comparison of SRI with Conventional Method

Year	Yield (Kg Ha^{-1})		% Increase	Area under Demonstration (Ha)
	SRI	Conventional		
2007–08	5,709	4,465	28.3	1,311
2008–09	6,710	5,035	33.3	2,581
2009–10	7,058	5,139	37.3	4,000
2010–11	6,856	5,177	32.4	10,089
Average/Total	**6,583**	**4,954**	**32.9**	**17,981**

Table 2: Beneficiary-wise Analyses

Year	Per Cent Increase in Yield over the Conventional						
	<10%	10-20%	20-30%	30-40%	40-50%	>50%	Total Number
2007–08	337	311	363	301	144	-	1,456
2008–09	-	568	678	1,004	387	392	3,029
2009–10	71	567	543	331	2,790	943	5,245
2010–11	105	1,158	2,662	1,918	1,503	2,421	9,767
Total	**513**	**2,604**	**4,246**	**3,554**	**4,824**	**3,756**	**19,497**

became the main focus of the agriculture department during SRI promotion; issues with the capability and commitment of the Kisan Salahkars about the inclusion of poor, landless and share croppers; post transplantation follow-up and monitoring; and farmers' dropout rates despite their being supported during the preceding years.

A strategic multi-tier intervention was made that emphasized certain significant factors. It was suggested that farmers' empowerment should be made the core of the entire practice

In Jharkhand, the project was started in 2003–04, with mainly CSO collaborations. Government support has been minimal, with only incentive support provided to farmers. Currently, the collaborative efforts of NABARD and other CSOs have touched more than 80,000 households. In 2011–12, government gave incentives to 53,400 households for adopting SRI in 30,000 ha. The observations from the field reflect that the presence of reliable CSOs at the grass-roots is advantageous and the partnership and convergence models whereby NABARD and SDTT have collaborated with CSOs have proved very effective. The experience of CSOs serving as resource organizations is very positive. NABARD reports show that SRI has improved the level of food security from 3 to 12 months for small holders.

In Chhattisgarh, the initiative was started in 2008 when PRADAN in collaboration with 11 NGOs carried out field trials of SRI with 800 families in 80 ha of land. The SDTT-PRADAN partnership has been instrumental in spreading SRI knowledge to about 16,000 families, covering 340 villages in 11 districts. This has led to the formation of state-level forum known as the 'SRI Manch'. The state has disbursed a cash subsidy of about Rs 3,500 per ha to each farmer, the demo in 20,000 ha amounting to Rs 7 crores. The field learnings in the area are that the proper selection and availability of farm implements is critical; the use of green manure and vermi-composting is limited; and there is need for committed funding in order to sustain the effort.

In Odisha, the project was begun in 2007, with a multi-stakeholder workshop that resulted in the formation of the 'Learning Alliance'. Thereafter, through 2007–08, an exposure visit of a government official to the adjoining state of Andhra Pradesh resulted in the adoption of 2,000 demonstration plots funded under Rashtriya Krishi Vikash Yojna (RKVY) scheme. NABARD and SDTT support to the CSOs since 2008–09 has benefited SRI promotion immensely too. In 2009–10, under the RKVY scheme, almost 11,575 ha were covered with SRI practice. In fact, the following year, SRI planning was done at the *gram panchayat* level. Some of the observations from the field here are that the cluster development approach in line sowing has made visible impact. Line sowing and weeding operations are the only two visible features found at field because a large number of small farmers are share croppers for whom it was not always possible, to adopt the whole package of practice. The challenges observed in the field range from the fact that line sowing has diluted the importance of other SRI principles, big farmers still not participating fully in the SRI programme, to farmers rarely availing any support assistance when pest attacks occur, and to the HYV seed promotion strategy needing to be looked at again.

A strategic multi-tier intervention was made that emphasized certain significant factors. It was suggested that farmers' empowerment should be made the core of the entire practice. The development of appropriate technologies extension services should then be looked

into and, consequently, a uniform knowledge base and capacity building of all the stakeholders should be undertaken. Last, SRI requires a policy stand with a separate budgetary allocation. At the micro-level, social mobilization, resource augmentation and area development, and the mobilization of mainstream resources and employment will be facilitative in encouraging SRI practice.

That SRI benefits not only individuals (through enhanced income/ unit area) but also the public (through saving in irrigation water, reduction in carbon emission, etc.) is a fact

An Innovative Extension Mechanism for SRI

Dr. N.K. Sanghi from WASSAN, a Hyderabad -based organization emphasized that reforms are needed in the delivery mechanism for promoting SRI, which primarily focuses on 'knowledge-centric' rather than 'input-centric' development. The conventional approach of holding 'demonstrations' with a small number of farmers and expecting that the subsequent coverage will take place through a natural diffusion process has not been found to be relevant for SRI. We have to reflect whether a project management approach is to be considered for promoting SRI. A new set of tools/instruments are to be used to motivate farmers and to provide educational inputs in a cost effective manner. The formal extension system needs to play a new role, with greater space for informal communication. Common interest groups (CIGs) could play a central role in sustaining SRI after the project period. That SRI benefits not only individuals (through enhanced income/unit area) but also the public (through saving in irrigation water, reduction in carbon emission, etc.) is a fact. A project management approach needs to be adopted through partnership with experienced project implementing agencies (PIAs), on the pattern of participatory watershed management programme. The flow of funds to the identified CIGs for development component and to the experienced PIAs for capacity building, institution building, administration, etc., are important. Flexibility in adoption of strategic options, depending upon the existing status of SRI adoption in the concerned district, is required too. Pro-active partnership between formal and informal extension systems, even at the district level, through three separate streams to promote SRI (large-scale promotion, challan fund-based promotion and intensive R&D) is necessary.

The adoption of a simplified concept of field schools for farmers to enhance their knowledge and skills will help disseminate knowledge in a structured manner. SRI farmers need to be organized into CIGs on the pattern of SHGs, to ensure sustainability. A compact block approach for a three-year period (on a project mode), particularly in areas where water management requires a group action (under tank, canal, etc.), will yield positive results. Initiatives such as exposure visits and the hiring of experienced farmers as consultants (to be paid against outputs) could also be considered. Management of equipment (for SRI) through the local SHG on a custom-hiring basis (rather than providing it to individual farmers on subsidy basis) will be helpful. The PPP model could be experimented with to include the formal and informal extension systems for greater visibility and acceptance. The concept of payment for public good, which would mean that continued incentive be provided to practising farmers for a 10-year period for larger environmental gains they bring in, could also be considered.

Experiences from Punjab

Dr Amrik Singh from Punjab Agriculture University (PAU) spoke of a study that was conducted by the Farmer's Advisory Service

Scheme at PAU and Department of Agriculture, Gurdaspur, in 2010. This was a joint trial on the evaluation of four different methods of paddy transplanting—SRI, standard transplanting, direct sowing in dry conditions, and the farmers' method. The results showed that in comparison to the other three methods, SRI worked wonderfully in all the parameters such as inter-culture and spacing. However, more research activities are needed on the quantification of water for irrigation, mechanized weeding and fertilizer use efficiency in different soils.

PRADAN follows a two-pronged strategy when promoting SRI. In the direct implementation model, professionals engage directly with SHGs and clusters through Community Resource Persons. In the non-direct approach, PRADAN works in support with various networks

PRADAN's experiences

Mr. Ashok Kumar from PRADAN recalled that PRADAN started its journey in SRI in 2003 with less than 1 ha of land belonging to four families. By 2012–13, about 45,000 families practise SRI in 6,500 ha of land. This is spread out in 4,600 villages/hamlets across 6 states, and the average productivity is around 6 tonnes per ha. PRADAN today is trying to ensure food grain sufficiency for small holders. PRADAN follows a two-pronged strategy when promoting SRI. In the direct implementation model, professionals engage directly with SHGs and clusters through Community Resource Persons (CRPs). In the non-direct approach, PRADAN works in support with various networks such as Vikash Bazaar Network (VBN) and SRI Manch. PRADAN also works closely with the implementing agencies and provides them support as a resource organization. It also provides end-to-end solution to the funding agency.

Some of the main reasons for adopting SRI among small and marginal farmers are less seed requirement, less labour and water, less area for nursery, low pest attack, easy to harvest, more grain and more biomass yield, and healthy and bold grains. Some of the reasons for the non-adoption of SRI and for dropping out of SRI among farmers are erratic rainfall, which does not allow transplantation at a stipulated time; field conditions, which prevents timely weeding; heavy demand of labour and unavailability of trained labour. The non-availability of effective weeders and markers in the local area are also two other reasons.

The challenges faced by the small and marginal farmers and the ways and means to meet these are listed below.

1. Rainfall risk: There is a need to integrate water bodies (farm ponds) with SRI and this can be done in support with various government programmes such as MGNREGA, RKVY, IWMP and NABARD.
2. Mechanization: There is a need to support mechanization in SRI. Low-cost, user-friendly weeders, markers, reapers and mini-tractors need to be developed to support SRI. These equipment must be made available to farmers when they need it; for this, the government extension system and the private sector could be involved. There is also need to develop locally suitable equipment, taking support from Krishi Vigyan Kendra's and resource institutions.
3. Sustaining efforts: In order to sustain these efforts, there is need to support the family for a longer period of around 3-4 seasons, and include a significant number of farmers practising SRI in a village. The timely availability of inputs and services is required to sustain efforts to up-scale

SRI. Soil health and social mobilization should also be within the focus to sustain efforts.

4. Expansion: There is need to bring SRI in the mainstream of agriculture training programmes; for this the government agricultural extension system should play the lead role in large-scale expansion. ICAR and associated institutions should include SRI and other systems of crop intensification as their mandate. There is need to establish collaboration with NGOs and community based organizations to scale up SRI and build upon the knowledge and social capital created.

There is improvement in soil health and microbial life. Inter-culture operations help the plant to exploit the full genetic potential of the plants and thus produce more with less input

Study of Dis-adoption Behaviour

Rahul Kumar from PRADAN focused on the objectives of the study conducted to examine the status of adoption of SRI and to study the cause and effects of dis-adoption behaviour; to examine the performance of SRI in rainfed areas in comparison with the irrigated areas; to assess the impact of SRI on household food security in rain-fed as well as irrigated areas; and to analyze the farmer's perceptions of the preference of the practice and derive policy imperatives. It was a longitudinal study where data from Keonjhar and Gaya was collected in the first year. In the same year, data was also collected from Tamil Nadu and Uttaranchal. Some of the salient findings of the study are that productivity under SRI management increases by around 50–100 per cent. Increase on net return is around 60–70 per cent. There is nearly 90 per cent saving of seeds and 30–40 percent saving of water. There is improvement in soil health and microbial life. Inter-culture operations help the plant to exploit the full genetic potential of the plants and thus produce more with less input.

High production was the main reason for adopting SRI in comparison with the conventional method of agriculture. The other factors were less labour, less input cost such as that of seeds, fertilizers and water. More tillers, more profit from paddy cultivation and enhanced land productivity were yet other factors that led to SRI being adopted in Gaya and Keonjhar.

That the practice of SRI was dis-adopted by some was also observed during the survey. The dis-adoption of SRI, as measured in number of farmers who did not continue, was to the extent of thirteen farmers in Gaya (11 per cent) and 11 (10 per cent) of the sample farmers in Keonjhar. The reasons cited for dis-adoption were beyond the control of human beings. Severe chronic drought during past three years and the erratic rainfall, ultimately leading to water scarcity was the main reason for dis-adoption in Gaya. In Keonjhar also the reasons were similar, viz, water problem, sickness and labour problem as well. Therefore, the disadoption was termed as in-voluntary disadoption.

A Comparative Study of Indigenous Paddy Variety in SRI and Non-SRI Practice Conducted by the NCS in Six States

Soumik Banerjee, an independent consultant based in Jharkhand, presented the findings of the study in six states, namely Chhattisgarh, Odisha, West Bengal, Maharashtra, Meghalaya and Tamil Nadu, and assessed the performance of IPVs under SRI and the non-SRI practices. Indigenous varieties are those cultivated among the local community that has a long traditional farming history. As many as two lakh varieties of rice cultivars

were there in India. In fact, more that 1,750 cultivars existed before the Green Revolution. The data was collected through the triangulation of different methods, in order to address the richness and diversity of the subject. The hypothesis and the myths surrounding IPVs as low yielding, lodging and having more straw with less grain was proven to be false. There are almost 800 varieties of IPVs preserved in the study areas. The findings indicated that the practice of SRI with IPVs does not show incidences of pest attacks or diseases in the crop; enhances productivity; has less or no lodging; requires less time and labour in agricultural operations; has reduced rates and so on. The resistance to multiple task and quantifiable benefits are among the best qualities of the IPVs, which have long been accepted by the farming community.

The findings encouraged the practice of SRI with IPVs, with no incidences of pest attacks or diseases in the crop; higher productivity; less or no lodging; less time and labour requirement in agricultural operations; reduced seed rates, and so on

We need to reflect on the dimension of knowledge and fact-sharing with the larger community, for wider acknowledgement and acceptance. The listing of IPVs in the database, adaption and recording of the practice by individual farmers on Web will be useful for interested people to get in touch with the field and verify facts on their own. The need for validation of crop varieties for wider adoption could be regional but accreditation would be beneficial for the preservation of the species of such indigenous crops. The details of production data of around 94 IPVs under SRI management practices were presented. Ten varieties produced more than 6 tonnes per ha whereas 28 varieties produced between 6 and 8 tonnes under SRI practice.

In Chhattisgarh, of the 49 indigenous varieties studied, 5 had produced more than 8 tonnes per ha. In Maharashtra, of 5 varieties, 2 produced between 6 and 8 tonnes per ha. In Odisha, of the 33 varieties studied, 5 had produced more than 8 tonnes per ha, and 12 produced between 6 and 8 tonnes per ha.

The NCS

The systems of crop intensification have the potential to address the food security and resource conservation concerns of the country and this knowledge needs to be widely disseminated and mainstreamed. NCS has been consistently working on crop intensification and believes SRI needs to have more visibility. It has carried out various studies to understand and validate the utility of SRI for the small and marginal farming section of agriculturists. Findings of the comparative studies of IPV in SRI and non-SRI practices or those conducted in other states need to be consolidated in order to arrive with some degree of finality about the factors that influence or hinder the adoption of the system in the field. There is need to look forward to delve into what more should be done, how linkages have been built over the period with various agricultural institutions, etc., could be further explored and draw leverage from the already existing networks.

NCS seeks to extend its engagement at the state level and to influence the state-level allocation of funds and streamline the extension mechanisms. It also seeks to increase engagement with the scientific community, to mainstream the idea of crops intensification in the scientific discourse. That will give SRI the legitimacy and space to be recognized as part of flagship programmes and ensure that more allocations of funds flow to it.

Indigenous Paddy Varieties under SRI and Conventional Practices: A Performance Study

SOUMIK BANERJEE

Assessing and documenting the experiences of various organizations and farmers with regard to on-site yield performance of IPVs under SRI, this study, commissioned by NCS, identifies specific areas for future action in research and policy on the subject.

This study was commissioned by National Consortium of SRI (NCS) to assess and document the experiences of various organizations and farmers with regard to the onsite yield performance of Indigenous Paddy Varieties (IPVs) under SRI. IPVs or folk rice are cultivars that are native to areas with a long traditional history of farming. The results of the study will help identify, test and improve the potential of IPVs under SRI so as to bring them into common use and to promote their in situ conservation.

An objective of the study was to develop a database of IPVs that show promising performance in production under SRI and conventional systems. Another was to develop appropriate methods, tools of data compilation and analysis of an in situ assessment of the comparative yield performance of indigenous varieties. Compiling farmers' perspectives on the subject, the study was conducted across different regions and ecosystems with 24 organizations in six states using IPVs. These organizations were selected in consultation with NCS and other field practitioners.

MANAGEMENT SYSTEMS—PADDY

In this study, four different management systems were found, namely—SRI, Single Plant Transplant (SPT), traditional systems of transplant and direct seeded. Table 1 cites the salient features of these management systems.

Methodology

The methodology adopted was to identify at least 10 indigenous varieties per location visited that were performing well, in terms of yield (4 t/ha and above) as per the organization's experiences over the years. Indigenous varieties are defined as paddy cultivars that:

a. Are on the verge of extinction.

b. Are grown over small areas by limited cultivators.

c. Have special features and grain characters.

d. Have a long traditional farming history in the area.

A detailed format was prepared, to record the basic characteristics of IPVs, and the growth and observations data; besides this, a supplementary format was developed for documenting management practices, to record details of the nursery, the main field and costing.

The following tools were used for data collection and compilation. In most cases, the yield and other information about IPVs under SRI was collected from different organizations through the supervized crop-cutting method (primarily by harvesting the crop over a 25 sq m area and taking the weight of the grain after threshing and sun drying for two to three days) for the *kharif* 2012 crop. In places (usually in the non–SRI areas) where such precise information had not been recorded by the organization, yield and other data was collected based on the farmers' estimates and observations.

FINDINGS

Locations

The survey was carried out in 24 organizations across six states, namely, Chhattisgarh, Maharashtra, Meghalaya, Odisha, Tamil Nadu and West Bengal. Approximately, 200 IPVs were identified during the study. The IPVs show amazing diversity, ranging from the submerged deep water saline tolerant varieties to ones growing in dry up-lands and in altitudes

Table 1: Salient Features of Management Systems

SRI	SPT	Conventional Transplant	Direct Seeded (Broadcast)—Biasi
Seed treatment, 2–3 kg seed/acre; nursery at the corner of field-0.1 decimal, drainage	Seed treatment, 1-3 kg/acre	Nursery preparation, 25–30 kg seed/acre, 10 decimals	Land is ploughed twice
Transplanting at 7–14 days, 2-leaf stage	Transplanting at 6–15 days	25–30 days transplantation, seedling removed by pulling; multiple (2–10) seedlings per hill, spacing 4 inches	Seeds are broadcast 40–60 kg/acre
Seedlings taken out with mud ball.	Seedlings taken out with mud ball.	Main field preparation	Land is ploughed again after 30–50 days
One seedling per hill	One seedling per hill	Manual weeding at 50–60 days	Thinning and distribution done
Line sowing and spacing of 6 (plant-plant)–10 inches (row-row)	Line sowing and spacing of 10 inches		One hand weeding
Multiple weeding 10–15 days, 20–30 days, 30–45 days, using mechanical weeders	One hand weeding		

up to 1,700 m. The locations were spread across diverse eco-systems and agro-climatic zones, including the deltaic and coastal regions of the Sundarbans (West Bengal), Ganjam (Odisha) and Tamil Nadu, the plain regions in Bilaspur district (Chhattisgarh), Baramba-Cuttack district (Odisha), the plateaus in the Eastern Ghats (Koraput and Rayagada in Odisha, Bastar and Sarguja in Chhattisgarh, Gadchiroli in Maharashtra) and the mountains in the Garo Hills (Meghalaya).

Communities

The study revealed that 65 per cent of the IPVs are being cultivated by indigenous communities, residing in marginal lands across varied agro-climatic regions. This is the best example of in situ conservation as it is the indigenous communities who have, in many instances, been slow to shift to modern varieties and continued cultivating the local varieties thus conserving and developing these unique cultivars. However, in many cases, the varieties are under critical risk of extinction because they are being cultivated by a lone farmer. Besides these, six organizations are into in situ conservation of a number of varieties.

Management

Of the IPVs, 47 percent (97) were cultivated under SRI farming, whereas the remaining were cultivated under Conventional Transplant (CT), Broadcast (BD) or SPT techniques.

The 16 organizations using SRI adopted the SRI steps in different degrees, listed in Table 2.

Irrigation

Ninety-one per cent of the varieties was cultivated under rain-fed conditions although in some cases where irrigation possibilities exist, protective irrigation was provided on need basis. The study looked at 98 per cent of the varieties that were cultivated in the *kharif* season. Kalinga, Barijata (Sarguja, Chhattisgarh), Thoymalle and Vaikuntha (Tamil Nadu) were the varieties cultivated under irrigated conditions in the summer and *rabi* seasons. Pandidavar (Kanker, Chhattisgarh) is also a variety suitable for the summer season.

Habitat

About 59 varieties (29 per cent) are cultivated in lowlands and 40 per cent in rain-fed medium lands (RML) each whereas 19 varieties (9 per cent) can be grown both in lowlands and RML; 33 varieties (16 per cent) are dry up-land cultivars and six can be grown both in medium and up-lands; Five varieties are adapted to submerged habitats as shown in Fig.1.

Table 2: Adoption of SRI Steps

SRI Steps	Remarks
Reduction in seed rate	Adoption: High. Seed rate reduced by two-thirds in most cases.
Seed selection and treatment	Adoption: Medium. Seed treated with cow urine or concoctions.
Early transplantation	Adoption: Medium. Seedlings transplanted within two weeks.
Line transplantation	Adoption: High.
One seedling per hill	Single seedling adoption: Low; 2-5 seedlings per hill generally.
Weeding	Adoption: Medium. Some locations had only manual weeding.

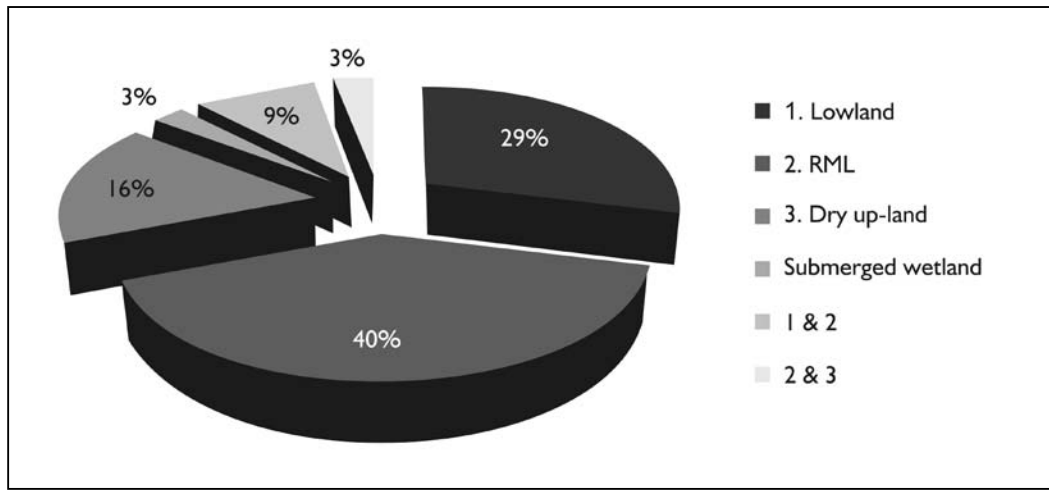

Fig. 1: IPVs Cultivated in Different Land Types

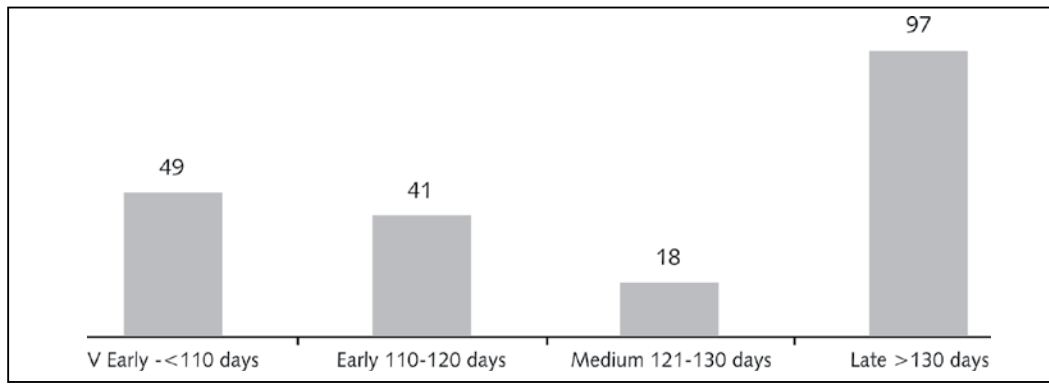

Fig. 2: Maturity Period of Different IPVs

Crop duration

The majority (47 per cent) of the cultivars are late varieties, with maturation times of more than 130 days whereas 24 per cent mature very early in 60 to 110 days (Fig 2).

Table 3 shows the habitats and management practices adapted by various varieties. The very early cultivars are usually cultivated in the dry up-lands under BD; the early varieties and medium duration varieties are cultivated in the RMLs primarily under SRI whereas the late varieties are cultivated in the lowlands under SRI or SPT.

Table 3: Habitats and Management Practices of Cultivars

Cultivars	Habitat	Management
Very early	55% in up-lands, 35% in RML	43% BD and 37% SRI
Early	56% in RML & 27% in lowlands	54% SRI, 27% CT
Medium	72% in RML, 28% in lowlands	78% SRI, 17% BD
Late	50% in lowlands, 44% in RML	44% SRI, 42% SPT

GROWTH & OBSERVATIONS

Sowing and transplant

Most of the varieties are sown at the time of commencement of the monsoon. Thus, with the arrival of a late monsoon, 61 per cent of the varieties are sown in July (Fig 3.); in terms of transplant, 77 per cent are carried out in July stretching to August (Fig 4.). IPVs, being photo-period sensitive, have the remarkable ability to adapt to late agricultural activities and are still able to maintain productivity, as compared to photo-period insensitive modern varieties. This greatly affects yields.

Days to flowering

Flowering days (Fig. 5) vary from 35–125 days, depending on crop maturity, with a mean of 90 days; 50 per cent of the cultivars flower within 90 days.

Table 4 shows the tillers, panicle percentage, panicle length, grains per panicle and range in different management practices.

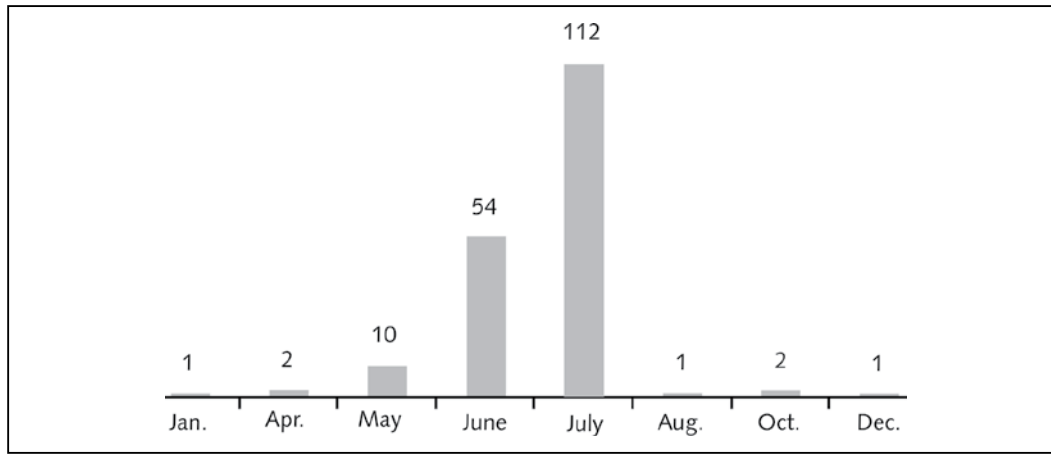

Fig. 3: Sowing Time of Different IPVs

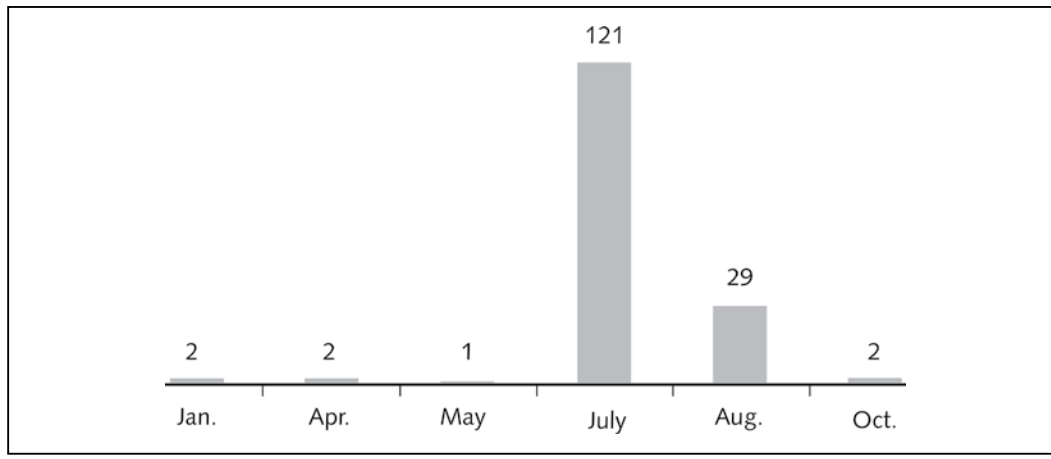

Fig. 4: Transplanting Time of Different IPVs

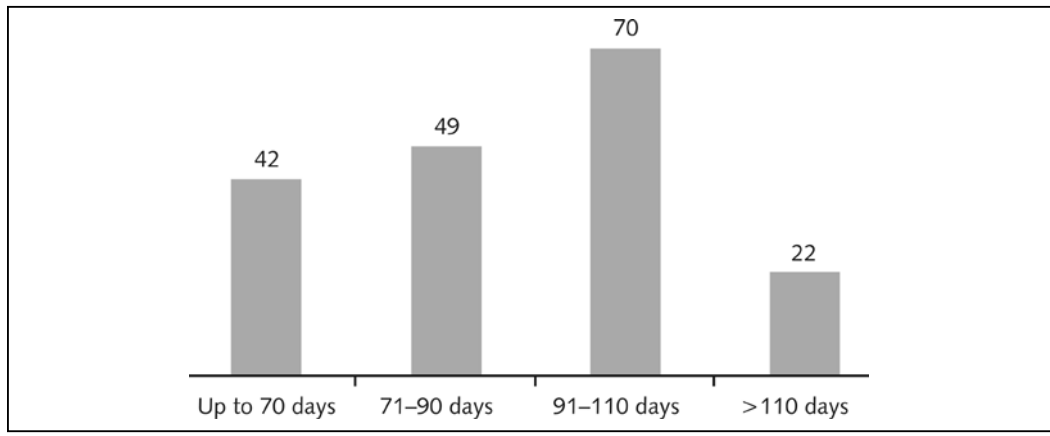

Fig. 5: Flowering Days of Different IPVs

Table 4: Comparison of Yield in Various Management Practices

Practice	Mean Tillers	Range	Mean Panicle %	Range	Mean Panicle Length in Cm	Range in Cm	Mean Grains/ Panicle	Range
SRI	28	8–80	93	58–100	26	15–35	263	105–450
CT	13	2–45	95	84–100	20	15–29	187	125–300
BD	7	2–14	94	80–100	17	13–28	125	50–275
SPT	15	8–25	95	79–100	25	15–38	231	90–600

As observed, the tillers, panicle length and grains per panicle are higher in SRI and SPT.

Table 5 shows cultivars that have the highest number of tillers, panicle length and grains per panicle.

Plant Height

The mean height of the paddy plants is 1.3 m, with a range of 0.6 to 5.7 m. Fig. 6 shows the range of heights and the number of cultivars.

About 90 per cent of IPVs are non-dwarf varieties, primarily in the dry up-lands or RMLs whereas the very tall varieties found in flood-

Table 5: Tillers, Panicle Length and Grains Per Panicle of Different Cultivars

Parameter	Cultivars	Location
Tillers	Rudra–125	Sarguja, Chhattisgarh
	Kanchan Safri–80	Kanker, Chhattisgarh
Panicle length in centimetres	Sundarbans, West Bengal	Sundarbans, West Bengal
Grains per panicle	Bahurupi–600 Bahurani–600	Rayagada, Odisha

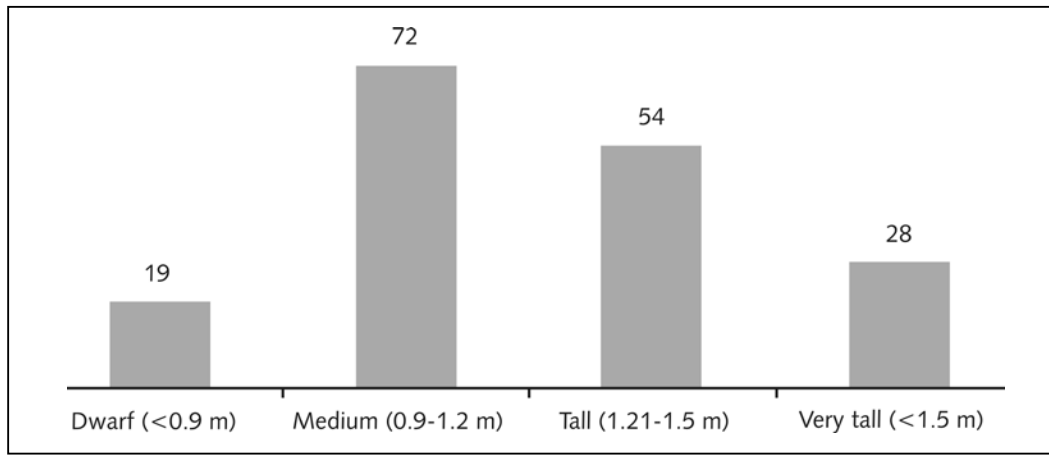

Fig 6: Height Ranges of Different IPVs

prone or coastal areas are able to tolerate flood, submergence and salinity. Due to higher plant heights, as compared to modern varieties, there is a tendency to lodge, ranging from leaning, moderate lodging to prostrate, during the final stages of grain ripening or in stormy or windy situations. However, under SRI, traditionally lodging IPVs showed an erect stand.

Stand

Many IPVs, being tall cultivars, show lodging, primarily at the final stages of maturity or under stormy and windy weather conditions. About 83 per cent of IPVs recorded did not show lodging, except at the final stages of grain ripening (on account of the weight of the grains). Lodging, though considered a negative quality, is accepted as an appropriate adaptation by many farmers and field practitioners and is not reported to reduce yields (in the Katarangi of Sundarbans, lodging results in higher productivity). Under SRI, many of the lodging IPVs did not show any lodging due to the higher culm/plant strength and spacing. Almost 87 per cent of the IPVs cultivated under SRI and 92 per cent of the IPVs under the SPT showed no lodging, except in the final stages or in abnormal weather conditions of storm and wind. The application of chemical fertilizers in IPVs results in lodging.

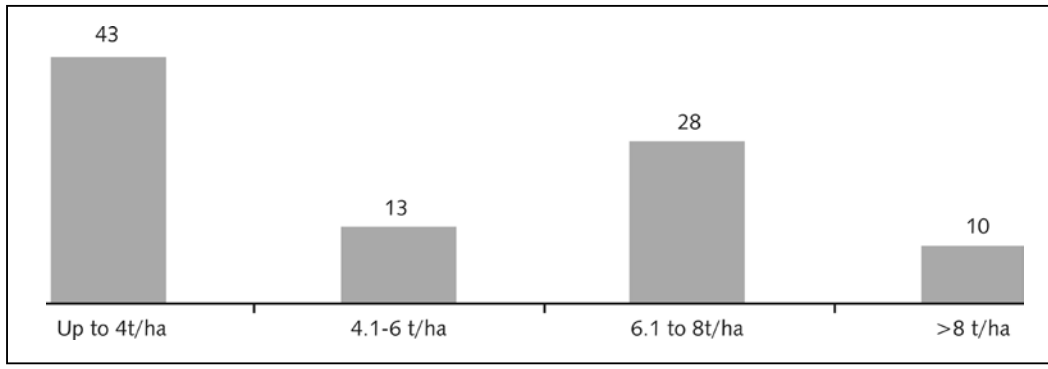

Fig. 7: Yield Range of IPVs under SRI

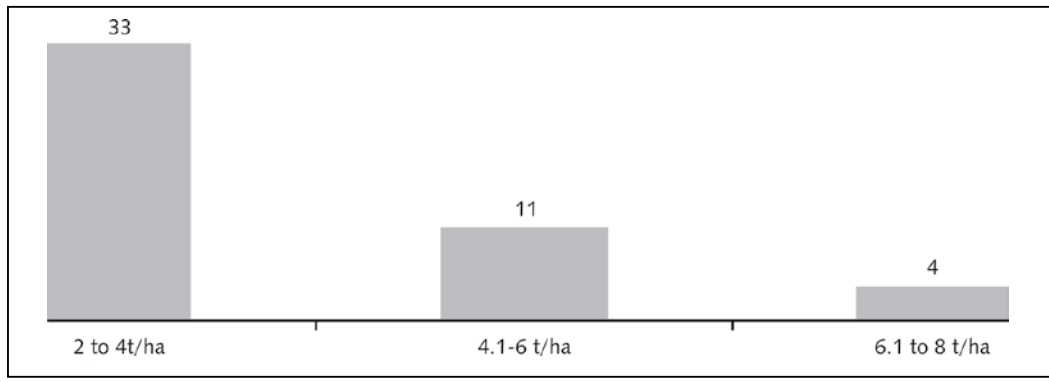

Fig. 8: Yield Range of IPVs under SPT

Grain Yield

The mean yield of 94 IPVs under SRI management across different locations for the year 2011–12 is 5.08 t/ha; 54 IPVs reported yields above 4 t/ha. Fig. 7 shows the number of varieties in different range of yields.

In terms of yield of IPVs in different states, Odisha reported the highest mean yield of 6.1 t/ha, followed by Chhattisgarh of 4.9 t/ha and Maharashtra at 4.5 t/ha; the remaining states of Meghalaya and Tamil Nadu reported yields below 4 t/ha whereas no variety was cultivated under SRI in West Bengal. Forty-eight varieties were cultivated under SPT (primarily in West Bengal), with a mean yield of 4 t/ha. Of these, 15 cultivars showed yields above 4 t/ha. Fig. 8 shows yield ranges.

Thirty-one IPVs recorded were cultivated under the CT system, with a mean yield of 3.1 t/ha. Of these, 20 IPVs showed yields above 2 t/ha and 29 IPVs recorded were cultivated under the BD system, with a mean yield of 2.4 t/ha. Fig. 9 and 10 show yield ranges and the number of varieties.

Table 6 shows the comparative yield of popular modern varieties in the respective regions.

As can be observed, the mean yields are similar to those of modern varieties, and even in the

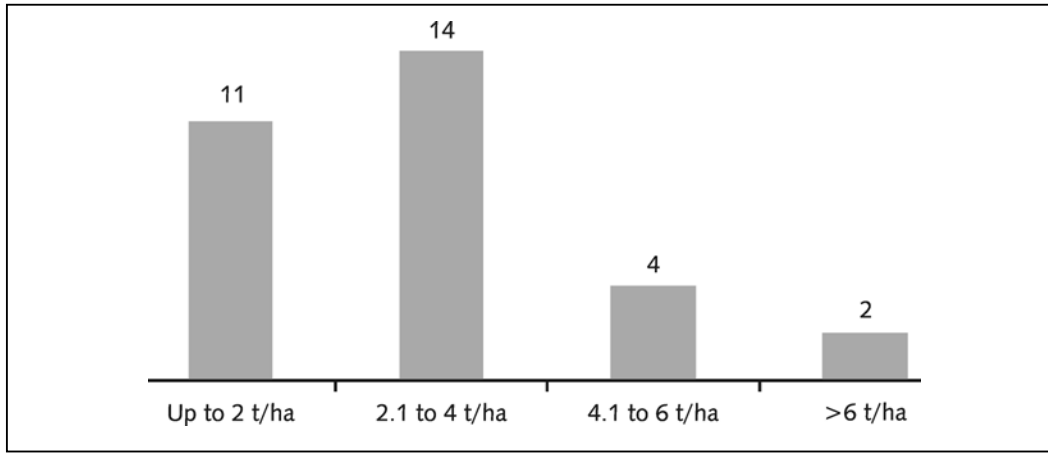

Fig. 9: Yield Range of IPVs in CT System

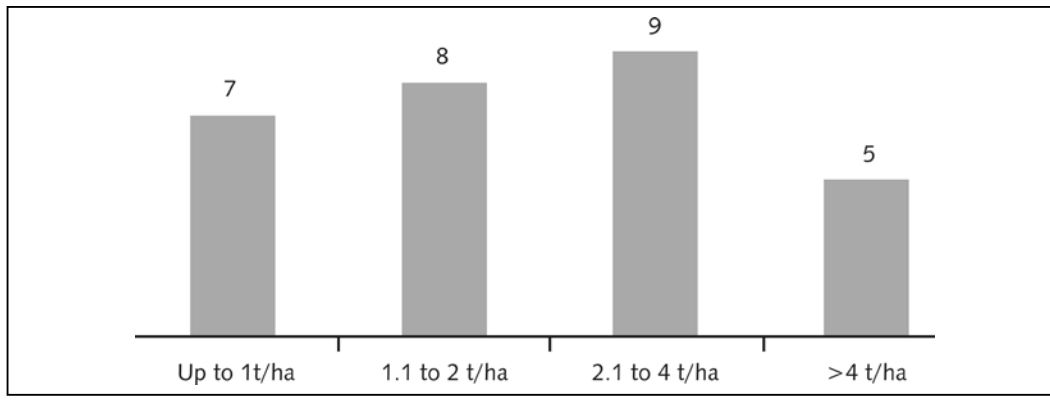

Fig. 10: Yield Range of IPVs in BD System

Table 6: Comparative Yield of IPVs and Popular Modern Varieties

State	IPVs	Modern Varieties
Chhattisgarh	6.1	6.1
Maharashtra	4.5	4.6
Meghalaya	3.7*	5.3
Odisha	6.1	5
West Bengal	4**	4.1

***under CT, **under SPT**

areas where SRI has not been attempted with the IPVs, the potential for having higher yields exists. Most IPVs are being cultivated under organic farming systems as against high input chemical farming in modern varieties.

Straw Yield

The data on straw yield was collected for 123 IPVs, with a mean production of 5.7 t/ha. Being taller varieties, the grain-to-straw ratio is 1:1. Unlike in modern varieties, the straw of IPVs has a number of traditional uses, in terms of

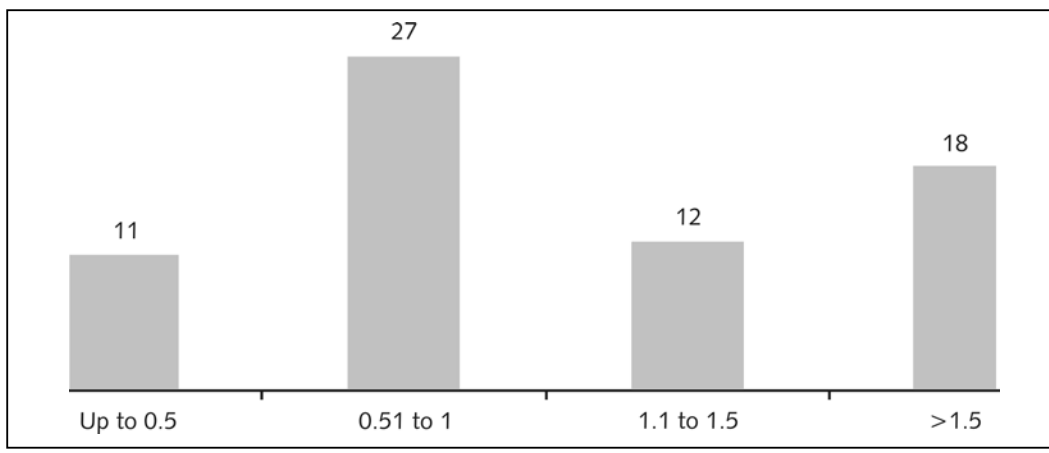

Fig. 11: Straw Yield Ranges of Indigenous Varieties

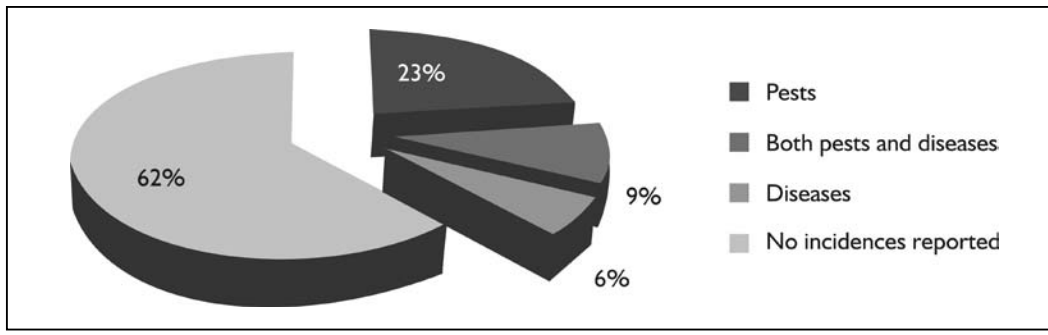

Fig. 12: Pests and Diseases Reported from IPVs

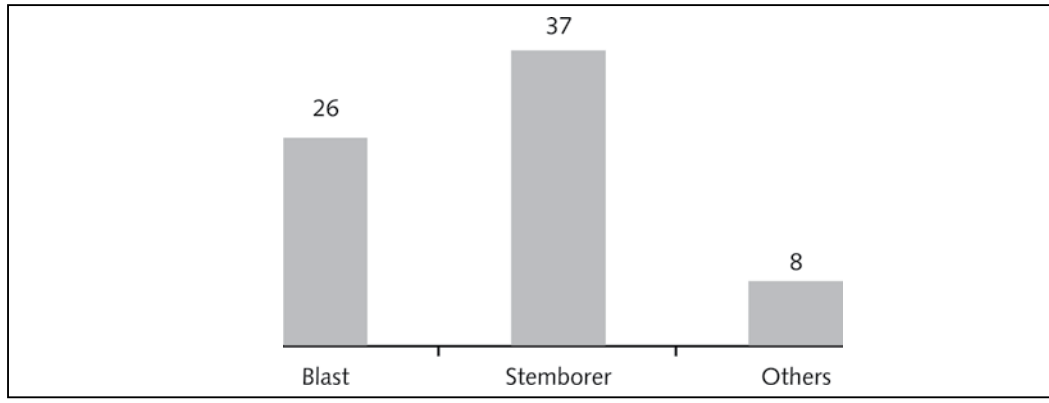

Fig. 13: Most Prevalent Diseases and Pests

fodder, thatching, grain storage structures and other household uses. The cattle also finds the straw more palatable and preferable compared to that of modern varieties. Fig. 11 shows the number of IPVs with different grain-to-straw ratios; 40 per cent IPVs have a ratio between 0.5: 1 and 1:1.

Pests and Diseases

Usually, under favourable weather conditions, there are few pest or disease incidences in IPVs; of the 205 IPVs recorded, cases of pest and diseases were seen only in 71 varieties (35 per cent). Fig. 12 shows the incidences of percentage of varieties.

Fig. 13 shows that 37 per cent of the cases had stemborers, 26 per cent had blast and the rest had other pests such as gall midge and gundhi bug.

Tolerance

The tolerance to drought, flood, pests, diseases and other special features such as salinity were recorded for 78 per cent of IPVs. Table 7 shows IPVs under different stress resistances.

Table 7: IPVs under Different Stress Resistances

Drought	Flood	Pests & Diseases	Salinity
114	30	113	11
56%	15%	55%	5%

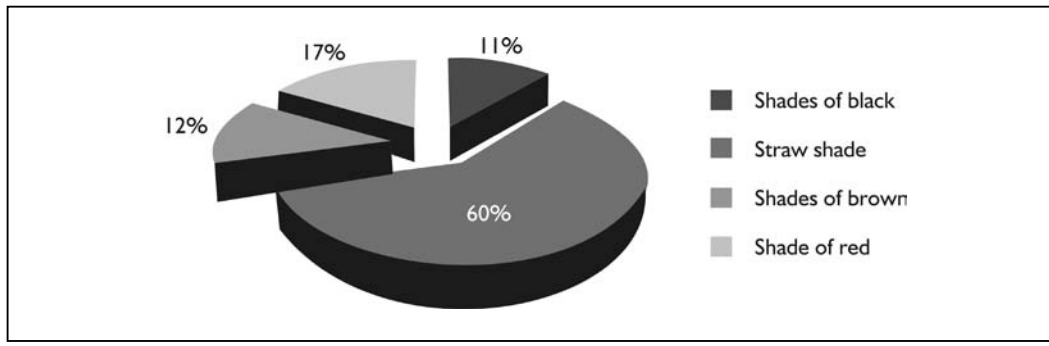

Fig. 14: Hull Colour of IPVs

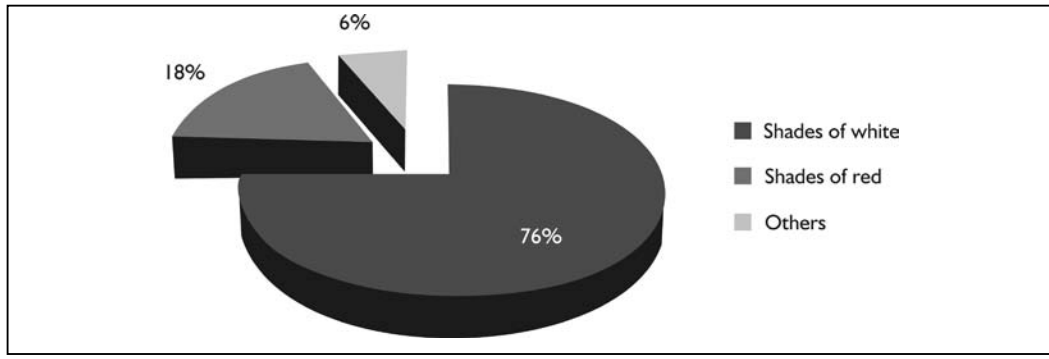

Fig. 15: Kernel Colour of IPVs

IPVs being cultivated in the Central Plateau and the highlands showed increased tolerance to drought. The Sundarbans and Mahanadi basin IPVs show flood tolerance up to 30 days of submergence. Salinity tolerance was reported in 10 IPVs in the Sundarbans delta region. IPVs showed a remarkable ability to adapt to changing environs. Many IPVs not known for flood or salinity tolerance usually showed good yields in saline soils and also tolerated submergence; this was clearly observed in the Sundarbans delta, where after the Aila cyclone, the paddy lands had become saline. Initially, experts were wary about whether paddy would ever grow in these regions because modern varieties had failed to grow on such soil. However, a number of IPVs (Bahurupi, Kerelasundari), not known traditionally for saline tolerance, showed good productivity of 5.6 t/ha in 6 mS/cm salinity. IPVs such as Chamormoni (Sundarbans, West Bengal) can tolerate salinity as well as tolerate 1.5 to 1.8 m of standing water for a month. Their height increases with the rising water. Similar traits are also seen in the Champaisiari (Mahanadi basin, Odisha) and Jalkamini (24 Parganas, West Bengal), which grow to 5 m, remain completely submerged and float. The Katarangi (Sundarbans, West Bengal) continues to thrive despite complete submergence for a week. Many IPVs show resistance to prevalent diseases such as blast or other pests; farmers reported higher incidences of pests and diseases in modern varieties. Some varieties also show tolerance to strong winds.

GRAIN PROPERTIES

Hull and Kernel Colour

Sixty per cent of the IPVs had hulls with shades of straw colour whereas 76 per cent of the kernels were shades of white. Apart

from this, black, red and brown hulls with red, brown, black and amber kernels were recorded. In a number of instances, non-white rice was considered rich in minerals and possessed medicinal properties. However, modern milling and polishing make all rice look white.

Most farmers reported that IPVs are usually nutritional and flavourful (sweeter and tastier), have a good appearance, texture, cooking (grain elongation) and keeping quality, as compared to modern varieties and this is one of the primary reasons for cultivating IPVs

Grade

Grade was measured in three types: round, bold and slender, based on the rice kernel length-to-breadth ratio (l/b ratio) as shown in Table 8.

Table 8: Grading of Rice Kernels

Round (l/b < 2)	Bold (l/b- 2- <3)	Slender (l/b >=3)
20	149	31

Almost 75 per cent of IPVs have a bold grain with an l/b ratio of between 2 and 3.

Qualitative Features

Some qualitative features such as fragrance, end uses (apart from daily cooking) or any other special features (Table 9) were recorded.

Most farmers reported that IPVs are usually nutritional and flavourful (sweeter and tastier), have a good appearance, texture, cooking (grain elongation) and keeping quality, as compared to modern varieties and this is one of the primary reasons for cultivating IPVs. A number of varieties also have high satiety and thus preferred by economically weaker sections. Some IPVs are used for a number of rituals, making of traditional sweets *(kheer, pitha, alsa, moa, liya, roti,* etc.), local culinary delights *(phenbhat, pokhalbhath, amat, pech, biryani, idli),* and rice beer *(landah, pochai, dikha).* A number of varieties also do not need to be parboiled and can be eaten raw, directly after harvest. IPVs also show less breakage in milling and have less percentage of chaffy grains as compared to modern varieties. Jugal and Ramlaxman are double-seeded varieties whereas Sateen and Ramlaxmansita are triple-seeded varieties.

REASONS FOR PREFERRING IPVs

Farmers across different states and regions cited various reasons for continuing with IPVs in spite of the Green Revolution and the overwhelming promotion of the modern varieties, namely:

- Low cost of cultivation due to low external inputs (in terms of seeds, fertilizers, pesticides, irrigation and labour).
- Tolerance to weather vagaries of drought, flood, submergence, salinity, wind, etc.
- Flexibility to varied timings, practices and adaptability to a changing environment.
- Resistance or low incidences of pests and diseases.
- Possibility of re-using the seeds over long periods.
- Minimal chaffy grains and loss in milling.
- Availability of quality straw for fodder, thatching and other uses.

Table 9: Qualitative Feature of IPV

FRAGRANCE		END USES			
Light Aroma	Strong Aroma	Puffed Rice	Rice Flakes	Popped Rice	Medicinal
14	42	24	9	10	4

- Ecologically and environmentally safer.
- Rejuvenation of soil and water.
- Healthy, nutritious, flavourful and keeping quality for home
- Consumption.
- Traditional food, sweets, recipes, drinks and rituals.
- Medicinal and nutritional properties.
- Higher price (in scented/fine rice IPVs).
- Possibilities of innovations and development of new cultivars through selection.

Advantages of SRI with IPVs

- Higher productivity
- Less or no lodging
- Less time and labour requirement in agricultural operations
- Reduced seed rates

Record Production of Indigenous Varieties under SRI

Sahabhagi Samaj Sevi Sangsthan (Charama, Kanker District, Chhattisgarh) has been promoting SRI among farmers of Kanker and Kondagoan since 2008–09. At Lihagaon village in Rajpur block of Kondagoan district, Chhattisgarh, under the able guidance of Jeevan Baghel, Punaram Netam cultivated kanchan safri (a 110-day, slender-grain IPV) in three acres of land under SRI and got a yield of 9.2 t/ha. The crop had 70–90 tillers/plant with 90 per cent panicles, with a length of 28 cm and 275 grains. This variety was brought by Jeevan Baghel's father about 40 years ago from the neighbouring district of Nabarangpur in Odisha, where it was predominantly grown.

Gangaram Markam and Bajrang Markam of the same village cultivated a scented IPV-*basabhog* (120-day, small-bold IPV) under SRI, to get an yield of 10.4 t/ha. The plants had 40–45 tillers with 90 per cent effective panicles, a length of 32 cm and 350 grains. The *kumlichudi,* a reddish-yellow rice variety also gave a yield of 9.2 t/ha under SRI (40–50 tillers/plant, 90 per cent panicles, with a length of 28 cm and 275 grains). *Adanbargi,* a 95-day, red-rice IPV gave an yield of 8.8 t/ha under SRI in the same village (35 tillers/plant, 90 per cent panicles, with a length of 27 cm and 225 grains). Inspired by the results of SRI, the community has taken up SRI in Finger Millet, with encouraging results of 6t/ha.

Chaupal (Ambikapur, Sarguja District, Chhattisgarh) is actively promoting SRI among tribal farmers of Udaipur Block. Agar Sai, an SRI farmer in village Tunga, cultivated mansuri (a 120-day, bold-grained IPV), in 40 decimals of land, to get a yield of 8.4 t/ha. The IPV showed 50–60 tillers/plant and 90 per cent effective panicles, with a length of 25 cm and 285 grains. Agar Sai also cultivated a 135-day, black IPV—kajri—and had a yield of 8 t/ha under SRI. The variety had 45 tillers/plant, 90 per cent panicles, with a length of 25 cm and 290 grains.

The Gramin Yuva Pragatik Mandal, GYPM, (Bhandara, Maharashtra) has been promoting SRI for the last five years in Bhandara and Gondia districts of Maharashtra. Vashist Devaji Gadwe and Damo Gopichand Pandre, of Sarpewada village in Bhandara district of Maharashtra cultivated lochai (120-day, bold IPVs) under SRI in 30 decimals of land each, to get an yield of 7.4 t/ha (40–45 tillers/plant, 95 per cent panicles, with a length of 24 cm and 275 grains). These IPVs had been growing in these areas earlier but had gone extinct with the advent of HYVs and hybrids. GYPM re-introduced these varieties by getting seeds from Gondia district.

THE SEED KEEPERS

The study revealed a number of organizations and individuals, who have gone against all odds to conserve, document and promote IPVs among farmers. Working under severe constraints with limited financial, infrastructural and human resources, these organizations have demonstrated the enormous potential of indigenous varieties.

The Dharohar Samity, Kondagaon, Chhattisgarh, inspired by the rural communes, has been into the conservation of IPVs since 1995. Initiated with 135 varieties from Bastar region, it has 255 cultivars at present. About 60 IPVs are being cultivated under SRI here in 1 sq m plots, for distribution among farmers. In 2012, about 100 farmers received seeds from the Samity. The seeds are given free to the farmers, with an understanding that they will return the amount of seed taken after the harvest. The organization is composed of grass-roots workers and local farmers, and is managed by Sri Shivnath Yadav, who is also the Secretary. Apart from conserving and distributing seeds, the Dharohar Samity has also been making farmers aware about SRI with organic inputs and on various indigenous varieties. The Samity has 15 dry up-land varieties, 26 RML and remaining lowland cultivars. There are 20 scented varieties as well as one double- and triple-seeded variety of *Ramlaxman* and *Ramlaxmansita.*

Dr. Debal Deb of VIRHI, Kerandiguda-Bissamcuttuck, Odisha, has been conserving 820 IPVs for the last 17 years. Dr. Deb, an ardent ecologist from the University of California at Berkeley and Indian Institute of Science, Bangalore, gave up his well-paid job at the WWF in 1996, to set up VIRHI—the first non-governmental seed bank in West Bengal, with 200 IPVs. In 2002, he set up a small farm of 0.7 ha in Bankura district, West Bengal, to grow and multiply IPVs. Dr Deb shifted to Odisha two years ago and has been conserving and distributing IPVs among farmers, facilitated by Living Farms, a non-profit organization working to promote sustainable farming in Odisha. The seeds are maintained in a number of earthen pots, labelled and coded with the names of different IPVs in a two-room hut. Kerandiguda Village, surrounded by the Niyamgiri range. Each of the pots stacked one above the other has a bunch of panicles of different varieties. The unique collection has 100 scented varieties, 130 dry up-land IPVs, 6 salinity tolerant and 12 submergence tolerant IPVs, apart from a number of rare IPVs including the two-grained jugal and the three-grained sateen. About 0.5 ha of land has been leased from local farmers for cultivating IPVs. Each variety is cultivated on an area of 4 sq m, with 64 plants under SPT. To prevent cross pollination, Dr Deb plants different IPVs with different flowering dates. Under the able guidance of Dr Debal, Debdulal Bhattacharyya meticulously does all the farm operations, recording data and collecting the panicles to be stored for seed as well as developing new cultivars through selection.

The seeds are maintained in a number of earthen pots labelled and coded with the names of different IPVs in a two-room hut

Natobor Sarangi (Rajendra Deshi Arthaniti Adhyan Kendra), an octogenarian retired school teacher and a resident of Norisho village near Niali, Cuttack (Odisha), has been conserving and cultivating 365 IPVs since 1999. Sarangi used to grow HYVs, used chemical fertilizers and pesticides in his farms and he had been chosen to promote modern varieties in and around his village by companies and government officials. He switched to organic agriculture when a labourer spraying carbofuran on the farm collapsed and had to be rushed to hospital. Though the labourer survived, Sarangi was convinced of the

serious consequences and hazards of chemical farming. Initially, he used organic inputs with HYVs; his son Rajendra (who was involved in a number of environmental movements), however, advised Sarangi to use IPVs. Most of the cultivars had disappeared from the area by then. In 1999, Rajendra and his friend Jubraj travelled across Odisha and brought dozens of varieties from indigenous farmers. All these varieties were tried and more IPVs were collected. They cultivate 365 varieties now.

Sudhir Patnaik from *Samadrusti,* an Oriya journal, has developed a two-volume album of IPVs, in which each page has small packets of IPVs with their characteristics. Sarangi grows three crops on his land—paddy, followed by green gram and finally gourd in summer. This way, he gets fodder as well as mulching material. The overall productivity of his farm is high.

The Paschim Sridhar Kati Jonokalyan Shongo (PSKJS), in Hingalgunj Block of North 24 Parganas, West Bengal, established in 1988, has been conserving and distributing 300 IPVs among farmers since 2009. It has one main seed bank at Jogeshgunj and 10 associated seed banks in 18 villages across five *panchayats.* Currently, 800 farmers are members of the seed bank. The programme was initiated after the AILA cyclone when modern varieties failed due to high soil salinity. The organization, under the leadership of Bishnupado Mridha, collected IPVs from the Sundarbans and other parts of West Bengal, to initiate the seed bank at Jogeshgunj. It also has a small farm where IPVs are cultivated every year for conservation, multiplication, distribution and research. The organization boasts of a unique collection of 8 salinity tolerant IPVs, 5 deep submergence tolerant IPVs, 17 scented and 10 fine rice IPVs. The PSKJS has been involved in farmers' awareness activities on organic farming with IPVs in the area.

Dr. Anupam Pal, Deputy Director at the Agricultural Training Centre (ATC), Phulia, Nadia district, West Bengal, has been conserving 248 IPVs for the last 11 years. The centre distributed 78 IPVs among farmers in 2012. The varieties are cultivated in the farm of the ATC under SPT. Dr. Anupam has been closely associated with Dr. Debal and both have been instrumental in motivating PSKJS in the Sundarbans area and Richaria Conservation Centre at Abhirampur, Burdwan district, West Bengal, about IPV conservation and distribution. Dr. Anupam has been involved in a number of training programmes, to promote organic practices and indigenous varieties at different levels.

Sambhav is an organization set up in 1988 by a group of like-minded persons deeply concerned about acute problems of conserving our common habitat. It has established a facility in Rohibank, Nayagarh district, Odisha, across 40 ha of wasteland. The name 'Sambhav', meaning possible, was inspired while selecting the highly degraded land where there were only nine trees, gullies, hard rocky soil and heavy grazing. All the local people had remarked that it was 'impossible' to reclaim this land but today the area is a thriving forest with deer and other wild animals and more than 1,200 plant species. The vision of Sambhav's founder, Prof Radhamohan and the untiring efforts of Sabarmatee, Namita and the Sambhav team have not only created a seeming impossibility but have also been conserving 435 IPVs through SRI in its two acres of farm. Apart from IPVs, Sambhav also conserves a number of indigenous vegetables, millet, pigeon pea, fruit trees, etc. Sambhav is a resource centre for organic farming, where a number of residential training programmes are held every year for farmers, creating awareness about sustainable agriculture. Sambhav has been instrumental in motivating and

providing indigenous seeds for SRI to a number of organizations and interested farmers and individuals in Odisha. Sambhav believes that SRI with IPVs is critical to increasing outreach among farmers.

In the Rampur Block of Nayagarh district, Odisha, Nilomani has helped conserve 70 IPVs across three to four *panchayats,* involving about 200 farmers. Nilomoni says the absence of irrigation facilities, fewer pests and diseases, and the lower cost of cultivation have prompted farmers to continue with IPVs, in spite of the promotion of modern varieties in the area. In spite of having no financial support or encouragement from his organization, Nilomoni facilitates and motivates farmers to go for IPVs under organic farming.

The study of IPVs under SRI clearly indicates that mean productivities are at par with those of modern varieties and these are much better adapted and suited to the unique local conditions and thus able to tolerate climate change and adapt to changing environs

CONCLUSION

The study of IPVs under SRI clearly indicates that mean productivities are at par with those of modern varieties and these are much better adapted and suited to the unique local conditions and thus able to tolerate climate change and adapt to changing environs. IPVs are also embedded in the cultural and traditional milieu of the indigenous communities, in terms of their presence in rituals, food, drink, medicinal uses and household items. IPVs are primarily grown under organic conditions, have a low cost of cultivation, maintain and rejuvenate the soil and are environmentally safe as well as nutritious and healthy to eat. A number of IPVs are scented fine rice, thus offering enormous possibilities of higher end marketing and generating additional income for the farmers.

In view of the above points, the promotion of IPVs under SRI management will not only bring in food and nutrition security but also reduce the cost of cultivation, excessive dependency on markets for inputs, as well as make farming sustainable and less hazardous. The efforts in marketing of scented and fine rice will also lead to increased farm income.

Though this was an exploratory study on the potential of IPVs under SRI management; subsequent studies need to be more comprehensive involving locations in other states as well as more robust in terms of sampling especially in relation to the yield variables. Crop measurements and observations need to be carried out in situ in the respective farmer's field over 2–3 years in different stages of the standing crop to validate the results.

Some of the interventions that could be taken up are:

- Increasing Organic SRI outreach with IPVs: Efforts have to be made to increase SRI management across different regions (modifications need to be made for submerged wetlands and dry up-lands) with IPVs, rather than rejecting them for low productivity and introducing hybrids and HYVs. The adoption of practices, especially the one seedling per hill and weeding with organic inputs, need to be emphasized.
- Generating awareness of and action towards adopting SRI with IPVs: There is urgent need to campaign for promoting SRI with IPVs, as opposed to hybrids, in an effort to clear the myths of low productivity, lodging and other negative traits cited against IPVs. Organizations and institutions already involved in

the promotion of IPVs need to spread and share the potential of IPVs among farmers and regions that have lost most traditional seeds through IEC, as well as demonstrations, exposure and seed fests. Policy advocacy and sharing of farmers' experiences and issues with government departments and institutions are critical in bringing back IPVs.

- Supporting existing seed banks and organizations/individuals: The study documented eight indigenous seed keepers and banks. However, in most cases, the organizations are working under enormous constraints. Efforts need to be made to support these endeavours by empowering farmers. Documenting experiences and characteristics of cultivars in the seed bank is greatly needed.
- Farmers' field trials and setting up of decentralized community seed banks and farms: All-round efforts have to be made to collect IPVs across various regions and set-up community seed banks, not only for conservation but to multiply, distribute and release among farmers, thus re-establishing the lost or endangered varieties. Selection, trials, research and documentation of IPVs will help in characterizing and maintaining the breed purity of IPVs as well as bring back the innovative spirit among farmers.
- Protecting IPVs as a community resource as against individual patents: Currently, there are no provisions for protecting IPVs from the onslaught of bio-piracy and patents; a number of processes for individual patents are in place but there are no provisions for protecting IPVs as a critical community resource. There is a strong need for a united approach to effective policy formulation, aimed at protecting IPVs as a community resource.
- Marketing of scented fine rice: There are more than 100 scented and fine IPVs still being cultivated. Sixteen scented IPVs also have more than 4 t/ha under SRI. There is, however, very little awareness, demand or markets for these. Most people understand long-grained basmati as the only scented variety. Barring some popular scented IPVs, in most cases there are no price incentives to cultivate these IPVs as opposed to the bold varieties because there are only two categories in government paddy procurement programme—Bold and Medium. The scented IPVs, thus, end up being sold at the price of medium grade at the most. The traders' report of erratic supply of scented-fine IPVs thus reduced the demand and led to unfair prices. The present laws also forbid the export of non-basmati rice and thus scented-fine rice has no high-end markets as opposed to basmati. The stabilization of production would need to be followed up by effective marketing of scented varieties at high-end markets and exclusive stores. Apart from scented IPVs, there are enormous possibilities of promoting nutritional and medicinal properties of many IPVs.
- Documentation of IPVs: Studies to document IPVs in different states, characterizing and recording of farmers' experiences are important to promote IPVs and bring them under SRI. Analytical studies on nutritional and medicinal qualities of IPVs will help characterize and market the same.

Engagement of the State in the Promotion of SRI: Understanding the Process

AMIT KUMAR AND AMIT SAHA

Presenting facts, experiences and lessons of a study conducted to assess the engagement of states in the SRI programme in Bihar, Chhattisgarh, Jharkhand and Odisha and the role played by various stakeholders including the government, CSOs and farmers

The National Consortium of SRI (NCS) reviewed SRI research in India, in order to unravel the various phenomena related to farmer behaviour, productivity enhancement, water- and nutrient-use efficiency and a concept note on SRI and indigenous varieties. The objective of the study was to assess the initiative taken by the government, CSOs, research institutions and other stakeholders in four states—Bihar, Chhattisgarh, Jharkhand and Odisha. This research aimed at providing a detailed look at the performance of the SRI programme over the years, based on the experience of farmers, promoting agencies and the government in the respective states. Another objective was to study the adoption process, the innovations introduced and the modifications made over the years in these states. The factors that helped the programme, what the constraints in scaling up have been and what the lessons are for the future were also scrutinized.

This report present the facts, experiences and learnings of the study conducted to assess the engagement of states in SRI programme in Bihar, Chhattisgarh, Jharkhand and Odisha. During our visit to all the states, we met government officials, agriculture universities, CSO's and farmers in the field to understand the status of the SRI programme.

The System of Rice Intensification (SRI) is now a decade-old practice within the farming community. Its benefits have received wide acceptance among various stakeholders, including the government. Civil Society Organizations (CSOs) have contributed in a big way to influence several state governments to create a conducive environment for the adoption of SRI on a large scale. In Bihar, the SRI programme began mainly because of the ground work of CSOs. Later on, the agriculture departments of state governments, the Jeevika programme and CSOs took it to a larger scale. In other states also, the SRI programme was started by CSOs, and the government response has been minimal. In states such as Jharkhand and Chhattisgarh, government support for the spread of SRI has been passive. In Odisha, the government has taken up line-sowing on a large scale. In Bihar, the synergy between PRADAN and Bihar Rural Livelihoods Promotion Society (BRLPS) made a great impact whereas, in Jharkhand, the synergy between NABARD and CSOs yielded positive results. In Chhattisgarh, paddy procurement, revamped by computerization, has resulted in very good market selling price (MSP) for farmers.

This is why paddy is considered to be a cash crop. The support of organizations such as NABARD and SDTT has given a boost to the SRI programme; however, somehow the state government's involvement has varied from one state to another. In all these states, CSOs are, at best, input distributors or programme implementers for the government.

BIHAR

Paddy production and the area under cultivation has been almost constant in Bihar for the last ten years. The productivity of paddy has been in the range of 14 to 16 MT per hectare. In 2009–10 and in 2010–11, productivity decreased drastically. However, due to a good monsoon and a supporting agricultural environment, productivity has increased significantly in 2011–12 and 2012–13. Paddy, as a crop, is considered to be the lifeline of Bihar's agriculture. Earlier, agriculture used to be one of the most neglected sectors in Bihar; however, in the last three to four years, the government has taken several steps to improve the agricultural scenario of the state. Paddy cultivation has been made one of the main thrust areas while implementing schemes such as the National Food Security Mission, the Rashtriya Krishi Vikas Yojana (RKVY), National Rural Livelihood Mission (NRLM), Bringing/ Extending Green Revolutions in Eastern India, Samekit Cereals Vikas Yojana Macro Management, etc. These initiatives have helped Bihar take big strides in the agriculture sector. Realizing the importance of agriculture in ensuring food sufficiency and understanding that the sector is one of the prime livelihood options for the people, the Department of Agriculture took a number of initiatives, both directly through its own departments and by collaborating with other support agencies such as the BRLPS and Agricultural Technology Management Agency (ATMA).

Due to the many initiatives of PRADAN, CSOs and BRLPS, several state- and district-level programmes were organized. From 2008 onwards, agencies such as Aga Khan Rural Support Programme (AKRSP) and BASIX gradually began promoting SRI in their area of work. These efforts helped in creating awareness at every level across the state. As there was a significant increase in productivity in the first year, the government decided to continue with SRI promotion under the Jeevika programme. In 2008–09, more farmers from Nalanda and Gaya districts participated under the PRADAN-Jeevika collaboration. In the same year, AKRSP and BASIX also continued their work in SRI. By 2009–10, SRI had spread to other districts through the joint efforts of CSOs, BRLPS and the Department of Agriculture. The government, through BRLPS and its Department of Agriculture, and the CSOs, with support from organizations such as NABARD and SDTT, have been involved in spreading SRI in Bihar.

Interventions by CSOs

AKRSP started its work in SRI in 2005 in five districts of Gujarat. In 2007, AKRSP started its field operations in Bihar in Samastipur and Muzaffarpur districts in four blocks, with 24 households; the number crossed 500 by the end of the second year. At present, AKRSP is practising SRI with almost 2,000 farmers. AKRSP focuses on providing process support, as opposed to input support. The area where AKRSP started work was relatively advanced in agriculture. This helped in developing a pool of agricultural volunteers, to work at the ground level. The farmers were free to choose any variety of seeds, ranging from hybrid to local. Although, finally, it was proved that the yield under SRI was high, independent of the seed variety, it was the farmers' participation that made the process successful. Based on field level experiences, the package and

the practices suggested were changed. For example, the spacing was brought down to 10 inches from 12 inches. AKRSP also developed a pool of agricultural volunteers who worked directly with the farmers at the ground level. Marker usage and transportation of seedlings at the time of transplantation were the key challenges faced by AKRSP during implementation.

At the field level, the pilot project yielded wonderful results. Almost all the farmers recorded a very significant incremental yield and, hence, it was decided to introduce SRI at a much larger level

On the other hand, the strategy BASIX used for implementation was designed around SHG federations promoted by Women Development Corporation (WDC). In this intervention, SHG-based federations were very actively involved right from the stage of concept-sharing to preparing the list of interested farmers. Because most of the farmers were already members of the SHGs, it resulted in the smooth implementation of the process. The other uniqueness in the BASIX model was that it was a fee-based model. The farmers paid a small fee to receive extension services. This was designed with the objective of making the programme sustainable as well of developing ownership amongst the farmers. Village Resource Persons (VRPs) were identified and selected by SHG members and these VRPs took responsibility for smooth implementation of the programme. BASIX took the responsibility of training, hand-holding, providing technical support and linkages and motivating the farmers whereas the SHG federations took care of implementation-related tasks such as registration of farmers, identification and selection of the VRPs, implementation of Package of Practices (POP), facilitation of the community nursery and production of vermi-compost.

PRADAN and BRLPS jointly started the pilot project in 2007–08. At the field level, the pilot project yielded wonderful results. Almost all the farmers recorded a very significant incremental yield and, hence, it was decided to introduce SRI at a much larger level. A cadre of village level staff was selected and trained to provide rigorous extension services. Eighty-one VRPs were identified that year and given four rounds of training by PRADAN on various aspects of SRI. Communication media such as audio-visuals, flex charts and boards were used by experienced SRI farmers. Based on their skills and abilities, VRPs were given the responsibility of providing services to 30 to 120 farmers.

Through a differential payment structure, VRPs were encouraged, through special incentives to include more farmers belonging to the Scheduled Castes (SCs), the Scheduled Tribes (STs) the landless and the marginal farmers. The incentive for bringing in farmers from the general category was Rs 20 per month per household; from the backward castes it was Rs 25 and from the socially disadvantaged sections it was Rs 35. Almost 5,146 farmers practised SRI in their fields, covering a total of 544 ha.

Unfortunately, there was a 45-day-long spell of drought during the critical panicle stage of paddy cultivation in Gaya. In spite of this, the average yield through SRI was recorded as high as 7–10 tonnes per ha. The highest yield recorded was 19.25 tonnes per ha.

This year, another action research and study was initiated on wheat productivity enhancement through the System of Wheat Intensification with around 400 farmers in Nalanda, Gaya and Purulia. To increase awareness, three cluster *adhiveshans* were organized in Chero, Dobhi and Jhikatiya in

Gaya district in which more than 500 SRI farmers participated. The farmers with the highest productivity were awarded certificates. Events such as these resulted in increasing awareness about SRI. The Project Director, ATMA, and the Block Agriculture Officer also participated in these *adhiveshans*. To create further awareness about the SRI methodology, wall writing was carried out in 40 villages of these clusters. This also resulted in a demand from other BRLPS districts such as Muzaffarpur and Madhubani. The foundation work for the intervention in newer districts started this year, in 2013, and the process of identification and training of VRPs has begun.

The last three years have been very successful in creating awareness and a positive impact at all levels in the state. Besides farmers, other stakeholders such as agriculture scientists, research organizations, policy makers and the government machinery are all convinced and confident of taking SRI forward in a big way

The last three years have been very successful in creating awareness and a positive impact at all levels in the state. Besides the farmers, other stakeholders such as agriculture scientists, research organizations, policy makers and the government machinery are all convinced and confident of taking SRI forward in a big way. BRLPS, the agriculture department, CSOs such as Action for Social Advancement (ASA), and PRADAN all took a big jump in up-scaling SRI. Three districts under Kosi region were also included in the programme. Table 1 explains the growth in the scale of SRI cultivation into other pockets of Bihar. The number of households could have easily crossed 1,30,000 and the area could have been more than 12,000 ha had it been a normal rainfall year. Due to the deviation in rainfall, especially at the time of nursery preparation and transplantation, some of the members who had initially shown interest, at the time of micro-planning, dropped out.

Interventions by the State Agricultural Department

Till 2010–11, the government supported the various SRI-based interventions initiated by BRLPS in Bihar through the Agriculture department. In 2011–12, the government decided to engage the Agriculture department directly in SRI promotion by engaging district- and block-level officials to take up SRI in 3.50 lakh ha in Bihar, which was roughly 10 per cent of the area under paddy cultivation. SRI, as a tool of improved paddy cultivation, became one of the favourite projects of Chief Minister Nitish Kumar and he took a very keen interest in spreading it. He launched the SRI Kranti on 27 January 2011. It was also decided to use SRI cultivation in 10 per cent area of the paddy cultivated and to engage agencies such as Krishi Vigyan Kendra (KVK), ATMA and BRLPS in the best possible way. One of the major components under this project was the formation of demonstration fields by providing 100 per cent subsidy to the farmers for one acre of land under SRI cultivation. Each of the farmers participating under this programme was provided Rs 3,000 to take care of expenses for seeds, fertilizers and other necessary inputs (Rs 1,200), to purchase organic manure (Rs 1,200), while the rest was fixed for irrigation support. To ensure that the input delivery was made on time, Block Agriculture Officers were asked to organize block-level events in which farmers would be able to purchase the inputs against reimbursements that were made to them directly.

This year, after a gap of two years, the agronomical conditions were very favorable

and the farmers had a record yield. Paddy production increased significantly and it was probably the first time that Bihar achieved recognition in paddy-based interventions among the major paddy producing states of India. All these factors resulted in building the confidence of the state government in SRI and it decided to continue with SRI for one more year. Though the final data has not been gathered, roughly another 3.5 lakh ha were brought under SRI this year. A couple of new interventions such as block-level workshops, training of farmers and staff and separate training for *ropenhars* (labourers who work during transplantation) were also organized to make SRI more effective. Notable in government interventions has been that its role has shifted from being an input provider agency to an agriculture extension management agency. For managing such a large area of extension mechanism at the ground level, qualified agriculture professionals or subject matter specialists, have been placed at block and sub-block levels, and *kisan salahakars* at *panchayat* and village levels. These people have taken on the responsibility of input distribution and providing other operational support during the programme.

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CONCLUSIONS

In a state like Bihar, where there have been very few success stories in agricultural promotion, SRI promotion has been a very successful project. The government, NGOs and agriculture research and support institutes such as ATMA, KVK and Rajendra Agricultural University (RAU) shared and learned from each others' experience, making the programme successful. It would have been difficult to implement the whole project in the absence of organizations such as PRADAN and ASA, which did extensive work at the grass roots to mobilize the community and ensured proper extension support in the initial two years. The successful implementation of the SRI programme in their project districts paved the way for large-scale up-scaling. A very serious commitment and belief in the SRI technology from the government ensured a high level of up-scaling. There may be doubts or conflicts about the level of adoption or adherence to the designed six critical practices of SRI, however, using SRI in 20 per cent of the cultivated area and making SRI a familiar word across all the districts and *panchayats* has, in itself, been a great achievement.

The importance of grass roots-based institutions: It would have been impossible to implement the project on such a large scale in the absence of community based institutions, developed as one of the key components of this project. These institutions became catalysts, and ensured inclusiveness in the project. In fact, when implementing livelihoods-based programmes of such a wide ranging level, the parallel creation of grass roots-based institutions is a pre-requisite.

The extension mechanism can also be developed from the community: Community based resource persons play the role of catalysts in ensuring the successful implementation of the project. Since its inception, the focus of the programme was to develop resource persons from the community, who were also farmers, This increased the confidence level of the farmers, who were initially hesitant to participate in the programme. Apart from being

able to communicate more effectively because they belonged to the same community, the commitment level of these resource persons was of a higher degree.

Hand-holding at every level is a must: One of the most important features of this project was the end-to-end hand-holding of farmers. Members from BRLPS were involved in the process from the stages of demand generation to the yield measurement. Even in times of adverse agro-climatic conditions, the presence of BRLPS yielded better results.

Small and marginal farmers can also be leaders: Usually, it is assumed that big and advanced farmers are the early adopters, and small and marginal farmers are followers of any new agricultural practice. The successful intervention of this model changed this perception.

Innovations are the key: Under this model, there were innovations such as paying more incentives to VRPs for covering farmers from the marginal sections; the involvement of women in all the processes; supplementing households through a range of services that have been instrumental in the great success of this project.

Non-input driven interventions can also be successful: Input distribution is one of the key components in most of the government-driven agriculture programmes. Though input subsidy was an important component under the Agriculture department's SRI promotion programme, in other models such as the one promoted by PRADAN/BRLPS, input distribution was at never in focus at any stage; yet, there have been very positive results. The entire focus of the project was on process improvement than on input improvement.

Communication is must: During the whole intervention process, the traditional medium of communication such as wall paintings and posters at critical locations was used, with a special focus on the improvement of practices. Exposure visits and the concept of demonstration plots were also used extensively. In addition to these, novel concepts such as SRI *jhankis,* SRI songs, and SRI sarees contributed to creating awareness and encouraging participation. The events related to SRI helped in making SRI a very popular name among the farmers. In fact, it can be inferred that irrespective of the number of farmers and area under cultivation, SRI, as a process of paddy cultivation, has received high visibility. To summarize, therefore, SRI has become a successful methodology in Bihar and it needs to be maintained and made stronger through conscious efforts.

LIMITATIONS AND CHALLENGES

The journey of SRI in Bihar, beginning 2007, can be considered to be fairly successful in terms of scale; however, there are many areas which require improvement, in order to bring about greater impact and meaning for the larger populace of the state. Mentioned here are a few limitations of SRI intervention by different agencies.

Making SRI all-inclusive: The SRI programme, implemented by the Agriculture department, seems to be biased towards big farmers. The selection criteria, in terms of location and size of land, were designed in such a way that small and marginal farmers were neglected and excluded. Though there was reservation for the socially backward communities, women, etc., in the programme design at the ground level, the beneficiaries were only from those groups that had certain access to block and other government offices.

No focus on share croppers: Most of the farmers, currently cultivating paddy, do it on a share cropping basis, with no formal agreements. A large number of the actual

cultivators, therefore, are excluded from the programme.

Up-scaling by CSOs: CSOs made a very conscious effort to bring in the maximum number of beneficiaries from socially marginalized groups. Despite having many reputed NGOs (PRADAN, ASA, AKRSP, BASIX, etc.) working at the grass roots, the number of beneficiaries of SRI is not up to the desired level. The state needs to make a conscious effort, to engage reputed CSOs as much as possible. This will help CSOs get support with full commitment as well as a cadre of committed staff that has good working knowledge and experience of SRI.

In a state where the majority of the population is dependent on paddy for its year-round food security, augmenting paddy production in terms of yield, as well as area under the crop, can take the state a long way towards food sufficiency

Input focus on SRI as well other programmes: There are many schemes that focus on input distribution such as seeds, fertilizers and others. Even in SRI, the input distribution is a key component. Though input distribution can be a useful intervention, it should not be run parallel to SRI. The challenges related to a biased selection will also be eliminated if the value of inputs is reduced. The same resources, in terms of critical irrigation support that is the backbone of paddy cultivation, can be channelized, to cover a larger number of farmers.

Less focus on customizing implements: Despite organizing an intervention on such a large scale, getting an effective weeder, so essential for SRI cultivation, is still a challenge. There is need for special efforts from the technical agencies to design a proper weeder.

Capacity building of staff at cutting edge: The skills of *kisan salahakars*, regarding the technical aspects of paddy cultivation, need to be improved. The staff working at the ground level should be capable of offering instant solutions to farmers, whenever required. In addition, there is need for orientation programmes for subject matter specialists so that they can be sensitized about issues related to the empowerment of farmers.

CHHATTISGARH

In a state where the majority of the population is dependent on paddy for its year-round food security, augmenting the paddy production in terms of yield, as well as area under the crop, can take the state a long way towards food sufficiency. By 2008, it was established from field experiences that SRI has the potential to improve the yield of paddy crop by 25–50 per cent. In 2008, PRADAN, in collaboration with 11 other NGOs, carried out field trials of SRI with 800 families on 80 ha of land. This marked the beginning of SRI intervention in the state, with the SDTT-PRADAN partnership. It was designed for three years, with the objective of reaching out to 16,000 families during the three years of the programme. The intervention aimed at having 100 per cent family coverage in the programme villages and achieve up to six tonnes per ha productivity. It aimed to involve various stakeholders in the process of implementation, to bring vibrancy to the programme. It also aimed at mobilizing the community to plan at the *gram panchayat* level, based on farmers' needs and converge it with other ongoing programmes. It also introduced a weeder subsidy on a larger scale, to promote weeding activity.

This project proposes to spread SRI knowledge to about 16,000 families, covering about 340 villages in 11 districts across three regions. The project envisages enhancing paddy productivity by 75–100 per cent—from the

level of two or three tonnes per hectare and ensuring year-round food sufficiency for participating families.

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Initiatives by Various Stakeholders

The positive experiences of SRI under the SDTT-PRADAN partnership led to the formation of a state-level forum, popularly known as 'SRI Manch'. Each CSO deputed a person, who had anchored the SRI programme, to the forum. All the members meet bi-monthly to review progress, discuss upcoming challenges and possible solutions in meetings. Together, they make future plans for SRI, in their respective districts, meet state officials to discuss plans for the convergence of the SRI programme with other developmental schemes of the government. This forum regularly organizes SRI *adhiveshans, kisan melas* and workshops to share, build capacity of farmers and generate awareness in the state. State officials, researchers and progressive farmers were encouraged to popularize SRI practices in the state. Last year, 27 such *adhiveshans* were organized at the *gram panchayat* and *janpad* levels.

Indira Gandhi Krishi Vishwa Vidyalaya (IGKVV) played an important role in working on weeder advancement-cum-availability, as well as in providing technical help to CSOs. The weeder is popularly known as the Ambika weeder. Without the presence of the Indian Council of Agricultural Research (ICAR) in the state, very little research has been done around paddy. Hence, not much scientific information is available. The newly formed KVKs did not have proper farms yet. Therefore, their contribution is limited to participating in workshops and *kisan melas.*

Interventions by the state government

The Chhattisgarh government prepared a draft of an Agriculture Policy on 15 April 2012. It states that 'Socio-economic well-being ought to be a prime consideration'; the focus, therefore, is more on the economic well-being of farmers rather than just production growth. The focus of the paddy programme of the state is mainly on the following three interventions: a) Adopting SRI to enhance paddy production in the state, b) Demonstrating a second crop around paddy cultivation and c) Promoting the usage of green manure in paddy cultivation. Field visits revealed that the programme implementation team is flat in structure. Each block has one Senior Agri Development Extension Officer (SADEO) and one Rural Agri Extension Officer (RAEO) in every three or four *panchayats,* to manage the programme. In such a scenario, the timely distribution of inputs becomes the only task during the paddy season. Representatives of various NGOs shared that RAEOs leverage benefits for their farmers in lieu of helping the RAEOs meet their target easily. Hence, the task of awareness generation, mobilization, capacity building, training programmes and day-to-day hand-holding support is left to NGOs. The government staff provides the inputs to the farmers endorsed by the NGOs. This has worked in favour of the farmers, although there are reporting issues, as names are presented by NGOs in the government beneficiary list.

The other interesting development at the state level is the decentralized procurement system. The whole process has been computerized and is considered to be the most efficient

in India. When the paddy is supplied, the farmers get paid immediately by cheque. This scheme was introduced by the central government in 1997–98 in a few states, to encourage procurement and extend the benefits of minimum support price (MSP) to local farmers. This system also enhances the efficiency of the Public Distribution System (PDS) and enables the supply of food grains more suited to the local taste through the PDS. This also results in saving transportation costs of Food Corporation of India (FCI). Under this scheme, the Chhattisgarh state government undertakes the procurement of paddy on behalf of the Government of India, and also stores and distributes the food grains under PDS and other welfare schemes. The central government reimburses the entire expenditure incurred by the state on the procurement operations. The benefit is that rice is considered to be a cash crop here and with the improved paddy procurement system and immediate payment, it becomes an attractive means of livelihood.

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Interventions by NABARD

NABARD support to the SRI programme started in 2010. The SRI initiative is through 15 PIAs, covering 10 National Food Security Mission (NFSM) and five non-NFSM rice districts, reaching 240 villages and 12,658 families by *kharif* 2012.The vision is to take up SRI with 12,000 families in three years, mainly in rain-fed areas. In the northern and southern parts of the state, which is tribal dominated, paddy is grown, using the traditional variety of seeds; there is very little use of the high yielding variety (HYV) and chemical fertilizers. The strategy for productivity enhancement is through creating awareness, and organizing training programmes and promotional activities such as *kisan melas* and workshops.

The NABARD-supported SRI programme has two models; one is the same as across all states and the other is the Jharkhand model. In states other than Jharkhand, NABARD directly supports PIAs separately; but in Jharkhand there is a lead agency between NABARD and the PIAs. It has two models—one is for 300 farmers and the other is for 600 farmers. This was done because of the low availability of good PIAs and also their quality of reach with the community. This model works better because it strengthens both the organization playing the role of integrator and the PIAs. The capacity building process as well as the monitoring system evolves gradually. This helps in developing an efficient MIS system. Exposure visits of lower performing PIAs are organized to the better performing ones. All the stakeholders have the opportunity to learn from each other and this layered approach helps create an environment of healthy competition.

CONCLUSIONS

PRADAN's Programme Director, Orissa and Chhattisgarh, explained that the approach of intervention always focuses on developing skills and making the best use of land. Structural and vegetative measures are taken to make the best use of land. In low-lands, SRI is promoted to address food grain sufficiency. The up-lands are used for commercial crops. The programme takes into consideration all the farming systems, and livelihood interventions are planned around it. SRI is understood as a modified agronomic practice. It is not a technology. Its practice has been mainly NGO-

driven and as long as it remains limited to the domain of NGOs and the community, it cannot be expanded and implemented on a large scale. The schemes are generally developed only around new technology popularization. The financial resources of the government, the social resources of the NGOs and the knowledge resources of the scientific community need to be brought upon the same platform.

The agriculture of Jharkhand is a paddy driven one and the livelihood of most of its population depends upon the performance of its paddy crop

With timely awareness development, training, skill development, support services, availability of farm implements and credit support, the programme can go a long way. Proper selection and development of the farm implements is critical for scaling up. There has been some experimentation around the weeder and marker, but we still have not been able to settle the usability of the cono weeder, the mandwa weeder, and the rotary and hand driven markers. Technology needs to be simplified and made usable for the end user. There should be a contingency plan for establishing an extra nursery or trying out the concept of a community nursery as water resource management is critical to SRI. To maintain the soil structure, perhaps organic farming could be introduced. For the timely availability during cultivation, green manure and vermi-compost production could be encouraged.

JHARKHAND

The agriculture of Jharkhand is a paddy driven one and the livelihood of most of its population depends upon the performance of its paddy crop. It is widely seen that the paddy production determines the migration status of a household. The total cultivable area of the state is 38 lakh ha, of which the net sown area is 18.04 lakh ha. The area under rice cultivation varies from 1.3 to 1.6 million ha and production is between two to three million MT.

Interventions by Various Agencies

In Jharkhand, CSOs have been the leaders in implementing SRI. The extension services provided by CSOs have been far more than those by agricultural research agencies or the government machinery. Organizations such as Collectives for Integrated Livelihood Initiatives (CInI) and the Society for the Promotion of Wastelands Development (SPWD) have played a prominent role in facilitating the spread of SRI techniques across the state whereas the contribution of organizations such as PRADAN and NEEDS has been phenomenal in bringing SRI to the grass roots. Support from agencies such as SDTT and NABARD has also provided a great impetus to the spread of SRI. PRADAN's contribution has been the most instrumental in bringing SRI to Jharkhand. PRADAN has proved that proper extension support can create wonders for small and marginal households. Livelihood promotion for the poor households has always been the key focus area for PRADAN.

PRADAN has already been making systematic efforts to promote rain-fed paddy by introducing an improved package of practices. During the process, PRADAN has developed a robust model of rain-fed paddy cultivation for small and marginal farmers across several districts in Jharkhand. In 2002–03 PRADAN realized that using SRI could help achieve food security. After its successful trial in Purulia, it decided to spread SRI through most of its teams in Jharkhand because both the socio-economic as well the geographical conditions were identical. In 2004, most of the teams in Jharkhand agreed to experiment with their normal *kharif* crops. In 2005, paddy by the

SRI method was made a major focus area and by 2006 the number of households crossed 5,000 in Jharkhand and kept increasing year after year. By 2008, the number of households using SRI had reached 16,000 and crossed 20,000 by 2010. At present, the number of households that have adopted SRI has already crossed 40,000. Apart from this, PRADAN has also helped other NGOs in Jharkhand to spread SRI, in partnership with NABARD, CInI, etc.

Non-monetary intervention: The most notable point under SRI promotion was that all the support provided to the farmers was non-monetary in nature. The farmers paid for all the inputs used in the field. In most cases, a group of five or six farmers got together and purchased a weeder for the group. This proves that for a technology such as SRI, input support is less critical than other support.

Quality human resource at the field level: Placing quality professionals at the grass roots has always been the guiding philosophy of PRADAN. Unlike the other structures in which usually less qualified staff is placed at the implementation level, PRADAN ensures that qualified professionals are always available with the farmers in their fields. This not only helps farmers to adopt better practices in the field but also increases their confidence at every stage, especially during a period of crisis.

Use of service providers: Every hamlet or village had at least one service provider (SP), who had been given the necessary training. These SPs were farmers from the community. Under the leadership of the SPs, the task of implementation became much easier. Within a period of two to three years, these SPs became an integral part in up-scaling SRI.

Communication is the key: When promoting SRI, proper awareness was created by using both traditional and modern methods. Demonstration plots were also prepared with some of the progressive farmers, helping build the confidence of other farmers. Other mediums such as charts, flex boards and posters were very effectively used. Using the concept of 'Seeing is believing,' an SRI-based movie was prepared and shown to the farmers.

Training: Direct capacity building of the community is one of the key characteristics of PRADAN's intervention. Various training programmes such as for SHG leaders, SPs and both husbands and wives, prior to nursery raising, prior to transplantation and, more importantly, at the time of transplantation in the field ensured maximum technology transfer to the farmers.

Making SRI practical and contextual: Following all the parameters of SRI was difficult in the context of the agro-climatic conditions of Jharkhand. Hence, based on the local conditions, as required, some customization of SRI was done. Chemical fertilizers were also used to get the maximum yields. The focus was on training farmers for better and more disciplined agriculture practices. This made the technology much more user friendly and farmers became accustomed to it very soon.

CInI has been promoted by Shri Ratan Tata Trust (SRTT), to work as a nodal agency for promoting and strengthening the central India initiative of the Trust. It is one of the main organizations working to spread SRI, in collaboration with partner organizations through various types of support. Since 2007, CInI has been working in the direction of increasing the food security of poor households in central India. Rain-fed paddy cultivation is considered to be the lifeline for more than 80 per cent of the poor households in Jharkhand because their whole year's food security depends upon the yield of paddy during the *kharif* season. Keeping this in focus, CInI started the Kharif Paddy Stabilization (KPS) programme, in which SRI was one of the main areas of focus.

SPWD, a national-level NGO, has been playing a catalytic role in reversing the process of degradation of land and other related natural resources, in partnership with other NGOs and grass-roots institutions. During the last 25 years of its existence, SPWD has worked in collaborative projects with over 80 local voluntary agencies, across 17 states, in 11 agro-climatic zones of India.

In Jharkhand, the government is undertaking many initiatives for the development of agriculture for all crops, including paddy. Unfortunately, most of the schemes for the development of paddy cultivation are more input-driven than process-driven.

Since the last two-and-a-half decades, NABARD has been directly or indirectly influencing farmers to adopt technologies that improve crop productivity. Initially, the focus of NABARD was on fulfilling the capital needs of farmers; gradually, it felt that the extension of new technologies to the farmers was equally important. In Jharkhand, SRI became one of the thrust areas because it helps small and marginal farmers increase the production of rice at a lower cost through a balanced use of seed, water and fertilizer. Prior to 2009–10, a number of CSOs, with support from SDTT and other agencies had already introduced SRI at the farm level and farmers were getting good results. Organizations such as PRADAN believed that technology should be spread across all of Jharkhand. Fortunately, M.V. Ashok, who was the CGM of NABARD's Jharkhand office at that time, was very impressed and convinced with the output of SRI at the field level and hence decided to support SRI in Jharkhand. PRADAN, prepared a detailed plan for the implementation of SRI, to which NABARD agreed. With the objective of promoting SRI technology in paddy among the maximum number of farmers in Jharkhand, NABARD initiated a grant-based pilot project in Jharkhand, using the services of 52 experienced NGOs, covering 21 districts across the state. The project was targeted to cover 29,406 farmers, covering 7,456 acres of paddy land with a grant support of Rs 495 lakhs for two years—2010 and 2011, commencing from the *kharif* season of 2010.

Interventions by the State Government

In Jharkhand, the government is undertaking many initiatives for the development of agriculture for all crops, including paddy. Unfortunately, most of the schemes for the development of paddy cultivation are more input driven than process driven. The government has appointed agricultural specialists at the block level such as Block Technology Managers (BTM) and SMSs, who are qualified agricultural professionals to look after the proper implementation of various agricultural extension schemes. Their presence has brought the desired efficiency in the delivery mechanism but their role in the area of extension and transfer of process-driven technology has not been adequate. Currently, the government is administering a number of programmes for agriculture development under schemes such as the National Food Security Mission, Rashtriya Krishi Vikas Yojna and Bringing Green Revolution to Eastern India (BGREI) in the state. SRI has been made a component in all these schemes. At present, the farmers can avail a subsidy of 50 per cent for purchasing a weeder. The government is already working on seed replacements by promoting hybrid varieties and certified seeds. Last year, more than 8,000 MT of seeds of paddy were distributed in the kharif season.

The government has started incentive-driven schemes for farmers whereby farmers as well the extension machinery (NGOs and others)

get an incentive for promoting SRI at the field level. The farmers get Rs 1,000 per ha for using SRI whereas supporting NGOs get a sum of Rs 250 per ha.

ATMA and KVK have been the main agencies taking care of demonstration work at the field level. Though ambitious targets were fixed in 2011–12 and 2012–13 for the promotion of SRI, so far the achievements have not been satisfactory. Even adherence to POPs was not up to the best possible extent. As per the data provided by the Agriculture department of Jharkhand, in 2011, SRI was promoted in all 24 districts of Jharkhand. In 2011, the government promoted SRI in 30,000 ha against the target of 1,62,900 ha and the number of households that participated in SRI was 53,405. As per the data provided by the respective DAOs to the state office, SRI is being promoted in 1.4 lakh ha against the target of 4.88 lakh ha.

LEARNING

SRI in Jharkhand has been driven totally by CSOs, with very limited participation from the Agriculture department. CSOs such as PRADAN and NEEDS started their work in SRI from the very start of when SRI was initiated in the region. Apart from the direct promoting institutions, support from agencies such as CInI, SPWD, SDTT and NABARD also helped in a big way. Mentioned below are a few important lessons from Jharkhand regarding the promotion of SRI.

The presence of quality CSOs can make a great impact: PRADAN has been one of the front runners in spreading SRI at the grass roots. It started its work for SRI promotion in Jharkhand in 2004. Due to its experience and quality human skills, PRADAN not only successfully promoted SRI but also acted as a resource agency for other CSOs as well. PRADAN professionals are not only highly qualified but also very committed. They helped many CSOs in various aspects of SRI promotion. CSOs such as the SPDW and NEEDS also did commendable work in capacity building of other CSOs.

Benefits of working together: In Jharkhand, there have been two or three very successful examples of the hub-and-spoke model wherein there is a main organization at the centre with better expertise and experience, which takes responsibility for guiding other organizations mapped around it. Under this model, the task of bringing SRI to newer areas becomes much easier and the replication is very smooth.

Perseverance pays: In terms of adoption of modern agricultural practices, Jharkhand is one of the most backward states. Paddy cultivation by transplantation in itself has been a delayed phenomenon. It was the sheer commitment and perseverance of promoting agencies, and their continuous support and hand-holding that ensured its spread.

Long term commitment: The practice of technology such as SRI requires behavioural changes. For making such a practice a part of the farmers' routine requires hand-holding for at least three to four years. There are many places and pockets of Jharkhand, where small and marginal farmers are continuing with SRI despite the fact that the promoting organizations have withdrawn from the area.

Input support is just a myth: Input subsidy or support is given a lot of importance in the agriculture promotion programme; however, in almost all the successful models of SRI promotion in Jharkhand, there has been very little support in the form of input subsidy. There can be no substitute for quality extension services in agricultural promotion schemes. If at all some subsidy or grant has to be given, it must be in the form of critical irrigation or

for the purchase of some implements such as weeders.

Large acceptance: The SRI programme has been fairly successful even in districts such as Gumla, Khunti and Lohardaga, considered to be backward on many socio-economic parameters. Traditionally, these districts were more known for their primitive way of agriculture but SRI has broken that myth. Most of the tribal dominated districts have followed SRI rigorously.

NABARD Model: NABARD has been involved for many years in the promotion of SRI in many states, with their own model. In Jharkhand, the model which was being followed in 2010–12 by PRADAN was found to be the most effective in terms of its impact as well as its cost effectiveness. It was a perfect case of synergy where all non-government stakeholders came together and worked continuously for two years to make the SRI pilot project one of the most successful ones.

CONCLUSION

The government provides an incentive of Rs 1,000 to farmers and Rs 200 to the promoting organizations for every hectare adopting the SRI method. It was difficult to understand the rationale behind fixing such a small amount of incentive for SRI. For a programme such as SRI, a good extension support would be much more beneficial than any amount of incentive. Either there should be no incentive or the incentive needs to be increased. Most of the farmers in Jharkhand do not go for one full hectare of paddy cultivation in the *kharif* season and so the incentive of Rs 1,000 per hectare becomes immaterial for them. Even the most adventurous of the farmers set aside a maximum of one or two acres for SRI. In such scenario, the incentive to farmers as well to the promoting institutions is almost negligible. The payment in installments makes the situation even worse.

Presumably, participation of the private sector brings efficiency; probably this is one of the reasons that input-oriented programmes are more successful. The push from the input supplying companies, due to their commercial interests, makes these programmes successful. SRI is criticized because it does not suit the commercial interests of the companies that are involved in input supply. In the words of a representative from the SPWD, "SRI represented the second Green Revolution." However, it was at a disadvantage because it was knowledge-based and not input-based. Seed varieties (hybrids) and fertilizers are prioritized ahead of SRI in extension efforts, he says, "SRI is in the third place, when it should be in the first place."

SRI is a knowledge-based technology and hence requires a totally different approach. Most of the implementing agencies treat SRI as an activity technology with too much focus on activity. A PRADAN professional says, "To bring sustainability into SRI, one needs to understand the context of the household. Dimensions such as food security, labour availability, migration pattern of the households and cash-flow status need to be taken into account at the time of planning. These factors will result in a pull factor, bringing sustainability into the programme."

In the context of SRI, the field-level implementation has puzzled research agencies. Most of the research agencies focus their attention on input-related factors such as the variety of seeds and the usage of inputs. SRI is a totally process-driven intervention; the level of trust between the research agencies and the implementing agencies is somehow sadly lacking. Research agencies need to be more receptive to promoting agencies in the

context of SRI. In Jharkhand, the synergy between government departments and CSOs needs to be improved. To bring scalability to this programme, people in the government machinery need to be more sensitized.

To bring sustainability into SRI, one needs to understand the context of the household. Dimensions such as food security, labour availability, migration pattern of the households and cash-flow status need to be taken into account at the time of planning. These factors will result in a pull factor, bringing sustainability into the programme

ODISHA

SRI practices reached farmers' doorsteps in early 2003, thanks to the efforts of CSOs engaged in the promotion of agriculture-based livelihoods. PRADAN, SAMBHAV, Sahabhagi Vikash Abhiyan (SVA) and Centre for World Solidarity (CWS) are a few names commonly heard in the context of SRI in Odisha. PRADAN was among the early starters in the state in 2003, with their presence in Mayurbhanj district. But its programme did not pick up until 2005 due to low awareness levels and the lack of confidence among the farmers about SRI practices. The introduction of SRI, however, has been location specific and restricted to a few areas due to the lack of funding support in the early days. SVA got leads from South India that encouraged them to conduct SRI trials even with limited knowledge and resources. The Regional Centre for Development Cooperation (RCDC) of Bhubaneshwar prepared a booklet on SRI principles in 2006. CWS organized an awareness workshop for its partners the same year. In early 2007, SVA published an SRI manual in Oriya. By then, SRI had reached several districts, and promoting organizations were experienced enough to share their knowledge. In April, an experience sharing workshop was organized at SAMBAV. SRI initiatives were being noticed by various stakeholders that led to organizing of first state-level SRI dialogue on the 23 June 2007 during which the innovative concept of 'Learning Alliances' was born. Dr. Radhamohan, then the Information Commissioner of Odisha, shared facts about SRI with the then Agriculture Director, Dr. Arvind Padhi, who later became interested in promoting SRI through government schemes. This unique platform of Learning Alliances not only linked knowledge sharing but also brought in funding support. SDTT and NABARD came together with committed funds for capacity building, along with programme support that led to a growth of SRI programme in the state. SDTT was successful in roping in the state government funding support and Rs 3 crores was sanctioned for the promotion of SRI in the state through the SRI partners of SDTT. The programme has been taken up by ATMA in convergence with the state Plan and RKVY.

Initiatives of the Various Agencies

The Government of Odisha has initiated several programmes to improve the agriculture scenario of the state. The Department of Agriculture is promoting new varieties of HYV/Hybrid seeds. Its objective is to increase the seed replacement ratio and fertilizer consumption. The other agendas of the programme are to implement integrated nutrient management and pest management, farm mechanization, water management, post-harvest management of Agri-produce, etc., in the state.

NABARD is one of the key players promoting SRI in the state. The strategies it employs are to focus more on small and marginal farmers involving the necessary capacity building, hand-holding through on-site technical

guidance, and credit and financial support. Taking these aspects into consideration and through discussions with SDTT and other implementing NGOs such as WASSAN and PRADAN, NABARD has worked out a model for including 560 farmers, covering an area of about 192 ha, spread over 16 villages, in the next three years, 2013–16.

In 2010, PRADAN received a sanction of four units for two blocks each in Mayurbhanj and Keonjhar districts. The money is released as per the number of farmers mobilized. The following are the achievements of the plan, based upon which the money is released. Reasons for variance: in Keonjhar, delayed rains and the delay in sanction are the main reasons for the variance, whereas in Mayurbhanj, the year has been declared as a paddy drought year. Most of the families participated as far as the nursery raising stage but could not transplant because of insufficient rain.

CWS started their SRI programme with an orientation workshop for partners in 2005. The workshop included a theory session that discussed the chronology of SRI, the rationale and the principles to be followed. This was followed by a training-cum-demonstration programme on SRI in 2006. This programme gave the participants hands-on experience on land preparation, bed for nursery, manuring and other processes in detail. These two initiatives set the ground for popularizing the SRI programme. The other notable initiative by them was the state-level dialogue 'Odisha State Dialogue in SRI' with XIMB, WWF, Oxfam and the Department of Agriculture, Government of Odisha in 2007.

CONCLUSIONS

The SRI programme of the state has been successful in terms of awareness generation, input supply and adaptation of line sowing by farmers. There are a few interesting cases, which can give direction to large-scale programmes. Two of these are the Odisha Community Tank Management Project (OCTMP) and Pragati. Line sowing and weeding operations have helped in increasing paddy production. These are the only two visible methodologies being followed in the field. The farmers acknowledged that SRI practices are easily doable and scalable. The government machinery has been actively engaged for the successful implementation of the programme. Except one instance of large-scale partnership with SDTT, there was no other collaboration with any CSO. They have preferred to do it themselves. The field staff, however, co-ordinates informally with the CSO staff to identify farmers, plots and for other day-to-day support.

The SRI programme gradually shifted its focus to increasing the per capita productivity with extensive usage of technology and mechanization because of the large-scale implementation of the Bringing Green Revolution into Eastern India (BGREI) programme.

1. With increasing focus on inputs supply, private companies have found it an opportunity to do large-scale business with the government.
2. SRI principles are about issues of acceptance, not labour or cost. So, radical thoughts of outsourcing the nursery preparation and transplantations need to be well researched, and discussed before trying them out. The government needs to explore the outsourcing of the village development plans or SRI plans to CSOs engaged with the community for many years. The control over quality seeds, the availability of green manure and pest management are the three major concerns of the farmers. These issues need to be

addressed through various interventions with SAMBAV, PRADAN, PRAGATI, etc.

3. A large number of small farmers are share croppers; therefore, it is not always possible for them to adopt the whole package of practices due to less say in the matter or pressure to follow the conventional practices.
4. Big farmers should be brought under the SRI programme to make the programme sustainable. Just by input subsidy, HYV seeds and easy availability of credit, the required discipline in the farming practice will not be possible. SRI should not be seen as an activity only. There is a need to shift from 'activity focus' to 'productivity focus' because the former is always short term and ends with the crop cycle whereas the latter has a long-term focus and will help build a long-term relationship among the actors to empower the beneficiary.
5. CSOs play an important role in creating awareness about the SRI programme in all districts, with or without the support from the government or the funding agency. Initiatives such as Learning Alliances will continue to help in learning and adopting progressive practices and unlearning outdated ones, thereby strengthening the SRI programme in the state.
6. Strengthening the farmers' knowledge through the KVKs, making available progressive farming practices and knowledgeable resources at the field level should be on the priority list. At present, this is missing on the agenda. The process needs to be simplified and the technology made usable for everyone.
7. Very little support is available to the farmers during pest attacks. All recruits at CSOs as well as the government should be compulsorily trained through a basic certificate course on food grains. The course can be designed by the State Agriculture University. More investment is required on knowledge building of manpower.

The farmers have received information about SRI from their respective promoting agencies with varied levels of treatment, which has resulted in different perceptions, depending upon the quality of the extension and other services. In all these processes, there has been hardly any focus on the empowerment of farmers, which is required in order to make SRI internal to the farmers

The field study was conducted across four states namely Bihar, Chhattisgarh, Jharkhand and Odisha. During the field visits, we interacted with various stakeholders such as the farmers, the CSOs, other implementing agencies, supporting organizations, the Agriculture departments and government-promoted institutions such as ATMA, KVK, and research institutions such as agricultural universities. The purpose of these meetings was to understand their views over critical issues in the context of SRI. The aim was to develop a better understanding about the reasons for promoting SRI, understanding the various delivery models and extension services, understanding the approach of transfer of resources and technology, the way forward, etc. There are many stakeholders promoting SRI, each with different objectives and following different approaches, as reflected in the reasons for the adoption of SRI at the farmers' level. All the stakeholders—the government, CSOs, NABARD, research institutions (agriculture universities) and even the farmers—are very convinced about the benefits of SRI. But the responses from all these stakeholders have been in great variance from one state to the other and from one

intervention design to another. The government in the states of Odisha and Bihar are promoting SRI as a tool for increasing the paddy output in their states and are treating it as one of their agricultural activities. CSOs are treating it as a tool for food security, which has helped them in mobilizing the community but which poses challenges in up scaling. The role of research agencies has been so far passive in the context of SRI and most of their steps have been reactive. The farmers have received information about SRI from their respective promoting agencies with varied levels of treatment, which has resulted in different perceptions, depending upon the quality of the extension and other services. In all these processes, there has been hardly any focus on the empowerment of farmers, which is required in order to make SRI internal to the farmers.

The spread of SRI has been mainly due to interventions by governments and CSOs. CSOs or government agencies have pushed SRI at the ground level through different approaches. The strategies adopted by agencies have helped in creating awareness at the ground level

SRI or any other agriculture programme can only be considered successful if it has been internalized by the farmers and this can be achieved only when we make our intervention family-focused rather than activity-focused. There is need to understand the context of the household, the farmer's resources, limitations and readiness about accepting any new technology. This can only happen by empowering farmers. In all the interventions by and large, external agencies treat the farmers only as recipients of the services rather than partners in the implementation process.

The spread of SRI has been mainly due to the interventions by governments and CSOs. CSOs or government agencies have pushed SRI at the ground level through different approaches. The strategies adopted by agencies have helped in creating awareness at the ground level. Many farmers have been very successful in achieving a higher level of food security, resulting in better quality of living. The initiatives of CSOs have ensured a much better livelihood scenario for small and marginal farmers in tribal-dominated pockets of Jharkhand, Odisha and Chhattisgarh, for both of which paddy cultivation is a must for survival. Due to the efforts of the government through its Agriculture department and Jeevika (BRLPS), Bihar has received great recognition in paddy cultivation at the national and international levels. The number of farmers practising SRI—in hundreds until five years ago—is now in lakhs. Yet, the state has a long way to go. Even if we put all the numbers together, not even 10 per cent of the farmers are practising SRI, neither is it being grown in even 10 per of the total area under cultivation. Following are a couple of notable points gathered during interactions with various stakeholders.

Proposed SRI Up-scaling Model

Despite having fewer resources and input subsidy, CSOs have been very successful in spreading SRI. The focus on the household and ensuring empowerment has been the main reason for this. Based on the analysis of various implementation models—operational and field—a sustainable way of up-scaling SRI has been proposed.

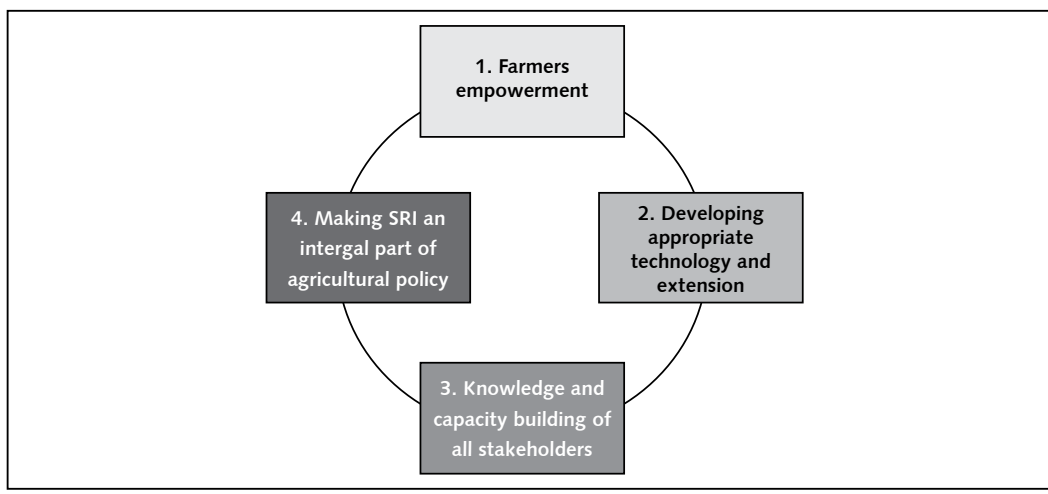
A large number of parallel programmes are operational at the field level, which have different objectives. Prior to starting interventions, various government departments and agencies need to merge their programmes and schemes that are operational in any particular area or cluster. Once this has

been done, programmes need to be designed as per the socio-economic and geographical conditions. The implementing agencies, with support from community based institutions such as *panchayats, gram sabhas* and SHGs should conduct a proper resource mapping. Based on the context of the household and the availability of resources, different programmes can be linked to different households. For example, small and marginal farmers can be engaged in those programmes where risks are lower.

All the common resources, either natural or created, need to be managed and maintained by the community themselves. In future, if the government or other supporting agencies are introducing any asset development programme, minimum exclusion needs to be ensured. In agriculture-based interventions, extension services are the key to the effectiveness of such programmes. There is need to design appropriate extension services that can be effective in the local context. Some of the technologies such as markers and weeders need to be made more customized as per the soil quality of the area.

Policy makers and other stakeholders designing the programme need to be more sensitive to the needs of the households and a support area has to be designed by keeping the criticality of the intervention in mind. For example, a small support in terms of critical irrigation can be more effective than providing the farmer with inputs, implements or cash incentives.

Interactions with all the stakeholders revealed that farmers' empowerment should be at the core of all interventions. This has to be followed by the development of an appropriate technology, which can be supported through the local extension systems. These should be backed by knowledgeable and skillful staff, extension workers and CSOs, all working towards the stated vision. At the same time, at the macro level, SRI has to be given greater attention by the policy makers when framing agricultural policies, and the necessary resources have to be dedicated to it through various programmes.



Suggested Model for Up-scaling SRI Programme

All You'd Like to Know about SRI in India and More

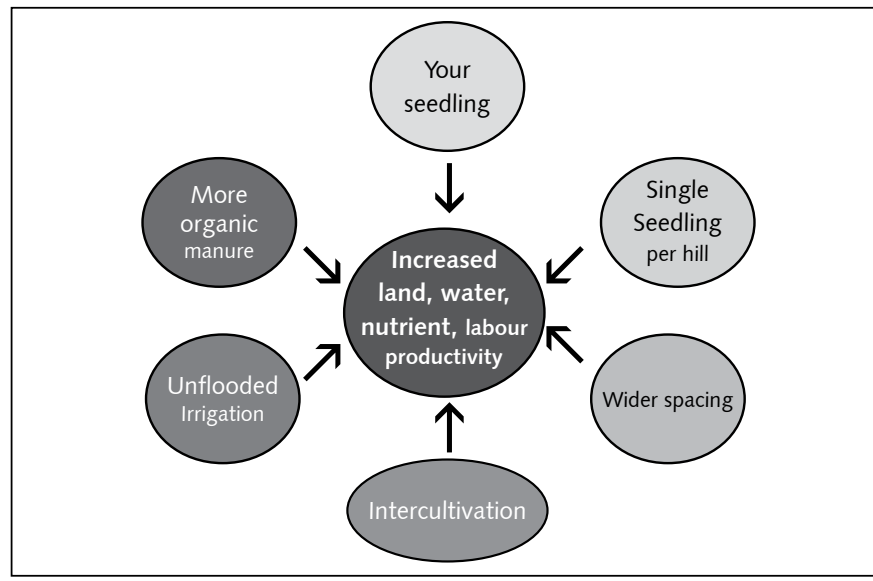
***Transforming Rice Production with SRI: Knowledge and Practice,* by T.M.Thiyagarajan and Biksham Gujja**

BOOK REVIEW: RAVI CHOPRA

How do you think an Indian paddy farmer will respond if you tell her that you can almost double her paddy yield by using much less seeds (and that too her old traditional ones), less water and only organic fertilizer? She will probably suggest that you have your head examined. But if she dared you to do it, you could take up the challenge and introduce her to the System of Rice Intensification, or SRI. That is the paradox of SRI—using fewer inputs you can significantly enhance crop yields.

Speaking about their book, *Transforming Rice Production with SRI: Knowledge and Practice,* the authors say, "This book is an attempt to explain the origin, principles and practices of SRI and the developments so far in communicating the importance of SRI to rice farmers, students, Scientists and policy makers so that the material could be used for extension, research and policy support." Dr Thiyagarajan is a well-known agricultural scientist, earlier with Tamil Nadu Agricultural University, and Dr. Gujja is a former SRI promoter-turned-entrepreneur, who was earlier an advisor to Worldwide Fund for Nature (WWF).

SRI is a new approach to paddy cultivation. It is knowledge-intensive rather than inputs-intensive. The SRI hexagon (see figure) highlights six basic principles that guide the SRI farmer to obtain significantly higher yields. Typically, SRI farmers transplant 8- to 15-day-old single seedlings at distances of 20 cm x 20 cm or 25 cm x 25 cm, using alternate wetting and drying or irrigation, accompanied by weeding and the application of organic manure.



SRI Hexagon

Though the science of SRI is still being understood, particularly how SRI affects the soil, "sufficient scientific explanations are available on the better performance outcome of rice crop under SRI," say the authors. Thus:

- The very young seedlings preserve the plant's inherent potential for growing roots and tillers.
- Low plant densities ensure room to grow for the root and canopy, and better access to sunlight and nutrients.
- Less water application, active aeration and alternate wetting and drying allow the roots greater exposure to air, that is, nitrogen.
- Organic manure improves soil conditions and provides beneficial micro-organisms.

Chapters 4 to 8 are the heart of the book. They elaborate the practical steps in SRI from seed selection/preparation to harvesting. The practical details are supported by scientific explanations, pictures, data and references. The outcomes of SRI are discussed in terms of the impact on soil, grain yields and farmers' response in Chapters 10 to 12.

Increases in grain yields due to SRI are reported from on-station experiments, on-farm trials and farmer experiences. Thiyagarajan and Gujja point out, "Because the yield gains are driven by biological processes rather than mechanistic responses to external inputs, the gains are quite variable and range widely 25%, 50%, 100%." Interestingly, grain yields reported by farmers across India show higher SRI over conventional paddy gains than trials by scientists. The values cited range from a low of 12% to over 96%, with most values being between 23% and 83%. "This is the reverse of the usual situation where farmers have a hard time replicating researchers' results. With SRI it is often vice versa," argue the authors.

The higher grain outputs due to SRI are usually accompanied by higher straw yields, which provide more fodder for cattle and, therefore, more farmyard manure, saving of seeds, land for nurseries, water, labour and costs

The higher grain outputs due to SRI are usually accompanied by higher straw yields, which provide more fodder for cattle and, therefore, more farmyard manure, saving of seeds, land for nurseries, water, labour and costs. The labour issue, however, is controversial because labour saving in nursery raising and transplanting may be offset by increased labour due to hand weeding because mechanical weeders are not available. Two other major benefits of SRI are higher nutrient-use efficiency and better yields during droughts and floods, that is, better climate change adaptability.

In India, SRI has been largely promoted by voluntary organizations (VOs) rather than the official agriculture establishment—the Union Ministry of Agriculture, other government departments, agricultural universities and the ICAR institutions. The role of civil society in SRI extension in India is unprecedented say the authors. Fortunately, some state governments have chosen to support the extension of SRI. Wherever the state governments have supported the VOs' efforts, as in Bihar, Tripura and Tamil Nadu, the spread has been more rapid. In Chapter 12, the authors highlight the SRI extension methods adopted by the VOs, the support received from the government—primarily in Andhra Pradesh, Tamil Nadu, Tripura, Bihar and Jharkhand—and the role of donor agencies. The constraints experienced in extension have also been discussed in this chapter.

It is well-known that the response of India's agricultural establishment at the national level to SRI has been unenthusiastic. Despite the mountain of evidence from farmers' fields, government scientists often dismiss SRI saying that there is nothing new in it or that it has not caught on like wildfire among the farmers. Thiyagarajan and Gujja point out that SRI is not a series of mechanical steps that a farmer can follow by simply reading about it or hearing about it. In fact, the steps involved in SRI are not different from those in conventional agriculture. The difference lies in how basic steps such as transplanting, irrigation, weeding or fertilizing are done. SRI being essentially knowledge-based rather than input-driven, the important constraint in sustaining SRI practice is the farmer's or the supporting agency's lack of adequate scientific knowledge. This often leads to lower yields when the conditions are less than ideal or the farmers are unable to practice all the six principles because of practical constraints. "Once farmers understand the innovation, and the reasons behind it, there can be various ways to take advantage of its opportunities to raise productivity," the authors assert.

Thiyagarajan and Gujja have responded to some of the arguments of the government scientists against SRI in the concluding Chapter 14. But they have shied away from addressing the political question of why India's agricultural establishment at the national level refuses to promote SRI. That is not surprising because the main objective of the authors appears to be to comprehensively present information about the current status of SRI knowledge and practice in India rather than produce a polemic against its official detractors.

Potential practitioners and promoters of SRI in India would do well to read this book and absorb the information about its practice. Despite some typographical errors, the text is easily read. The book has useful data and is well-illustrated.

Dr. Ravi Chopra is Director, People's Science Institute, a no-profit research and development organization, based in Dehradun.

SRI is an opportunity for India to address the three immensely volatile 'Es'–economy, employment and environment. SRI seeks to address the food security and the economic growth of the country. Owing to its inherent nature of water conservation and soil preservation, environmental factors are also covered.

PRADAN is a voluntary organization registered in Delhi under the Societies Registration Act. PRADAN works through small teams of professionals in selected villages across eight states. The focus of PRADAN's work is to promote and strengthen livelihoods for the rural poor. It involves organizing the poor, enhancing their capabilities, introducing ways to improve their income and linking them to banks, markets and other economic services. The professionals work directly with the poor, using their knowledge and skills to help remove poverty. *NewsReach,* PRADAN's monthly journal, is a forum for sharing the thoughts and experiences of these professionals working in remote and far-flung areas in the field. *NewsReach* helps them to reach out and connect with each other, the development fraternity and the outside world.

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