Final Proceedings of

First National Symposium on

System of Rice Intensification (SRI) - Present Status and Future Prospects

17th - 18th November 2006

Venue

Acharya N.G. Ranga Agricultural University
(ANGRAU), Rajendranagar, Hyderabad

Co-sponsored by :

Directorate of Rice Research of ICAR

Acharya N. G. Ranga Agricultural University

Society for Advancement of Rice Research

World Wide Fund for Nature (WWF) International - ICRISAT Dialogue Project

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Background

Rice is the main food crop in India, grown on about 42.5 m. ha. Since rice has been traditionally grown under impounded water, it consumes more water than any other crop. FAO estimates that rice crop consumes about 4000 – 5000 litres of water per kg of grain produced. Many believe that rice is an aquatic crop, since it can grow well under water-submerged conditions. But like other plants, it grows better in moist but well-drained soil. Increasing water scarcity is making it difficult to sustain the area currently under irrigated rice. Hence the question of growing rice be grown with less water without sacrificing the returns has become more pertinent.

In recent years, the System of Rice Intensification, commonly known as SRI method, is gaining popularity among rice farmers in several states of the country. It has the potential to improve water and land productivity in irrigated rice cultivation, using less water while it increases production. This innovative method has been shown to be productive in over 25 countries across the world, and many more countries are evincing keen interest to adopt it. However, such methods need to be verified, researched and modified, as necessary, to suit local agro-climatic conditions so that it could be adopted on large scale.

SRI Method

SRI is a combination of several practices that include changes in nursery management, time of transplanting, nutrient, water and weed management. It is a modified way of cultivating irrigated rice crops although the fundamental practices remain more or less the same. SRI alters certain agronomic practices from the conventional way of rice cultivation. The new practices together are known as System of Rice Intensification. However, experience of working with farmers for a few seasons suggests that farmers have modified, altered and even dropped some of the elements depending on soil, climate and other social conditions. There is lot of scope for experimentation in this method rather than following strict prescription. In parts of India, the practices are being modified for upland (rainfed) rice production with considerable success. However, most focus is on improving irrigated rice production.

Components of SRI Method

SRI is not a fixed package of technical specifications, but a system of production with four main components, *viz*., soil fertility management, different planting methods, weed control, and water (irrigation) management. Several field practices have been developed around each of these components. Of them, the key cultural practices followed in most cases are: soil nutrient management through application of adequate farmyard manure or other decomposed biomass, transplanting young seedlings (preferably 8 to 12 days old), transplanting seedlings carefully, with a soil clump (along with seed sac) attached to their roots, transplanting at wider spacing and in a square pattern (25 X 25 cm), regular weeding with cono weeder that actively aerates the soil, and reduced but sufficient irrigation to keep soil wet without flooding.

Rice grown with these practices has a larger root system, profuse and strong tillers with big panicles and well-filled spikelets and higher grain weight. The rice plants develop about 30–80 tillers, and the yields

are usually higher under SRI methods than otherwise obtained. The explanation behind this is that rice plants do best when young seedlings are transplanted carefully at wider spacing; their roots can grow larger in soil that is kept well aerated with sufficient organic matter so that plants receive the benefits of abundant and diverse soil micro-organisms.

SRI rice field, hybrid variety,

The First National Symposium

SRI is an unusual instance where extension has taken a lead over research. The scientific community is still debating SRI, collecting data in the process of scientifically validating its performance. Such process is at different levels in different countries. There are some institutions, which are still not convinced about its merit. However, the visual evidence of improved crop performance due to the new practices in farmers' fields is driving the adoption of the system increasingly by farmers in states like Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, Chattisgarh, West Bengal, Assam, Tripura, Punjab, Himachal Pradesh, etc. Taking cognisance of enthusiasm of farmers and adoption results, many research institutes across the country have also started conducting trials on various aspects of SRI method. There seems to be a wide range of experiences from bad to good among farmers and scientists.

At this juncture, a need was strongly felt to share, synthesise and document the experiences, good or bad, farmers' innovations, constraints, deficiencies, future prospects, and policy issues related to SRI methods at national level. Such a get-together has great potential for achieving convergence of ideas based on field experiences of farmers, civil society and scientists to look critically at the results to assess the performance of SRI methods. This first national symposium on SRI methods of rice cultivation was organized on 17-18th November 2006, inviting scientists, Government officials, NGO promoters and practitioners, and critics of SRI from across the country, with the following specific objectives:

- To share experiences and understand the constraints and limits on SRI at national level;
- To identify the policy and institutional changes required for producing more rice with less water by adopting SRI methods tailored to suit different agro-climatic zones; and
- To facilitate formation of a national-level network of SRI promoters, scientists and practitioners for further dialogue based on scientifically valued and verifiable information on SRI.

Directorate of Rice Research (DRR) of ICAR, Hyderabad, Acharya N.G. Ranga Agricultural University (ANGRAU) and Society for Advancement of Rice Research (SARR), Rajendranagar have jointly organized this symposium with the support from World Wide Fund for Nature (WWF) International – ICRISAT Dialogue Project based at ICRISAT, Patancheru. The symposium for the first time brought together about 200 people with an interest in SRI — scientists, promoters, practitioners and policy-makers from across the country. Two days of deliberations and interaction among all the stakeholders provided an opportunity for sharing successful experiences, constraints, farmer innovations, identification of research priorities, and policy directions to enhance adoption and scaling-up of SRI methods to ensure food security, improve the livelihoods of poor people, and avoid further stress on the crucial sources of life-giving water - our rivers and ecosystems.

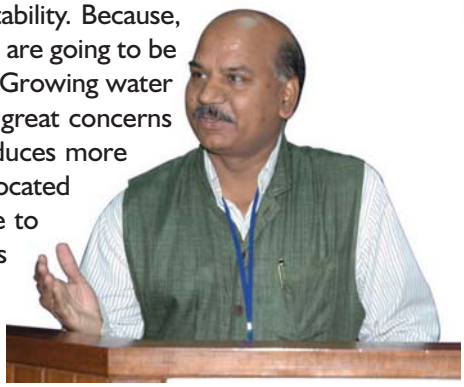
Inaugural Session

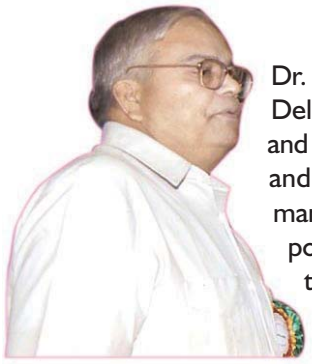
Rapporteurs : Dr. Gururaj Katti, DRR
Dr. Ch.Padmavathi, DRR

The Inaugural Session commenced with invocation and lighting of the lamp by the dignitaries. Shri Gudivada Nagaratnam Naidu, a farmer from Andhra Pradesh, presented rice panicles from SRI cultivated plot to all the dignitaries present on the dais.

Dr. B.C. Viraktamath, Project Director, DRR, welcomed the dignitaries and all the delegates to the symposium. In his opening remarks, he mentioned that this symposium has been organized mainly to critically assess the present status and future prospects of SRI and to identify and highlight the factors contributing to higher yields in SRI method.

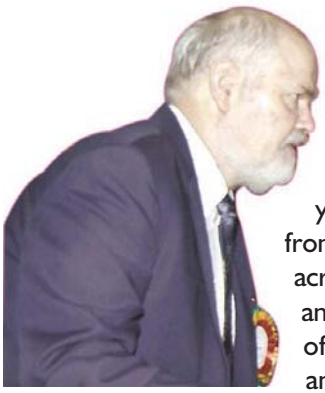
Dr. Biksham Gujja, Policy Adviser, WWF, outlined the background and purpose behind organizing this symposium. He emphasized the need for developing methods, which require less water but can produce more rice throughout the world for food security and social stability. Because, he felt, in near future it is not the land, technology and seed that are going to be limiting. It is the water that will be very scarce to cultivate rice. Growing water conflicts and shrinking water availability in river basins are the great concerns that we are facing today in this country and anything that produces more with less water is very welcome. Rice consumes 70% of water allocated for agriculture production. So, it will be affected drastically due to lack of adequate water availability and food security of millions will be at stake leading to social instability. Hence, there is a need to explore and implement water-saving technologies such as SRI to overcome the challenge of water scarcity.



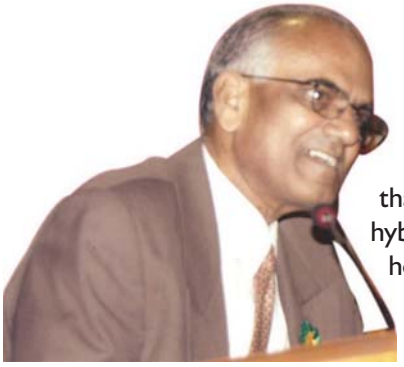


Dr. S.N. Shukla, Assistant Director General (Food & Forage Crops), ICAR, New Delhi, stressed the need for overcoming the current stagnation in rice production and productivity at the national level. He felt that SRI was still evolving in India, and it had potential in small and marginal farmers' fields where good water management facilities are possible. He also felt that the technology had good potential and found many farmers were also very happy with it. But, however, there are certain questions that need proper answers as regards SRI method. Dr. Shukla added that this symposium would also identify researchable issues such as suitable varietal selection, ideal and potential areas for its wider adoption, soil health, and economic aspects.

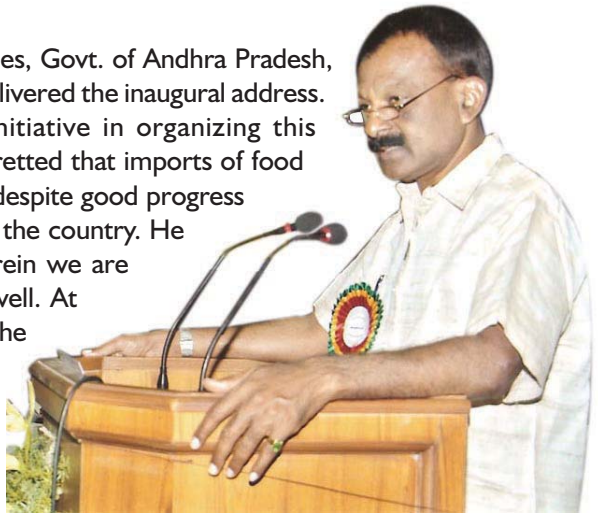
Dr. A. Padmaraju, former Director of Research, ANGRAU, and President, Society for Advancement of Rice Research (SAAR), welcomed the delegates on behalf of Society for Advancement of Rice Research (SARR). He felt group adoption is needed to promote SRI method over individual and isolated adoption. Mechanisation of weeder would go a along way in popularising in canal areas. Modification of the package of practices to suit areas and wide options for farmers would increase scaling up of the method. He opined that simplification of SRI is essential for its wider adoption by farmers. Dr. Padmaraju further mentioned that the outcome of this symposium should be publicized through publications of the Society.



Dr. Norman Uphoff, CIIFAD, Cornell University, USA, felt that SRI was more of a challenge rather than a solution. He recounted that four and half years ago in the first SRI symposium in China there were only two participants from India and amused to see today so many people researching and practicing across the country. Besides rice, SRI methodology is being tried out on sugarcane and ragi in India. He emphasized that SRI will play an important role in agriculture of 21st century contributing towards more productivity, water use efficiency, and mitigating the effects of global climate change.



Dr. M. Mahadevappa, former Chairman, Agricultural Scientists Recruitment Board (ASRB) emphasised the need for greater clarity on water-saving technologies such as SRI, aerobic rice, Integrated Crop Management, etc., among the farming community. He felt that seed saving in rice, especially for good quality and expensive hybrids, is an equally important benefit besides water saving. He opined, however, that situation specificity for the success of SRI should be clearly brought out for the benefit of farmers. He further felt that genotypic response to different methods should be a part of the research efforts on SRI.



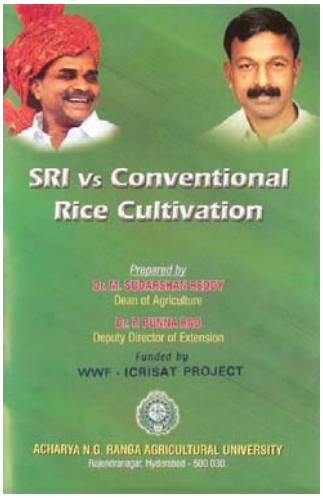
Honourable Minister of Agriculture & Civil Supplies, Govt. of Andhra Pradesh, and the Chief Guest, Shri N. Raghuveera Reddy delivered the inaugural address. He congratulated the organizers for taking initiative in organizing this symposium, as it is the need of the hour. He regretted that imports of food like wheat have become inevitable from outside despite good progress in achieving self-sufficiency of food production in the country. He feared that we should not have a situation wherein we are also dependant on out side supplies for rice as well. At present rice production is reasonably high and the country is exporting, but it is at the cost of high (4000-5000 litres of water per kg of paddy) water consumption. He remarked that the slogan 'more water and more food' is a myth and reminded the traditional knowledge that draining out water from paddy fields few times in the crop season will help to get more yield and good quality of rice. The Minister felt that SRI could help in achieving the major goals of saving water and seed while producing more rice. He also highlighted the steps being taken by the Andhra Pradesh Government to promote SRI through subsidies on quality seed as well as cono-weeders. He mentioned that farmers are still facing some problems of nursery seedbed preparation and weed management. Hence, he asked the scientists to find solutions to these problems and assured full support from the government.

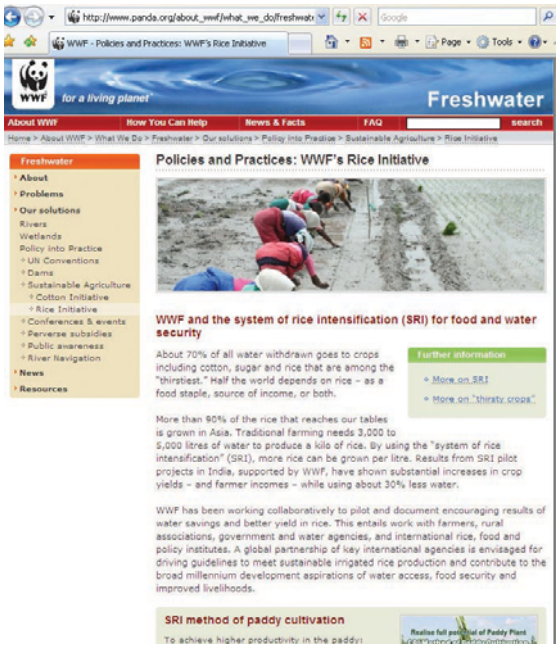
Dr. S. Raghuvardhan Reddy, Vice-Chancellor, ANGRAU, in his presidential address reiterated the need to understand the constraints of farmers in adopting SRI method. His major concern was regarding adoption of SRI in large command areas of Krishna and Godavari rivers as well as nutrition management and interaction effects of various genotypes.

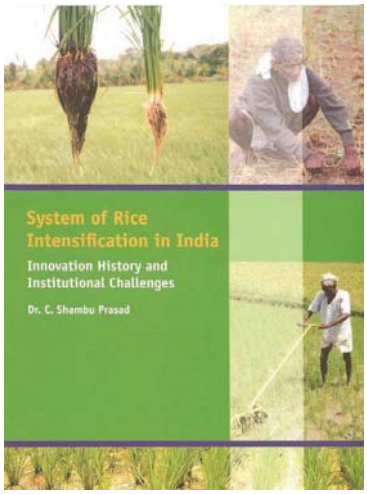
Dr. P. Raghava Reddy, Director of Research, ANGRAU, proposed the Vote of Thanks.

During the inaugural session, the Honourable Minister of Agriculture and Civil Supplies had also released two SRI publications. The first one entitled "**SRI Paddatilo Vari Sagu - SRI vs. conventional rice cultivation**" by Dr. M. Sudarshan Reddy, Dean of Agriculture, and Dr. P. Punna Rao, Deputy Director (Extension), ANGRAU. This small and concise book presents a vivid comparison of the conventional method of rice cultivation with SRI method from seed to grain. The reader can readily appreciate the differences and beneficial features of SRI method.

The second book by Dr. C. Shambu Prasad from Xavier Institute of Management, Bhubaneshwar, with a title "**System of Rice Intensification in India - Innovation history and institutional challenges**", presents an historical account of the introduction and evolution of SRI methods in India and the institutional dynamics involved in the process of SRI adoption by various agencies and the milestones so far in spreading it. It introduces SRI methods to a new reader in a lucid and convincing manner.





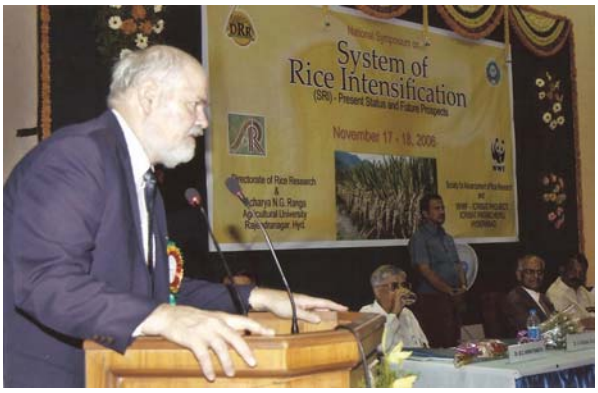


Introductory Session

Historical Development, Principles and Practices of SRI Method

Chairman : Dr.S.N.Shukla, ADG (FFC), ICAR
Co-Chairman : Dr.T.M. Thiyagarajan, TNAU
Rapporteurs : Dr.K.Surekha, DRR
Dr. Cheralu, ANGRAU

Dr. S.N. Shukla, Chairman, gave the opening remarks on importance of SRI, its advantage in saving water, seed, etc., and introduced the speakers and their topics. There were four speakers in this session.



The first speaker, Prof. Norman Uphoff gave a talk on "Thoughts on the History, Principles and Practices of SRI and its importance for the present scenario". In his talk, he had covered all the major principles of SRI, their effects, additional benefits apart from water saving and higher yields, extension of SRI to other crops like ragi and sugarcane. He reviewed the work done in eight countries and emphasized that "SRI is not finished but still developing". While narrating different results across the experiments/ countries, he mentioned that better water control and changed soil biology by adequate biomass application under aerobic conditions gave better results under SRI like resistance to biotic and abiotic stresses, robust growth of tillers and prevented lodging. He also emphasized how more output can be achieved using reduced water and external inputs in rice. SRI is not just a set of practices but also a set of insights and principles, which can help to reshape the paradigm of agricultural production.

In the discussion that followed, some farmers enquired about the possibility of higher yields, acceptance of SRI by farmers, weeding, and using drip system for SRI.

The second speaker, Dr. Biksham Gujja spoke on "Water saving potential of SRI: Need for evolving proper methodology, documentation and independent validation". He emphasized the need for a large-scale comparative data generation of inputs in SRI and non-SRI fields in different soil types and documenting the quantification of water input and management. He discouraged over emphasis of yields by proponents of SRI and felt that it would be counter productive if yields were unduly exaggerated. He shared the results of a small field study conducted by WWF, which found three main constraints in adoption of SRI by farmers viz., irregular supply of electricity, inability to manage water by individual farmers under canal areas and lack of flexibility of transplanting seedlings, as under SRI one has to transplant young seedlings (8-12 days old) only. He felt that coordinated and multi-disciplinary research would fix many problems expressed by farmers in SRI. Systematic studies and reporting on water-saving potential of SRI will trigger a process for major policy changes in promoting these methods at basin or irrigation project scale. He closed by suggesting the target of producing 30% more rice by using 50% less water by 2010 and hence methods like SRI have to be taken seriously.

In the discussion, a few delegates expressed the need for exact quantification of water saving under different systems. However, few farmers expressed their satisfaction over water saving by the SRI method.

Dr. B.N. Singh, Birsa Agricultural University gave the third presentation on "Modified SRI with Hybrid Rice" and presented the results of his experiments of adopting SRI for hybrids. He expressed the view that SRI will be very useful in promoting hybrid rice cultivation as it reduces the seed requirement, which is the major cost factor in hybrid rice adoption. He also emphasized the need for future research in areas of SRI with inorganic fertilizers with hybrids with an yield target of 12 t/ha.

At this juncture, Dr. Shukla suggested the group to conduct studies on the total economics of weed management, which varies from place to place and in large areas, such as using a rotary weeder, which is very important in SRI.

Finally, the fourth speaker, Dr. C. Shambu Prasad, talked on "SRI in India: Implications for promoting pro-poor innovations". He explained the evolution of SRI in India in the last few years by using a systems-of-technological-innovation perspective. He highlighted the role of civil society in facilitating grass roots innovations and promotion of SRI and explained several indigenous technological innovations of resource-poor farmers in SRI. He emphasised the need for change from the conventional linear model of agricultural research - extension to increased interaction between research and non-research actors in assessing and promoting methods like SRI. He suggested that a newer model of learning needed to be in place for further spread of SRI where various factors work together and feeding into the new knowledge that can transform agriculture in a suitable manner.

These presentations were followed by a brief report summarizing the posters displayed that day by Dr. Ilyas Ahmed. Posters were displayed on different aspects of SRI, viz., SRI vs. conventional method, nutrient management, water management and age of seedlings, etc. There were 61 posters brought to the symposium, ranging geographically from Jammu to the Andaman Islands. Dr. Ilyas Ahmed synthesized the major findings of the posters to say that there were yield increases with SRI (10-40%), reduction in water use (30-50%), lower seed cost (66% in hybrids), shorter duration of crop cycle (5-15 days), and less incidence of pests and diseases. He informed that SRI was genotypic-specific with better response of hybrids as compared to high yielding varieties (HYVs). He also highlighted the constraints of SRI presented in the posters as difficulty in transplantation of young seedlings, labour intensiveness, and weed management using weeders.

In the concluding remarks, Dr. T.M. Thiyagarajan as co-chairman for the session expressed that many farmers are adopting SRI method on their own, and many NGOs are also promoting SRI method due to its advantages. He felt that one has to try, practice and understand the principles and problems for one's self and then only can one really appreciate the advantages of this method.

Finally, Dr. Shukla, Chairman, summarized the presentations, suggested a few researchable issues, and thanked all the speakers for their excellent presentations.

Technical Session - I

Research Experiences on SRI in India

Chairman : Prof. Norman Uphoff, CIIFAD, USA
Co-Chairman : Dr.P.Raghava Reddy, ANGRAU
Rapporteurs : Dr.B.Majumdar, DOA, Tripura
Dr. Surendra Raju, ANGRAU

There were six presentations in this session.

Dr. O. P. Rupela, Soil Microbiologist, ICRISAT focused on the comparison of microbial counts in soils under both SRI and conventional rice cultivation. He found the microbial populations to be much more under SRI method than the conventional method, which contributes to the soil fertility. Under the SRI method, the absorption of nutrients is better due to the increased activity of micro-organisms. He also emphasized the need for more multi-disciplinary studies, particularly through long-term experiments, including addressing the issues of soil nutrient depletion in SRI plots and its adoption by farmers.

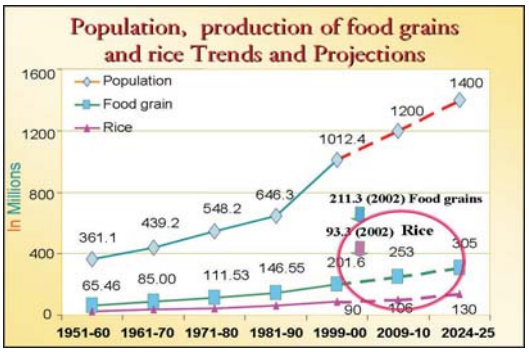
Water Productivity in SRI System at Tamil Nadu

	Coimbatore 2001-02		Killikulam 2003	
	Conventional irrigation*	Shallow irrigation*	Conventional irrigation*	Shallow irrigation*
Total water used (irrigation + rainfall) (m^3 ha^{-1})	16907	10259	10994	6317
Grain yield (kg ha^{-1})	6796	6290	5644	5736
Water productivity (kg m^{-3})	0.402	0.613	0.513	0.908
% increase in water productivity	-	53	-	77

* SRI principles of 14 d old seedlings, single seedling per hill and weeder use were adopted.

Prof. T.M. Thiyagarajan, Tamilnadu Agriculture University, presented results of comparative trials on SRI vs. conventional cultivation of rice. He found that younger seedlings, wider spacing, and organic source of nutrients, were components responsible for higher yield and improving the soil health in case of SRI. He also concluded that application of herbicides to control weeds has not enhanced the yield. He compared the use of rotary weeder with the application of herbicides to manage weeds and concluded that rotary weeder was very effective. Under SRI method, 40-50% water was saved. Yield increase under SRI was ranging from 0.6 to 2.3 t/ha. He also informed that SRI has been evaluated in farmers' fields through adaptive research trials in Tamil Nadu and has been recommended for adoption in the state.

In his presentation, Dr. B.C. Viraktamath, DRR, mentioned that in the AICRIP trials, yield increase of HYV under SRI method was 15-17% and in case of hybrids, it was 46 to 48%. Younger seedlings were better both in HYV and hybrids. The other salient findings from AICRIP trials were that SRI is location-specific, reduces seed cost and water requirements, and improves soil health. However, further investigations need to be carried out to validate the findings across the country and to identify the genotypes best suited to SRI so as to get higher yields with less seed and less water.



Dr. G. Ravi, Tamilnadu Agriculture University, mentioned that biotic stress is less under SRI methods as compared to conventional methods. The incidence of stem borer, brown plant hopper (BPH) and gall midge was less, whereas incidence of leaf folder and green leafhopper was more under SRI method. He

attributed this to young seedlings and square-planting creating a better micro-climate, which ultimately hinders the pest population build up. He reported that SRI method of cultivation would reduce human diseases like malaria and dengue fever due to the reduction of stagnant water for breeding of vectors of these diseases. He found the alternate wetting and drying disturbs the BPH pest in rice fields. He hoped that SRI might continue to contribute for a higher productivity in rice in the forthcoming era of "second Green Revolution".

Dr. Aum Sharma, Head (Farm Machinery), ANGRAU found that use of cono-weeder reduced 50-55% of drudgery among the women labourers involved in the intercultural operation in SRI. Efforts are on to find suitable mechanical methods to transplant the tender seedlings. Efforts are being made to fabricate different types of cono-weeders to suit various rice soils. Timeliness and precision of weeding operations is essential to reduce the weed growth in SRI cultivation. He also emphasized the need to refine and motorize the weeders by using low-weight engines, providing a clutch, and reduction of weight of the machine to make it suitable for all types of soil and field conditions.

Dr. Ganesh, National Seed Project (NSP), ANGRAU, narrated how the SRI method helps to produce quality seed with less cost and maximum purity. Seed production through SRI methods will help even the small and marginal farmers. The SRI methods increase 16% more seed yield than the conventional method of producing seed. Other advantages of seed production through SRI method are less seed requirement, less pesticide requirement, non-lodging, more filled spikelets, and maximum profit to the rice farmers. He emphasized the need for concerted efforts of all disciplines. With passage of time, SRI methodology may improvise further and become a greater boon to the rice-growing farmers, he concluded.

Prof. Norman Uphoff, chairman of the session, desired intensive research efforts to fine-tune SRI method to suit local situations and wider adoptability.

Interaction of delegates during sessions