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Socio-Economic and Ecological Challenges for System of Crop Intensification (SRI/SCI): Sustainable Productivity-Enhancing Innovation for Household Food Security

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The persistent low productivity and wider inter-regional differences in yield in the resource- poor production system is a prime concern. This implies ample scope for a strategy to increase food production and bridge the yield gaps

Rice is an important crop, being the source of main food item of the majority especially in INDIA. Yet,despite increase production, the availability of rice has reached an all-time low of 64 kg per annum per capita in this decade. This amounted to average food availability of a person is lesser by 20kg than the minimum requirement of a normal person (NSSO surveys). Therefore, to meet the nutritional needs of the population, food production has to further increase if not double' in the next decade or two.

The poor production performance, deteriorating health of natural resources (soil, water and biodiversity), fragmented land holdings, and credit facilities, made the situation more precarious. The biotic (pest, diseases and genetic decline) and abiotic stress including problematic weather aberrations due to climate change (such as flooding and drought, temperature snow, frost, submergence and cyclone etc.), put tremendous strains on production system adding more to year to year fluctuation. The worst is that the sector loses about 40% of production annually due to system inefficiency and wastage.

In view of area stagnation under food crops, while increasing consumption demand, and the population and urbanisation unabated, the onus lies on productivity enhancement at Global, National, and Household level. But, the rainfed areas, where the smallholders and the hungriest people live, are the victim of low productivity trap. The low productivity and inter regional differences in yield implies ample scope to exploit untapped potentiality to increase production and bridge the yield gaps.

The System of Crop Intensification, derived from the principles of **SRI,** is a suitable method for enhancing productivity and breaking the yield barrier in smallholders' fields. The novelty is that this pro-poor option produces more with less external inputs while conserving precious water. Realizing its importance, the government, civil society organisation and NGOs are promoting SRI methods for scale and helping farmers' capacity building. Due to tangible virtues of the method, the application of the innovation to other crops proves successful and hence spread widely across ecosystems. It is observed that nearly 1million ha of rice area is brought under SRI in a quick succession of couple of years by 2009-10. Subsequently, more SRI Area expanded at present.

The SRI is an amalgamation of integrated package of agronomic approaches that help exploit the genetic potential of rice plants; create a better growing environment (both above and below ground); enhance soil health; and reduce inputs cost substantially. Hence it suits the resource poor and the phenomenal saving in seed (90% saving) and water upto 40%, to the innovative method, attracted these farmers. Studies in India show that introduction of SRI enables the poor to achieve upto 100 days of additional homegrown food for the household (see Appendix). On achieving food security at household level, the farmers are also encouraged to adopt crop diversification as the method saved crop period. The crops like maize, wheat, mustard, and vegetables have shown adequate reward of improved methods of cultivation.

Professor Norman Uphoff, Cornell University, Ithaca, USA, fully convinced about the excellence of SRI in meeting the food security need of the poor, devoted his time in promoting its adoption and knowledge delivery globally. The origin of this simple technique can be traced in Madagascar where SRI was first practiced while confronting the vagaries of hunger and famine. The method has recently been introduced in India, where farmers improved productivity by using less water and external inputs while incurring no additional cost.

SRI being a set of care-intensive practices, imparting knowledge is essential. Capacity building and stakeholders awareness is crucial for its promotion. Therefore, strengthening the institutional framework including rural credit system, crop insurance, marketing and remunerative pricing policy is an essential booster of rural income.

The Government of India under the ambitious programme of National Food Security Mission (NFSM) has integrated the existing rice initiatives for the promotion of SRI all over the country. Multiple advantages of SRI as observed by governments institutions, NGO, civil society and other stakeholders incentivized the promotional strategies at the farmers' fields. Among the early adopter include the governments of Andhra Pradesh, Tamilnadu, Karnataka and Tripura. They added SRI promotion in right Ernest and allocated required financial resources from the year 2003-04 onward. The record saving of at least 25-30% water, reduced cost of cultivation by 10-15% and increased rice yield by 30-40% was substantial. This has benefited the needed improvement in the production system. The research and development organization and government-owned institutes, as well as CSOs have conducted SRI/SCI research, to provide gainful benefits. This concerted effort proved to be additional milestone strategy for scale up. The advent of stress-tolerant rice varieties (STRV) due to the introduction of sub-1 genes in rice varieties revolutionised the rice production, (for instance Swarna sub-1, Ranjit sub-1, Bahadur sub-1, CR dhan, BINA 11 etc are practiced in flood-prone ecosystems) and the paddies in submergence prone areas helped enhancing productivity.

SRI rice is a preferred method of farmers due to significant seed saving, built-in resource-conserving property, and yield performance. Availability of controlled irrigation (drip irrigation, fertigation of water harvesting system) also incentivised farmers to convert fallow areas into productive purposes especially in the rainfed areas. More significantly, imparting careful management care, resulted in the traditional rice varieties to perform well.

Policy conclusion

The paper attempt to synthesize and shares few observations and reviews the strategy for scaling up SCI/ SRI in India. SRI comprises diverse meanings as rice is cultivated in highly diverse conditions. While adopting technology, the farmers enhance productivity within their own agenda in conformity with the local production environments and social systems. This implies that there is no single solution or productivity policy for all situations across the various spatio-temporal dimensions.

The innovation of technology/practice like SRI/SCI opens up a new vista for sustainable rice production and/or revitalize the potential of traditional as well as improved seed varieties that seem to have gradually lost in the green revolution agenda.

The new practice dedicated mainly to small and marginal farmers, has important implication for their household food security. This innovative practice of food production has a chance to revive the shrinking opportunity in rice production systems for resource poor farmers. In particular,

- SRI is a suitable technology for the Rainfed rice system, where the Small & Marginal Farmers (S&MF) benefitted more from the innovation.
- It ensures and satisfies the Food Security needs of the green revolution bypassed population
- Therefore, SRI Awareness & GOVERNANCE (Advocacy model) should be promoted as long term strategy for SRI scale up

The effort requires the following policy steps in its pathways and smoothening road map

1. To re-orienting farmers and create awareness towards intensive management and knowledge in favourable rice agroecology
2. To create cadres of SRI Resource Farmers for imparting training and handholding. This will potentially supplement the conventional extension system
3. To enhance investments for ensuring sustainable land and water resources in large- scale coverage
4. To establish decentralised manufacturing hub of SRI implements and appropriate distribution system among the stakeholders to add to policy regimes
5. Provisioning availability of in-situ organic matter and resources for improving soil productivity and sustain microbial life system.
6. Establish research and development (R&D) back-up and support accompanied by policy advocacy strategy
7 Establish close linkages in mainstream R&D ecosystems, institutional Policy regimes and Practicing Farmer Collaboration: eg. SWI farmers from Rajasthan, Uttarakhand and Bihar participated at On-station experiment at experimental farm fields, which imparted mutual benefits

The process thus demands effective Policy strategy for sustaining SRI reach out. To conclude:

- SRI has apparently become a familiar household name amongst the farmers globally.
- It is the most preferred technological option for small and marginal farmers to ensure household food security who own less than 2 hectares of land. It has been observed that at present, there are instances, of farmers motivated for experimenting convincingly with SRI methods. In fact, these experiences enable scale up by "learning by doing and learning by seeing".
- Farm level studies in India show that introduction of SRI enables the poor to achieve upto 100 days of additional food for the household (NABARD 2008), which is significant.
- On achieving food security, the farmers also adopted crop diversification as the SRI method saved time of stages of crop growth. The crop diversification such as maize, wheat, mustard, and vegetables shown respectable reward of improved methods of cultivation.
- Moreover, it is the most welcome sign that research and policy establishments have accepted its worth in increasing productivity in the sustainable production space and made policy changes.
- For instance, the state of Tripura, Tamil Nadu, Bihar, Jharkhand, Chhattisgarh, Odisha, Andhra Pradesh, and Telangana have modified their work plan policy in favor of SRI. Other states also recognize SRI as alternative method rice cultivation. The civil society organizations (CSO) are credited for their continuous efforts in spreading the message and the method widely.
- According to farmers, the labour constraints however, is a dominant inhibiting factor. But given the time, the problem can be eased out as the practicing farmers acquire more expertized knowledge and become accustomed to the nuances of SRI principles, which make believe that SRI is actually labour saving and save time too.
- The cost benefit analysis shows the traditional mono-culture rice alone can't provide adequate farm income and means of livelihood; realizing this, the farmers resorted to crop diversification and reap benefits.
- Even at aggregative level, by targeting about 20-25% of land holdings, nearly 10-12 million hectares can be brought under SRI in India.
- For increasing income and livelihood, farmer need to adopt farming system approach with crop diversification with SCI as the main focus. The evidence-based experiences with SCI in wheat, maize, mustard, vegetables have shown proven opportunity to improve the produce market as SCI product is organic in nature, believed to be healthier and of superior quality food. Health-conscious consumer preferences are growing and attract premium price
- Therefore, there urgent need for the policy ecosystem to be supported by Research and development system on climate resilient technology (Climate-Smart Sustainable Agriculture-CSSA) and impart its promotion.
- The IIRR may be encouraged to develop and lead a mission mode schemes such as All India Coordinated project on SCI/SRI (AICSRI) emphasizing on technology demonstration at the on-farm and on-field (farmers field)
- More efforts needed on Training and capacity building on continuous basis as the innovation is knowledge intensive rather than input intensive. Seeing is believing attract rural youth to Agriculture.

The state governments experienced record saving of at least 25-30% precious water, reduced cost of cultivation by 10-15% and increased rice yield by 30-40% over the normal practice particularly in Andhra Pradesh. Due to these benefits, the Govt spelt out a detailed plan for SRI promotion and allocated the fund for proper implementation. These benefits of SRI is briefly quantified below

	Normal Practice (2004-05)-CMP	SRI (2004-05)
Yield (More)	5.561 t/ha (30 bag of 75 kg per acre)	7.31 t/ha (40 bag per acre), Difference +32%
Water requirement (saving)	1200mm	750-850 mm, Saving 350-450mm
Seed (saving)	30-40 kg	2 kg
Cost of cultivation (Less)	Rs.8000/acre	Rs.7500/acre
Gross return (Rs.) (More)	12750/acre (@ Rs.425/bag)	17000
Profit per acre (Rs.) (More)	4750	9500 (% gain 100%)