‘Differentiated Agronomies’ for Sustainable Rice Intensification :
Towards an Alternative Policy Framework for Local Food Security in India

Ravindra Adusumilli[1], **Debashish Sen**[1] , **Sabarmatee** [1]
[1] Ph.D. Researchers, Wageningen University, The Netherlands
Contact : raviwn@gmail.com

C. Shambu Prasad, Professor, Xavier Institute of Management, Bhubaneswar, Odisha, India
Rob Schipper, Development Economics Group, Wageningen University, NL
Raj Kumar Kumawat, Research Group, RRA Network, India

Context: While India concludes debate on the National Food Security Bill that seeks to balance concerns of mass hunger and bursting granaries and move towards its operationalization, there is a need to rethink the conventional growth strategies through chemical input intensification that have created a disconnect between productivity growth and achieving local food security. This paper explores emerging alternatives in sustainable rice intensification through localized adaptations of System of Rice Intensification as an alternative policy framework for achieving local food security through intensification of small farmer rice holdings.

Objectives:

- Assess and characterize the agro-ecological context of rice production and food security in India
- Analyze the technological approaches underlying the public investment/ promotional packages against the agro-ecological contexts of rice production
- Explore the potential of alternative emerging options such as System of Rice Intensification
- Evolve a policy paradigm for sustainable rice intensification

Methods:

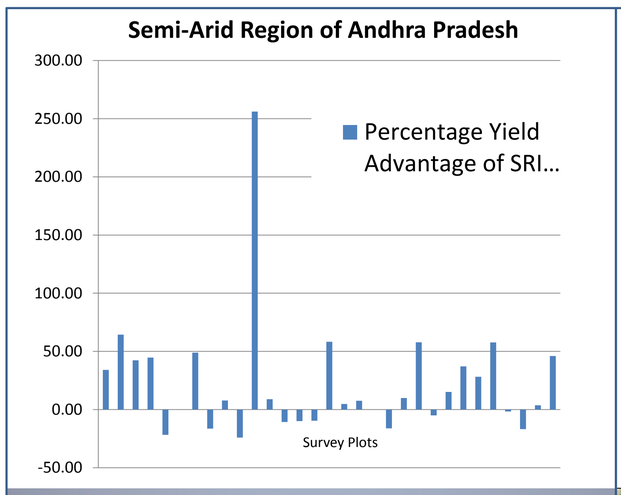
The agro-climatic context of rice production is analyzed taking 252 rice growing districts in India for which related data is available. These districts are scaled according to Moisture Index (MI = (P-PET)/PET)where P = Precipitation and PET is Potential Evapotranspiration) with 6 classes (range from -0.66.6 –Arid to >+100 – Per Humid). Analysis of rice area and productivity, cereal deficits etc., were made with the districts classified as rainfed or irrigated districts (<30% gross rice area irrigated as rainfed district and >30% as irrigated district); the analysis was done across the ranges of MI using a bench mark for understanding the rice agro-ecologies.

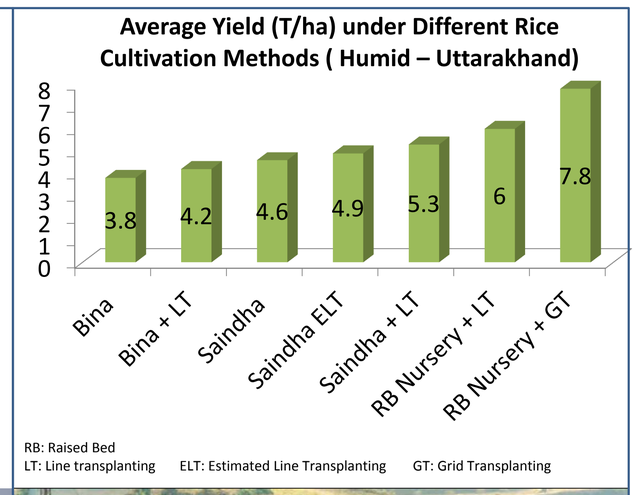
An analysis of the stricture of investments and technical components of the major programs of the Ministry of Agriculture for improving rice productivity provided a basis for technical-characterisation of the present policy-framework. The study draws from the intensive field studies of about 600 farmers focused on agronomic transitions in rice systems in three agro-ecologies viz., Himalayan mountains of Uttarakhand in the North, Rainfed areas of sub-humid regions in Odisha in the East and semi-arid regions of Andhra Pradesh in the South. These studies were multi-disciplinary in nature using a combination of technography, participant observation, case studies, agronomic evaluations and economic analysis. Dynamics of spread, technological change and impact of SRI in particular were systematically analysed.

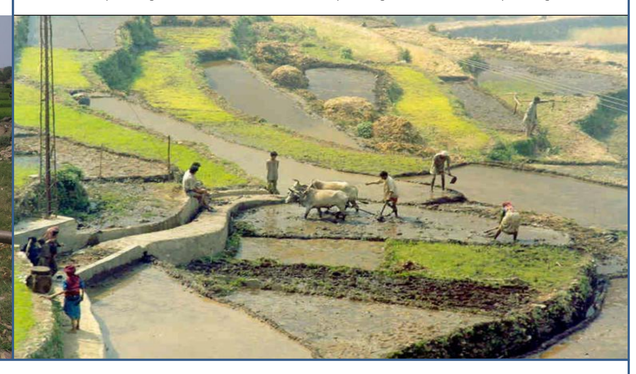
The results of these studies when implied to the different agro-ecological contexts of rice production in India, provided a basis for “Differentiated Agronomies” as a policy framework for sustainable rice intensification.

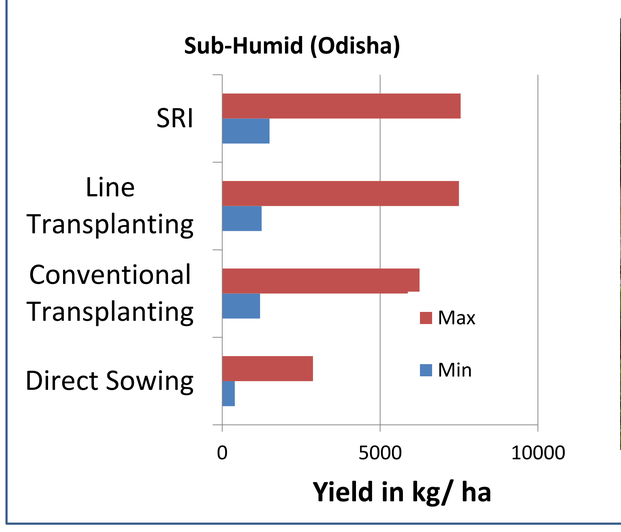
Exploring Emerging Options in Sustainable Rice Intensification:

Impact of SRI and other methods of rice cultivation in differential rice agro-ecologies from an intensive field level analysis of 3 different agro-ecological regions









Rice in Agro-Climatic Zones:

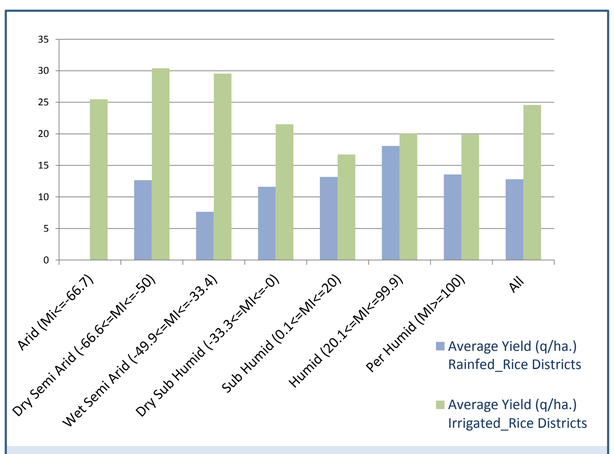


Fig 1 : Rice productivity is relatively higher in the moisture deficient districts and the gap between rainfed and irrigated rice districts is narrow as the moisture index increases (data for 2008-09)

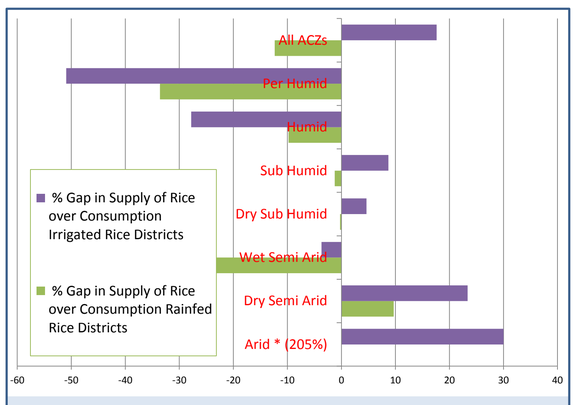


Fig 3: Many of the rainfed rice districts are deficient in cereal consumption, particularly districts with high moisture index

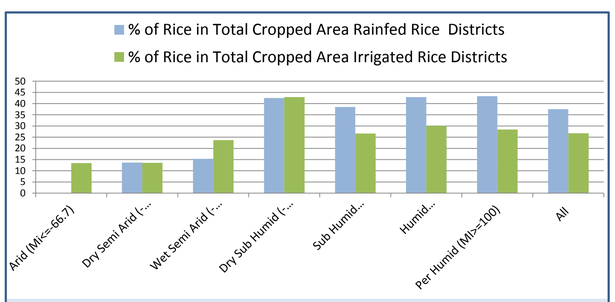


Fig 2 : Rainfed rice predominates as the moisture index increases. 26.43% of rice area is under districts with positive moisture index

Table 1 : Distribution of rice area in the Agro-Climatic Zones

Districts with predominantly →	Rainfed Rice	Irrigated Rice
Arid (Mi<=-66.7)	.	4.1
Dry Semi Arid (-66.6<=MI<=-50)	0.5	10.83
Wet Semi Arid (-49.9<=MI<=-33.4)	2.84	12.77
Dry Sub Humid (-33.3<=MI<=-0)	16.2	34.48
Sub Humid (0.1<=MI<=20)	1.56	3.28
Humid (20.1<=MI<=99.9)	3.55	2.85
Per Humid (MI>=100)	5.12	1.92
All Agro-Climatic Zones	29.78	70.22

Diversity in Rice Agro-ecologies: 26% of districts with high negative moisture index have predominantly irrigated rice. Intensive and unsustainable water use impinges on rice growth in these areas. About equal percentage of rice districts under low negative to high moisture index (Fig 2) have low productivity (Fig 1); these rice growing districts also face deficits in cereal supply (Fig 3). Emphasis of Green Revolution on increasing food production to meet national requirements has led to excessive focus on development of irrigation and chemical input intensification in 56% of rice districts, most of them having negative moisture index. Such growth path is buttressed with mounting subsidies in irrigation (electricity for groundwater) and fertilizers and also led to groundwater over exploitation.

Such strategic focus on achieving food security at ‘national level’ neglected improving rice productivity in the districts with higher and positive moisture index; many of these districts remained deficient in cereal supplies (Fig 3)– impairing their local food security. An analysis of the government programs revealed extension of the green revolution package on chemical inputs and HYVs/ hybrid seed into these districts with low negative to high positive moisture index but having ***diverse agro-ecological contexts*** and ***rice agronomic practices.*** The appropriateness and viability of such extension is questionable.

Sustainable Rice Intensification in Differentiated Agronomies:

The above figures from the three different agro-ecologies (the pictures provide a glimpse of the landscape) illustrate possibilities in increasing yields through agronomic innovations such as System of Rice Intensification. Even while SRI was introduced into these rice systems with similar principles, the method took variant shapes while being diffused with the farmers actively found adapting the methods and its principles to their convenience - family labour availability, landscape and other situations. Seven different methods were observed in Uttarakhand with graded enhancement in yields (from 3.8 to 7.8 tons/ ha) as the farmers improvise their practices. Around 1 ton/ha yield advantage was observed in Odisha, though variability is very high. An average yield enhancement of about 23 per cent over the conventional was observed in majority of the sample plots under groundwater irrigated rice in Andhra Pradesh, even while the actual irrigations decreased by about 20 to 30%. Substantial reduction in seeds and water was observed across all the three regions.

While expanding SRI practices, farmers were found adapting, modifying or compromising on some of the principles (line sowing in place of square planting, two seedling in place of one, maintaining thin layer of water through out against the recommended alternate wetting and drying etc). Farmers optimised their agronomic choices opened up by introduction of SRI to their critical bottlenecks.

Productivity enhancement with no additional external inputs / costs has enhanced cereal availability within the households moving them few steps ahead in achieving household level food security.

An Emerging Policy Framework:

The study brings out advantages of context specific agronomic innovations/ sustainable rice intensification methods in enabling growth in rice productivity across diverse agro-ecological regions. In the highly diverse agronomic and agro-ecological contexts, enabling farmers to find ways of enhancing productivity in their farms through multiple adaptations of sustainable intensification methods is found to be more appropriate than to target an average yield enhancement with subsidy led external input intensification as is practiced at this moment in India.

Focusing on the rainfed districts with low negative to high-moisture index duly recognizing their ‘differentiated rice agronomies’ and investing on promotion of sustainable rice intensification methods will enable each farmer to innovate and improvise their practices resulting in wide spread increase in productivity. Similar rice intensification approaches in districts with negative moisture index help in increasing / maintaining current levels of productivity even while reducing the external input (water and fertilizer). Such strategies auger well for sustainable growth in rice productivity. Such an approach blends well with achieving ‘local’ or ‘household level’ food security through sustainable rice intensification as a policy objective than to enhance dependence on subsidized food supplies through public distribution system.

We Acknowledge

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Netherlands Organisation for Scientific Research
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Also refer other posters under the same project :

P 4.25 – Glover and Maat

P 1.45 – Sen and Prasad

P 4.30 – Berkhout