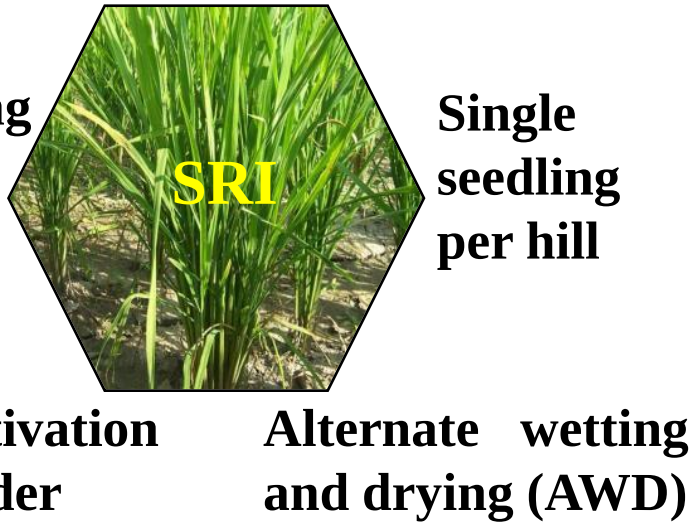
User Adaptations In Rice Farms of Uttarakhand: Landscape and Farm Level Interactions

Debashish Sen

Knowledge Technology and Innovation Group
Social Sciences Department, Wageningen University

PhD: Larger Research Objective & Research Questions

To characterize and explain modifications in rice farming system due to introduction of System of Rice Intensification (SRI) in Western Himalayan region of India



1) **What are the nature and extent of modifications in rice cultivation practices across space and over time?**

2) **What are the variables and processes that drive and shape rice cultivation practices under influence of SRI ?**

Introduction: Research Gap and Question

Past Studies on

- Rice – Transplanting: Effect of Plant Density on Crop Yields; Water Management: Water Consumption and Water Productivity
- SRI – Farmers' Uptake & Deviations, Labour & Water Use and Crop Performance, farm diversity and human relations discounted
- Agrarian Transformations – Labour Use and Gender Allocations, Economics & Women's Status; Farm-Landscape interactions ignored

Research Gap: Social Technical Aspects

Social implications of requirements of water, labour, skill and coordination

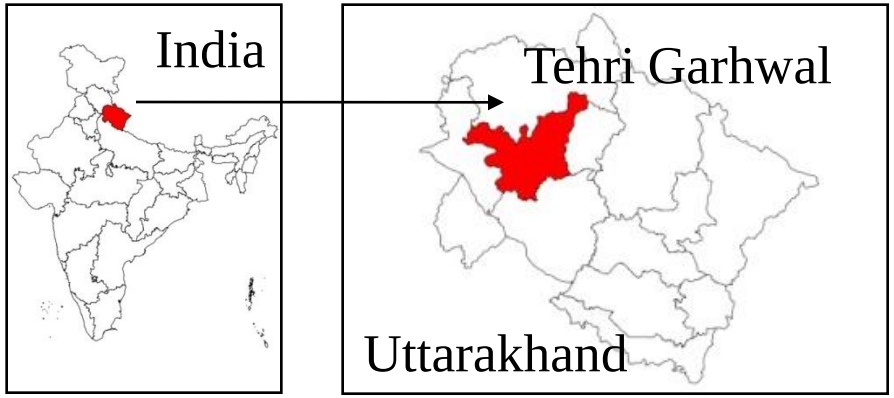
Research Question:

How introduction of SRI affected crop establishment & water management as a socially coordinated agronomic activity

Methodology: Conceptual Framework, Location and Tools

Theoretical Framework

- Agriculture as a Performance
- Actor Network Theory
- Task Group Culture



Ethnographic Approach

3 Villages in Tehri Garhwal district of Uttarakhand, India
Rice Seasons : 2011 to 2013

- RRA on Cropping Calendars
- Participant Observations
- Field Measurements
- Focus Group Discussions
- Semi-Structured Interviews

Bhilangana Sub-basin, Tehri-Garhwal, Utarakhand, India

Comparing Prevailing with Recommended SRI Practices

Method	*Bina*	*Saindha*	SRI (08-09)
Transplanting			
Nursery	Dry Bed	Direct Wet	Raised Bed
Seedling Age (Days)	25*-100	20* - 100	8-12
Number of Seedlings/Hill	3**-12	2** - 13	1
Plant Spacing (cm)	Random: 7-27 (15)	Random: 5-28 (15)	Row: 25 cm Plant: 25 cm
Hill Density (Hills/sq. m.)	33-72 (~50)	31-76 (~50)	16
Plant Density (Seedlings/sq. m.)	99 – 372 (>132)	99 – 428 (>122)	16
Water Management	Flooding (10-15 cm)	Flooding (10-15 cm)	AWD

Source: Field Observations and Focus Group Discussions, 2011-2012 (): Average

***Before SRI: Seedling Age > 30 days ** Before SRI: Number of seedlings per hill > 3**

SRI: Low Plant Density (Less Seed Rate), Less Water but Demands New Skills, Timely Labour Management and Close Monitoring

SRI Demands New Performative Skills

Careful Uprooting along with seed

Properly Marked Fields

Careful Handling of Seedlings

Water : Not Too Much nor Too Less

Reconfiguration of Transplanting Task Group Culture

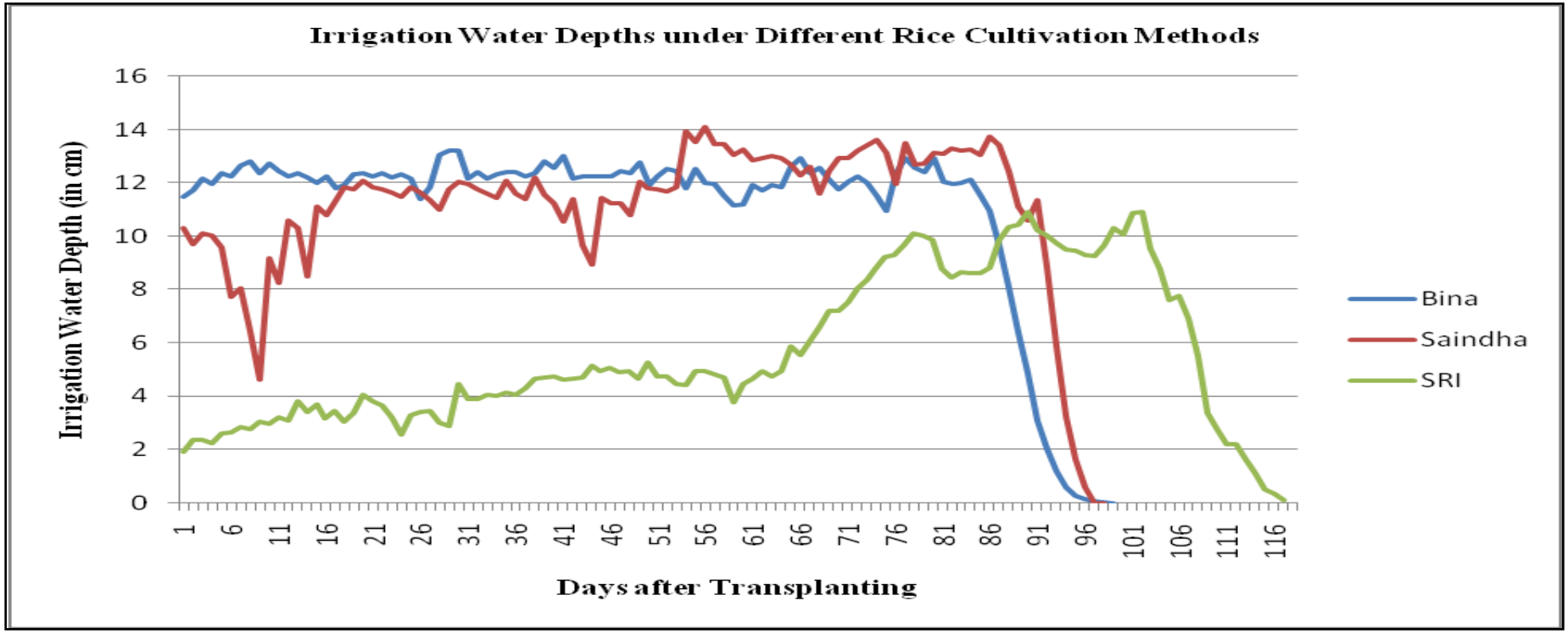
- **Rescheduling Dates**: Early establishment needed for timely ripening
- **Relocating Plots:** Most SRI plots located in middle reach of canal
- **Reforming Groups**: Emergence of larger and young aged groups
- **Readjusting Tasks:** Seedling density increased with age
- **Redistributing Tasks:** Elderly uproot while young transplant

Synchronized Transplanting vs Synchronized Harvesting

	Nursery Type	May			Jun				Jul	Aug	Sep				Oct	
		2 w	3 w	4 w	1 w	2 w	3 w	4 w	1-4 w	1-4 w	1 w	2 w	3 w	4 w	1 w	2 w
	Saindha/ Bina	N						T				H				
Synchronized Transplanting	RBN					N		T								H
Synchronized Harvesting	RBN	N		T								H				

W: Week, N: Nursery, T: Transplanting, H: Harvesting RBN: Raised Bed Nursery

New Norms for Irrigation under Influence of SRI



Source: Mean Daily Water Depth of 20 plots each under different rice cultivation methods, Village Phalenda, 2013

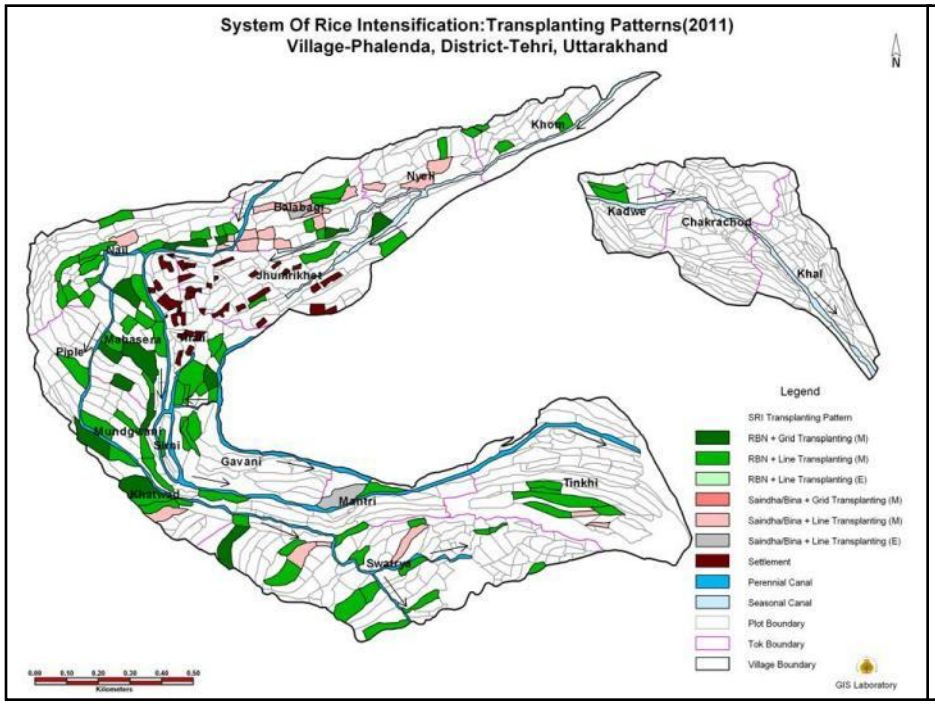
Non - SRI plots

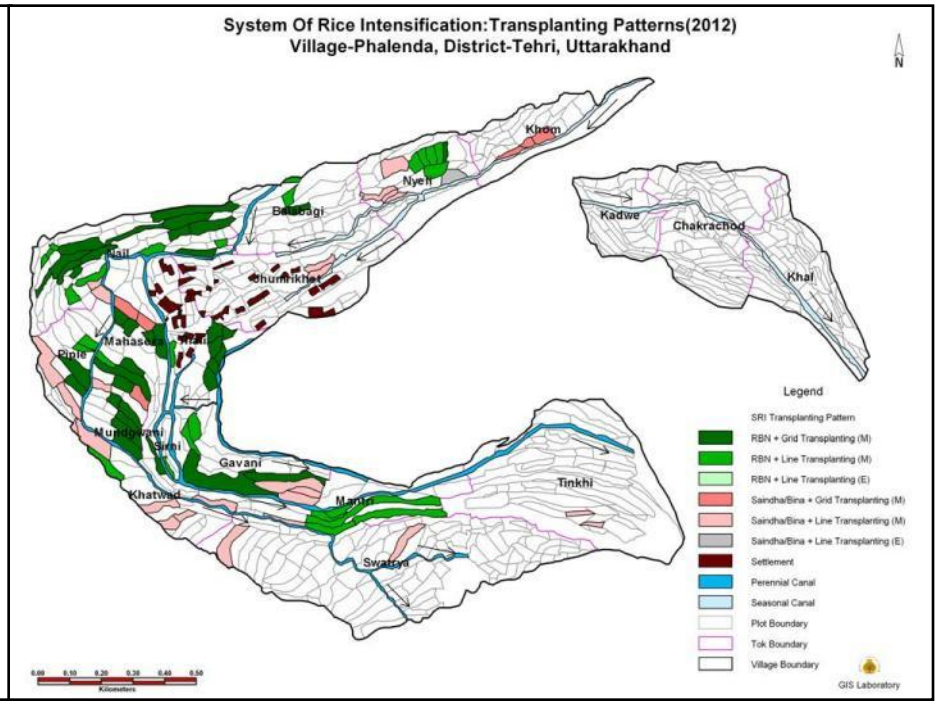
- **10-14 cm (Crop Growth Phase)**
- **More depth in *Bina* transplanted plots**
- **Older seedlings withstand higher flooding depths**
- **Flexibility to work in the un-irrigated plots, as water controls the weeds**

SRI plots

- **2-4 cm (Vegetative Phase); 10 cm (Reproductive Phase)**
- **Young seedling : Water depth gradually increased along with growth of seedlings**
- **Weed growth & water beetles controlled**
- **Flexibility in weeder operation**

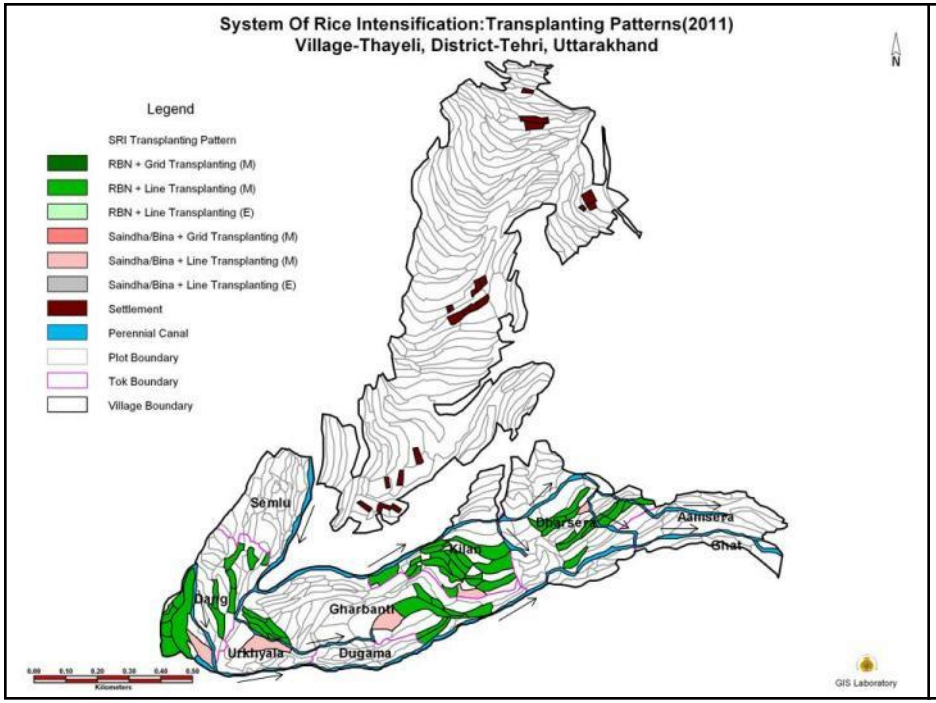
Phalenda: Location of SRI Plots & Transplanting Patterns

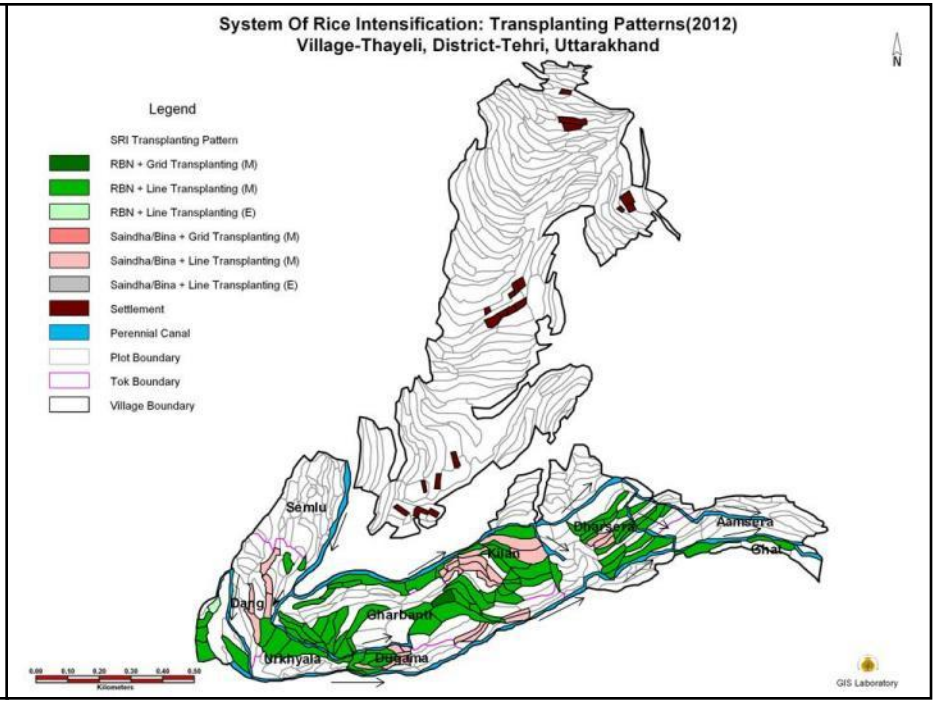




- SRI plots located nearer to habitat as frequent visits required for gap filling (in case of seedling mortality) and weeder application
- SRI plots concentrated in middle reach of canals (Head – too much of water for young seedlings, Tail- delayed transplanting and uncertainty of water)
- Increase in grid transplanting in 2012 as farmers realized loss in yields from line transplanting
- Increase in plots transplanted from *Saindha*/*Bina* (in tail ends and saturated soils) as 10-15% increase in grain yields was reported through wider spacing and mechanical weeding

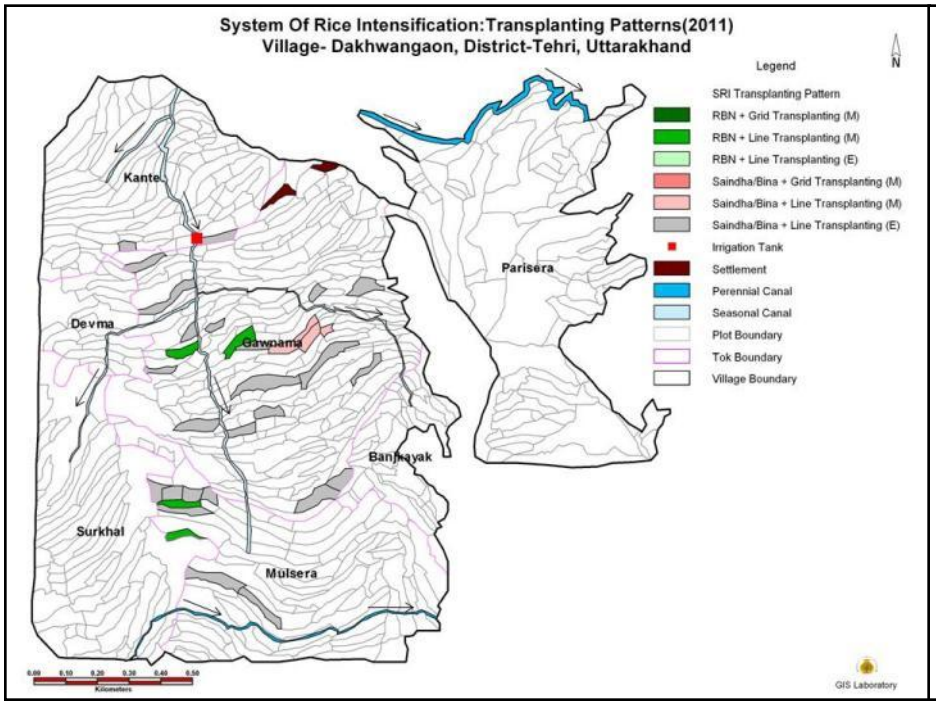
Thayeli: Location of SRI Plots & Transplanting Patterns

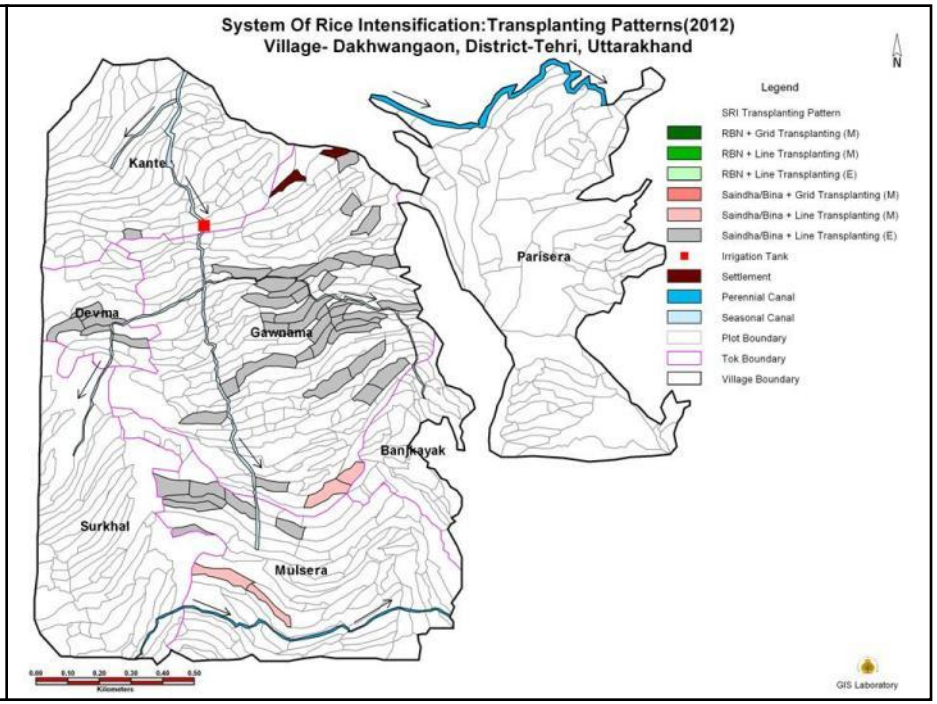




- SRI plots located nearer to habitat; SRI plots concentrated in middle reach of canals
- Only line transplanting is done : Increased number of SRI plots and sandy loam soils put extra workload (marking) on VLRP.
- Grid marking delays initiation of transplanting, difficult to transplant in hard dry soil
- In 2012, plots transplanted from conventional nurseries increased as farmers did not establish enough RBNs as one of the canals had broken down

Dakhwangaon: Location of SRI Plots & Transp. Patterns





- Perennial sources located outside village boundaries – Early transplanting from RBNs therefore avoided as requires frequent visits to distant plots
- Late transplanting of young seedlings from RBNs delays ripening in higher elevations
- Marking demands drying of fields, avoided due to uncertainty of water after transplanting
- Line transplanting of old seedlings from conventional nurseries through eye estimation
- Plots in which lodging was observed in previous season were particularly selected for SRI as no/less lodging was reported with wider spacing

Predominant Forms of Transplanting under SRI influence

	Phalenda	Thayeli	Dakhwangaon
Source of Seedlings	RBNs or Saindha/Bina	RBNs	Saindha/Bina
Seedling Age (Days)	11-27	10-22	35-80
Seedlings/ Hill	2-5	1-4	3-6
Row Spacing (cm)	25 (Marking)	25 (Marking)	15-30 (Eye Estimation)
Plant Spacing (cm)	Random: 10-30 Marking: 25	Random:10-27	Random: 10-30
Hill Density (Hills/sq. m.)	Line: 20-32 (24) Grid: 16-20 (18)	Line: 20-26 (24)	Line: 27-49 (35)
Plant Density (Seedlings/sq. m.)	Line: 42-84 (67) Grid: 32-64 (50)	Line: 24-78 (54)	Line: 202-292 (241)

Driving Forces

- **Scattered farms**
- **Irreg. & Small plots**
- **Soils and Elevations**
- **Diverse Crops**
- **Cascade Irrigation**
- **Limited Lab. & Draft**
- **Exchange Labour**

SRI opens up various options. Farm households make choices as per their bio-physical and socio-economic circumstances, and enter into negotiations

Conclusions

- **Entry of SRI necessitates rearrangements of a complex and balance system in place**
- **Hybridization of existing practices and SRI elements results into new syntheses**
- **Farmers might benefit from individual elements of SRI such as wider spacing**
- **Technical & social adaptations happen in situ, but also contingent on agro-ecological factors**
- **SRI encourages collective action, with reformulation of informal rules and routines**

Socio-Technical Assemblages around Transplanting and Water Management are Contextual, Complex, Contingent and Negotiable, addressing farm diversity and averting risks while increasing productivity

Implications

- **A standard package of agricultural practices may not be workable for all farm households**
- **Farmers' compulsion & ability to reconfigure tasks & task groups should be recognized**
- **Early RBNs and transplanting – a missing critical element in SRI advocated practices**
- **Reduced water depths as under SRI indicates large potential of water saving in rice farming**
- **Social organization of labour is critical for technological changes in labour intensive farms**
- **Relevance of 'adoption-disadoption – non adoption' concepts is questionable**

Need for collaborations between Agronomy, Irrigation and Social Sciences

THANK YOU !

Comments/ Suggestions ?