

---

# The System of Rice Intensification in India: Results of Rapid Rural Appraisals in 62 villages in in Telangana, Odisha and Uttarakhand

---

Rob Schipper, Sabarmatee, Ravindra, Debashish Sen and Ezra Berkhout

New Delhi, June 19-21, 2014



---

# Background

- Research programme: “The System of Rice Intensification as a socio-economic and technical movement in India”
- Main partners:
  - Xavier Institute of Management Bhubaneswar (XIMB), India
  - Wageningen University (WU), Netherlands
- Authors:
  - Rob Schipper (WU)
  - Sabarmatee (WU)
  - Debashish Sen (Peoples Science Institute, Dehradun / WU)
  - Ravindra A. (WASSAN, Hyderabad / WU)
  - Ezra Berkhout (WU / PBL)



---

# Overview

1. SRI: 6 practices
2. Methodology
3. Descriptive results
  - a. General village data
  - b. Land characteristics and use
  - c. Rice cultivation practices
  - d. Institutions
  - e. Facilities
4. Explaining occurrence of SRI
5. Performance of SRI
6. Conclusions



---

# SRI

- SRI, as an ideal type, is considered to consist of 6 practices:
  - 1) A raised seed bed
  - 2) Transplanting of young seedlings (8-10 days old)
  - 3) Cross marking of planting holes at 25 by 25 cm
  - 4) One seedling per hole
  - 5) 3 - 4 mechanical weedings with a cono or rotary weeder, at 10 days intervals, starting 10 days after transplanting
  - 6) Alternative Wetting and Drying (AWD)
- As such SRI is hardly encountered; Rice cultivation was seen as SRI, if villagers named it SRI and would consists of: a) Square or row planting, b) a few seedlings (1-3) per hole, and c) seedlings that are relatively young (less than 20 days)



---

# Reclassification of rice cultivation systems

- In the village meetings, many different rice cultivation systems were mentioned, these were classified into 3 groups on the basis of the way of transplanting:
  - A. Random
  - B. Square planted
  - C. Line planted
- This is based on the idea that the way of planting is a conscious decision taken by the farmer and is highly correlated with the 5 other rice cultivation practices
- A is called 'Conventional', B 'SRI-Square planted', and C 'SRI-Line planted'



---

# Methodology

- Rapid Rural Appraisals of 2 days in each village: Group interviews, transect & map
- States & surveys
  - Telangana: Ravindra, 17
  - Odisha: Sabermatee, 20
  - Uttarakhand: Debashish, 25
  - Tamil Nadu: Pushpalata, 5
  - Tripura: Petit, 5.



# Selection of villages

State	District	Sub-district	All villages (2011)			Selected villages		
			SRI	Non-SRI	All	SRI	Non-SRI	All
			N	N	N	n	n	n
Telangana	Mahabubnagar	Bomraspet	8	17	25	4+1=5	3	8
		Doulthabad	8	18	26	4+1=5	3	8
		Damaragidda	5	0	5	0	0	0
	Warangal	Bachannapet	2	21	23	2	2	4
	Total	23	56	79	12-2=10	8-1=7	20-3=17	
Odisha	Ganjam	Chhatrapur	15	65	80	4+1=5	2	7
		Kandhamal	56	156	212	4+1=5	1	6
		Koraput	19	75	94	4+1=5	2	7
	Total	90	296	386	15	5	20	
Uttarakhand	Tehri Garwal	Dhanolti	84	180	264	6	3	9
		Ghansali	118	139	257	6+4=10	5+1=6	11+5=16
		Total	192	319	521	16	9	25



# Population, households & area

State	Population		Households		Household size	Area		Population density
	n	persons	n	numbers	persons/hh	n	ha	persons/ha
Telangana	17	2,598	17	540	4.8	17	2,316	1.1
Odisha	18	419	19	89	4.7	12	130	3.2
Uttarakhand	25	390	25	67	5.8	24	160	2.4
Overall	60	1,024	61	205	5	53	845	1.2





# Population, households & area: Sri / Non-SRI villages

State	Village	Population		Households		Household size	Area		Population density
		n	persons	n	numbers	persons/hh	n	ha	persons/ha
Telangana	SRI	10	3,282	10	692	4.7	10	2,799	1.2
	Non-SRI	7	1,621	7	322	5	7	1,626	1.0
	All	17	2,598	17	540	4.8	17	2,316	1.1
Odisha	SRI	13	485	14	101	4.8	9	142	3.4
	Non-SRI	5	247	5	55	4.5	3	93	2.6
	All	18	419	19	89	4.7	12	130	3.2
Uttarakhand	SRI	16	382	16	65	5.9	15	189	2.0
	Non-SRI	9	403	9	70	5.8	9	111	3.6
	All	25	390	25	67	5.8	24	160	2.4
Overall	SRI	39	1,160	40	234	5	34	944	1.2
	Non-SRI	21	772	21	150	5.1	19	666	1.2
	All	60	1,024	61	205	5	53	845	1.2



# Generalized farm size distribution

State	Type of village	Landless		Very small 0-1 acre		Small 1-5 acres		Medium 5-10 acres		Large > 10 acres		All
		n	%	n	%	n	%	n	%	n	%	%
Telangana	SRI	10	2.4	10	5.3	10	73.5	10	13.6	10	5.1	100.0
	Non-SRI	7	3.0	7	7.2	7	79.5	7	8.6	7	1.7	100.0
	All	17	2.5	17	5.8	17	75.1	17	12.3	17	4.2	100.0
Odisha	SRI	13	12.5	3	30.6	3	46.2	3	5.4	3	5.4	100.0
	Non-SRI	5	28.1	3	19.6	3	39.8	3	6.3	3	6.3	100.0
	All	18	17.3	6	27.4	6	44.2	6	5.6	6	5.6	100.0
Uttarakhand	SRI	16	1.4	16	64.5	16	33.7	16	0.2	16	0.2	100.0
	Non-SRI	9	0.0	9	75.5	9	24.5	9	0.0	9	0.0	100.0
	All	25	0.9	25	68.8	25	30.1	25	0.1	25	0.1	100.0
Overall	SRI	39	3.3	29	85.9	29	10.1	20	0.4	20	0.4	100.0
	Non-SRI	21	3.9	19	87.9	19	7.4	13	0.4	13	0.4	100.0
	All	60	3.5	48	86.4	48	9.3	33	0.4	33	0.4	100.0



# Distance to markets, travel time and costs

State	Type of village	Distance		Travel time		Travel costs	
		n	km	n	minutes	n	Rs.
Telangana	SRI	10	22.9	10	38	9	20
	Non-SRI	6	17.0	6	45	6	191
	All	16	20.7	16	41	15	88
Odisha	SRI	15	6.2	12	48	3	43
	Non-SRI	5	5.4	5	43	2	10
	All	20	6.0	17	46	5	30
Uttarakhand	SRI	16	7.7	16	52	13	12
	Non-SRI	9	21.0	9	77	9	26
	All	25	12.5	25	61	22	18
Overall	SRI	41	10.9	38	47	25	19
	Non-SRI	20	15.9	20	59	17	82
	All	61	12.5	58	51	42	45



# Simplified land types

			State of India			Total
			Telangana	Odisha	Uttarakhand	
Land types used for crops	Black soils	Count	15	0	0	15
		% within State of India	10%	0%	0%	5%
	Sandy soils	Count	24	0	0	24
		% within State of India	15%	0%	0%	7%
	Red soils	Count	20	0	0	20
		% within State of India	13%	0%	0%	6%
	White soils	Count	3	0	0	3
		% within State of India	2%	0%	0%	1%
	Saline soils	Count	18	0	0	18
		% within State of India	12%	0%	0%	5%
	Land with seepage	Count	7	0	0	7
		% within State of India	5%	0%	0%	2%
	Upland	Count	0	29	1	30
		% within State of India	0%	38%	1%	9%
	Medium land	Count	0	17	0	17
		% within State of India	0%	22%	0%	5%
	Low land	Count	0	16	0	16
		% within State of India	0%	21%	0%	5%
	Irrigated land	Count	0	0	19	19
		% within State of India	0%	0%	19%	6%
Un irrigated land	Count	0	0	18	18	
	% within State of India	0%	0%	18%	5%	
Land not used for crops	Count	69	14	62	145	
	% within State of India	44%	18%	62%	44%	
Total	Count	156	76	100	332	
	% within State of India	100%	100%	100%	100%	



# Simplified soil types

			State of India			Total
			Telangana	Odisha	Uttarakhand	
Simplified soil types	Sandy	Count	21	39	5	65
		% within State of India	20%	53%	5%	24%
	Loamy	Count	8	0	32	40
		% within State of India	8%	0%	32%	14%
	Clayey	Count	40	17	16	73
		% within State of India	39%	23%	16%	26%
	Sandy/Loamy	Count	20	2	10	32
		% within State of India	19%	3%	10%	12%
	Sandy/Clayey	Count	0	3	6	9
		% within State of India	0%	4%	6%	3%
	Clayey/Loamy	Count	0	0	6	6
		% within State of India	0%	0%	6%	2%
	Stony	Count	4	0	24	28
		% within State of India	4%	0%	24%	10%
	Gravelly	Count	0	0	1	1
		% within State of India	0%	0%	1%	0%
	Saline	Count	2	0	0	2
		% within State of India	2%	0%	0%	1%
	Silt	Count	1	4	0	5
		% within State of India	1%	5%	0%	2%
Diverse	Count	1	9	0	10	
	% within State of India	1%	12%	0%	4%	
Unknown	Count	6	0	0	6	
	% within State of India	6%	0%	0%	2%	
Total		Count	103	74	100	277
		% within State of India	100%	100%	100%	100%



## Soil quality

		State of India			Total	
		Telangana	Odisha	Uttarakhand		
Relative quality of soil types	Good	Count	19	36	18	73
		% within State of India	20%	49%	19%	28%
	Good to medium	Count	0	12	1	13
		% within State of India	0%	16%	1%	5%
	Medium	Count	39	24	45	108
		% within State of India	42%	32%	48%	41%
	Medium to poor	Count	11	1	0	12
		% within State of India	12%	1%	0%	5%
	Poor	Count	24	1	30	55
		% within State of India	26%	1%	32%	21%
Total	Count	93	74	94	261	
	% within State of India	100%	100%	100%	100%	



Cultivation practices: Seedling numbers & age

**Catogories of numbers of seedlings per hill \* Corrected general classification of rice cultivation method Crosstabulation**

			Rice cultivation method			Total
			Conventional	SRI - Square planted	SRI - Line planted	
Categories of numbers of seedlings per hill	1 seedling per hill	Count	0	13	1	14
		% within Corrected general	%	43%	2%	11%
	1-2 seedlings per hill	Count	0	12	10	22
		% within Corrected general	.0%	40.0%	16.1%	16.5%
	2 seedlings per hill	Count	0	2	8	10
		% within Corrected general	%	7%	13%	8%
	2-3 seedlings per hill	Count	4	1	18	23
		% within Corrected general	10%	3%	29%	17%
	More than 3 seedlings per	Count	36	1	21	58
		% within Corrected general	88%	3%	34%	44%
Total		Count	41	30	62	133
		% within Corrected general	100%	100%	100%	100%

**Catogories of seedling age \* Corrected general classification of rice cultivation method Crosstabulation**

			Rice cultivation method			Total
			Conventional	SRI - Square planted	SRI - Line planted	
Categories of seedling age	Less than or equal to 10	Count	0	4	4	8
		% within Rice cultivation method	%	13%	6%	6%
	11 to 15 days	Count	1	14	11	26
		% within Rice cultivation method	2%	45%	18%	19%
	16 to 20 days	Count	2	7	3	12
		% within Rice cultivation method	5%	23%	5%	9%
	21 to 25 days	Count	1	3	16	20
		% within Rice cultivation method	2%	10%	26%	15%
	26 to 30 days	Count	19	0	5	24
		% within Rice cultivation method	46%	%	8%	18%
	31 or more days	Count	17	0	18	35
		% within Rice cultivation method	41%	%	29%	26%
Total		Count	41	31	62	134
		% within Rice cultivation method	100%	100%	100%	100%



# Cultivation practices: Seedling number \* seedling age

Categories of numbers of seedlings per hill * Categories of seedling age Crosstabulation									
			Categories of seedling age					Total	
			Less than or equal to 10 days	11 to 15 days	16 to 20 days	21 to 25 days	26 to 30 days		31 or more days
Categories of numbers of seedlings per hill	1 seedling per hill	Count	1	9	1	2	0	1	14
		% within	7%	64%	7%	14%	%	7%	100%
		% within	13%	36%	8%	10%	%	3%	11%
	1-2 seedlings per hill	Count	6	6	4	1	2	1	22
		% within	27%	27%	18%	5%	9%	5%	100%
		% within	75%	24%	33%	5%	8%	3%	17%
	2 seedlings per hill	Count	1	2	3	2	1	1	10
		% within	10%	20%	30%	20%	10%	10%	100%
		% within	13%	8%	25%	10%	4%	3%	8%
	2-3 seedlings per hill	Count	0	7	4	8	1	3	23
		% within	%	30%	17%	35%	4%	13%	100%
		% within	%	28%	33%	40%	4%	9%	17%
	More than 3 seedlings per hill	Count	0	1	0	7	20	29	58
		% within	%	2%	%	12%	34%	50%	100%
		% within	%	4%	%	35%	83%	83%	44%
	Total	Count	8	25	12	20	24	35	133
		% within	6%	19%	9%	15%	18%	26%	100%
		% within	100%	100%	100%	100%	100%	100%	100%
		Conventional							
		SRI-Squared planted							
		SRI-Line planted							





Cultivation  
practices:  
Weeding  
method &  
frequency

**Simplified weeding method \* Corrected general classification of rice cultivation method Crosstabulation**

			Rice cultivation method			Total
			Conventional	SRI - Square planted	SRI - Line planted	
Simplified weeding method	Hand	Count	34	3	31	68
		% within Rice cultivation method	85%	10%	50%	51%
	Weeder	Count	0	8	2	10
		% within Rice cultivation method	%	26%	3%	8%
	Hand & Weeder &	Count	1	0	3	4
		% within Rice cultivation method	3%	%	5%	3%
Weeder and by hand	Count	4	20	22	46	
	% within Rice cultivation method	10%	65%	35%	35%	
Hand and hoe	Count	1	0	0	1	
	% within Rice cultivation method	3%	%	%	1%	
Total		Count	40	31	62	133
		% within Rice cultivation method	100%	100%	100%	100%

**Catogories of frequency of weeding \* Corrected general classification of rice cultivation method Crosstabulation**

			Rice cultivation method			Total
			Conventional	SRI - Square planted	SRI - Line planted	
Categories of frequency of weeding	1 weeding	Count	4	1	6	11
		% within Rice cultivation method	10%	3%	10%	8%
	1-2 weedings	Count	3	2	9	14
		% within Rice cultivation method	7%	6%	15%	10%
	2 weedings	Count	13	10	26	49
		% within Rice cultivation method	32%	32%	42%	37%
	2-3 weedings	Count	20	12	15	47
		% within Rice cultivation method	49%	39%	24%	35%
	More than 3 weedings	Count	0	5	2	7
		% within Rice cultivation method	%	16%	3%	5%
Total		Count	41	31	62	134
		% within Rice cultivation method	100%	100%	100%	100%



# Cultivation practices: Water provision

**Ways water in field is managed \* Corrected general classification of rice cultivation method Crosstabulation**

			Rice cultivation method			Total
			Conventional	SRI - Square planted	SRI - Line planted	
Ways water in field is managed	Rainfed	Count	0	3	0	3
		% within Rice cultivation method	%	10%	%	2%
	Using less water including	Count	0	7	5	12
		% within Rice cultivation method	%	23%	8%	9%
	Continous flooding	Count	40	20	53	113
		% within Rice cultivation method	100%	65%	85%	85%
Total	Count	40	31	62	133	
	% within Rice cultivation method	100.0%	100.0%	100.0%	100.0%	



# Rice yields in Telangana, Odisha & Uttarakhand (kg/acre)

State	Rice cultivation method	N	Minimum	Mean	Median	Maximum	Std. Error of Mean	Std. Deviation
Telangana	Conventional	20	1,175	2,158	2,100	3,150	110	491
	SRI - Square planted	16	2,030	2,513	2,380	3,360	105	419
	SRI - Line planted	16	1,855	2,247	2,200	2,900	78	313
	All	52	1,175	2,294	2,203	3,360	61	440
Odisha	Conventional	3	1,250	1,670	1,510	2,250	300	519
	SRI - Square planted	14	650	1,706	1,725	3,010	165	616
	SRI - Line planted	29	490	1,419	1,525	2,645	105	564
	All	46	490	1,523	1,525	3,010	86	582
Uttarakhand	Conventional	13	700	1,342	1,300	2,200	101	363
	SRI - Square planted							
	SRI - Line planted	9	500	1,494	1,400	2,300	234	701
	All	22	500	1,405	1,300	2,300	110	518
All	Conventional	36	700	1,823	1,845	3,150	98	586
	SRI - Square planted	30	650	2,136	2,113	3,360	120	655
	SRI - Line planted	54	490	1,677	1,713	2,900	87	640
	All	120	490	1,835	1,895	3,360	59	650



Paired rice yields  
per village in  
Telangana,  
Odisha &  
Uttarakhand

	Rice cultivation method	N	Mean	Std. Deviation	Std. Error Mean
Pair 1	SRI Square planted rice yield (kg/acre)	22	2,211	647	138
	Conventional rice yield (kg/acre)	22	1,776	520	111
	Difference of means (kg/acre)		435	325	69
Pair 2	SRI Square planted rice yield (kg/acre)	23	2,003	573	120
	SRI Line planted rice yield (kg/acre)	23	1,698	580	121
	Difference of means (kg/acre)		306	274	57
Pair 3	SRI Line planted rice yield (kg/acre)	15	2,105	453	117
	Conventional rice yield (kg/acre)	15	1,882	390	101
	Difference of means (kg/acre)		222	366	19

Related samples (Villages: Average yields) Wilcoxon Signed Rank Test					
Test the null hypothesis that the median of yield differences equals 0					
Rice cultivation method		SRI Square planted		SRI Line planted	
		Observed yield		Observed yield	
		Result	Significance	Result	Significance
<b>Conventional</b>	<b>Observed yield</b>	Yes	0.000	<b>Yes</b>	<b>0.000</b>
<i>Conventional</i>	<i>Plus 5%</i>	Yes	0.000	<i>No</i>	<i>0.061</i>
Conventional	Plus 10%	Yes	0.000	No	0.496
<b>Conventional</b>	<b>Plus 15%</b>	<b>Yes</b>	<b>0.007</b>		
Conventional	Plus 20%	No	0.257		
SRI Line planted	Observed yield	Yes	0.000		
<b>SRI Line planted</b>	<b>Plus 5%</b>	<b>Yes</b>	<b>0.000</b>		
<i>SRI Line planted</i>	<i>Plus 10%</i>	<i>No</i>	<i>0.055</i>		

With a significance level of 0.05, the interpretation of the tests is as follows:  
 Yes: Reject null hypothesis that the median of yield differences equals 0  
 No: Retain the null hypothesis

# Advantages & disadvantages of rice cultivation methods:

## Group interview opinions

Theme # Name	Number of observations & percentage	Advantages of cultivation method								Disadvantages of cultivation method							
		First mentioned Rice cultivation method				Secondly mentioned Rice cultivation method				First mentioned Rice cultivation method				Secondly mentioned Rice cultivation method			
		Conventional	Square	Line	Total	Conventional	Square	Line	Total	Conventional	Square	Line	Total	Conventional	Square	Line	
1 Land related or land preparation	Count	2		1	3			2	6	8			2	2		1	
	% within rice cultivation method	5	-	2	2	-		7	14	9	-		4	2	-	9	
2 Nursery	Count	4		1	5	1			1	2	2		2	2		1	
	% within rice cultivation method	10	-	2	4	5	-		2	2	5	-		2	-	9	
3 Seed	Count		3	1	4		4	8	12	3		2	5			4	
	% within rice cultivation method	-	10	2	3	-	14	19	13	8	-	4	4	-	-	13	
4 Transplanting	Count	2		16	18	1		2	3	3	1		4			4	
	% within rice cultivation method	5	-	27	14	5	-	5	3	8	4	-	3	-	-	13	
5 Marking	Count															1	
	% within rice cultivation method	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	
6 Weed & weeding	Count	8	3	6	17	11	3	6	20	9	9	23	41			3	
	% within rice cultivation method	20	10	10	13	50	10	14	21	24	38	42	35	-	-	9	
7 Irrigation & water & rainfall	Count	2	1		3	4	11	6	21	1	1		2	2	1	3	
	% within rice cultivation method	5	3	-	2	18	38	14	22	3	4	-	2	15	9	9	
8 Fertilizer & compost, etc.	Count																
	% within rice cultivation method	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
9 Diseases	Count					1	1		2								
	% within rice cultivation method	-	-	-	-	5	3	-	2	-	-	-	-	-	-	-	
10 Pests	Count									9		6	15			1	
	% within rice cultivation method	-	-	-	-	-	-	-	-	24	-	11	13	-		9	
11 Yield & production	Count	18	23	27	68					4	2	12	18	5		4	
	% within rice cultivation method	44	74	46	52	-	-	-	-	11	8	22	16	38	-	13	
12 Labour	Count	2	1	4	7	2	7	10	19	4	6	6	16	4	6	7	
	% within rice cultivation method	5	3	7	5	9	24	23	20	11	25	11	14	31	55	22	
13 Timing	Count							1	1			1	2			5	
	% within rice cultivation method	-	-	-	-	-	-	2	1	3	-	2	2	-	-	16	
14 Management	Count	3		3	6	2		2	4	1	5	1	7				
	% within rice cultivation method	7	-	5	5	9	-	5	4	3	21	2	6	-	-	-	
15 Risks	Count																
	% within rice cultivation method	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
16 Costs	Count						1	1	2			2	2	2	1	1	
	% within rice cultivation method	-	-	-	-	-	3	2	2	-	-	4	2	15	9	3	
All	Count	41	31	59	131	22	29	43	94	37	24	55	116	13	11	32	
	% within rice cultivation method	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	



---

# Advantages of rice cultivation types

## ■ First mentioned

- SRI-Square: Good **Yield** (74%) & less **Seed** (10%) & ease of **Weed & weeding** (10%)
- SRI-Line: Good **Yield** (46%) & **Transplanting** (27%)
- Conventional: Good **Yield** (44%) & less **Weed & weeding** (20%)

## ■ Secondly mentioned

- SRI-Square: **Irrigation, water & rainfall** (less water needed; 38%) & less **Labour** (24%)
- SRI-Line: Less **Labour** (23%) & less **Seed** (19%)
- Conventional: Less **Weed & weeding** (50%) & **Irrigation, water & rainfall** (18%)



---

# Disadvantages of rice cultivation types

## ■ First mentioned

- SRI-Square: **Weed & weeding** (more weed infestation & use of mechanical weeders; 38%) & **Labour** (shortage, 25%)
- SRI-Line: **Weed & weeding** (more weed infestation & use of mechanical weeders; 42%) & **Yield** (low yields, 22%)
- Conventional: **Weed & weeding** (24%) and **Pests** (24%)

## ■ Secondly mentioned

- SRI-Square: **Labour** (55%) & **Irrigation, water & rainfall** (less water needed; 9%) & **Costs** (9%)
- SRI-Line: More **Labour** (22%) & **Timing** (of transplanting & weeding; 16%)
- Conventional: Low **Yield** (38%) & more **Labour** (31%)



---

# Conclusions

- Based on:
  - Survey in 62 villages in 2012
  - Selected districts & sub-districts in Telangana, Odisha & Uttarakhand
  - Stratification in SRI and Non-SRI villages; within strata random samples of villages
  - Rapid Rural Appraisal
- Types of rice cultivation: one Conventional type, and two SRI types: SRI-Square planted & SRI-Line planted
- SRI and Non-SRI villages are similar: No reasons to suppose that extension of SRI was mostly done in villages deemed suitable for SRI





---

# Conclusions

- Reported yields:
  - Telangana higher, Odisha & Uttarakhand lower
  - No significant difference between SRI and Non-SRI villages
  - SRI-Square highest (2,136 kg/acre), followed by conventional (1,823 kg/acre) and SRI-Line (1,677 kg/acre), but T-tests to judge differences are not advisable
  - Per village pair-wise comparisons, using Wilcoxon signed rank tests (non-parametric), significant differences (5%):
    - ✓ (17 pairs) SRI-Square > Conventional + 15%
    - ✓ (23 pairs) SRI-Square > SRI-Line + 5%
    - ✓ (15 pairs) SRI-Line > Conventional



---

# Conclusions

- Advantages and Disadvantages (Opinions expressed)
  - High **yield** is in all rice cultivation types seen as a the most important advantage (Opinions differ from villages to village depending on circumstances & experiences)
  - Weed:
    - Conventional: less **weed** (plant density)
    - SRI: Easier to combat **weeds** (**weeder**)
  - Seed:
    - SRI: Less **seed**
  - Labour:
    - SRI: Some times **labour saving**, but some times the opposite, more **labour needed**, or *special skills & timing*



---

# The System of Rice Intensification in India: A few Preliminary Results of a Household Survey in Telangana, Odisha and Uttarakhand

---

Rob Schipper, Sabarmatee, Ravindra, Debashish Sen and Ezra Berkhout

New Delhi, June 19-21, 2014



---

# Goals and objectives

- Comparative information on rice cultivation across project sites (in combination with village survey)
- Document differences in rice cultivation methods:
  - Input use
  - Production levels
  - Field practices
- Identify plots that are cultivated with SRI methods
- Understand how household and village-level characteristics shape rice production, and SRI adoption:
  - Household composition and assets
  - (Access to) local institutions
  - Access to information



# Survey design (A); Points 1 & 2 as in village study

- Stratification (1) of states, districts & sub-districts:
  - Telangana, Odisha, Uttarakhand
  - Within these states, specific districts and sub-districts (Sheet 6)
- Stratification (2) of villages:
  - 20 villages per state, of which:
    - 12 have received active SRI extension (SRI villages)
    - 8 have never received SRI extension (Non-SRI villages)
- Stratification (3) of households:
  - 10 households per village, of which:
    - 5 households who, at some time, received SRI extension
    - 5 households who never received SRI extension
- Total sample size: 628 households in 60 villages



---

# Survey design (B)

- Household composition:
  - Caste, religious orientation
  - Members and income sources
  - Food security status
  - Assets owned
- Agricultural production:
  - Land holdings
  - Detailed info on all rice production practices (SRI & conventional)
- Markets and institutions:
  - Labour market interactions
  - Loans, SHGs, farmer organisations
  - Access to agricultural information



---

# Results

- Preliminary, first analyses from database:
  - Results have not yet been weighed
  - No attempts, yet, to correct for selection biases or endogeneity.
  - Robustness, correlations, causality...



# Database overview

- 628 households, with 1256 rice plots:

Rice cultivation type	Telangana	Odisha	Uttarakhand
Conventional or other	177	267	551
SRI (self-labelled)	41	91	66
Total	218	389	628

- 16% of rice plots are self-labelled SRI
- Hardly any spread of SRI to Non-SRI villages (only 1 case in household survey, but review results of village RRA)





For now, we concentrate on rice production:

- Yield in kg/acre (2012)
- Village RRA: Group meetings per village
- Household survey: Interviews per household
- \* Differences between RRA and household survey

Trans-planting pattern	Telangana		Odisha		Uttarakhand		All	
	Village RRA	Household survey	Village RRA	Household survey	Village RRA	Household survey	Village RRA	Household survey
Random	2,158	1,455	1,670	1,018	1,342	1,382	1,823	1,255
SRI-Square	2,513	1,283	1,706	1,147	ND	2,183	2,136	1,441
SRI-line	2,247	1,545	1,419	1,013	1,400	1,381	1,677	1,296
All	2,294	1,460	1,523	1,039	1,300	1,489	1,855	1,283



---

# What should be considered SRI in the household survey?

---

- Self reporting
- Combination of all 'six' SRI practices does not occur often
- Not enough data to analyse individual or different combinations of practices
- Transplanting pattern: random, squares, lines (village RRA)
- However, we opted to identify common combinations of practices through 'cluster' analysis
- Variables: Type of nursery, Type of water management, Transplanting pattern, First weeding method and Transplanting age (not: Number of seedlings and Use of compost and manure, because very high correlation with the other variables)



# Clustering rice cultivation practices: 3 clusters (see table)

- Comparing clusters and 'closeness' with SRI, using 7 aspects (variables in data base) important for the description of SRI:

Type of nursery, Transplanting pattern, Seedlings per hill, First weeding method, Type of water management, Use of nutrients, and Transplanting age

- Using these variables, we developed a SRI Index with values between 0 (no aspects of SRI at all) and 100 (using all aspects of ideal type SRI)

Cluster	Cluster size	%	SRI Index	Name used for cluster
1	477	55	16	Conventional alike
2	217	25	24	More alike conventional than SRI
3	171	20	83	SRI alike
All	865	100		



# Yields (kg/acre)

Production Kharif 2012 kg acre

State	Clusters	N	Minimum	Mean	Median	Maximum	Std. Deviation	Std. Error of Mean
Telangana	Conventional alike	112	7	1,496	1,558	3,500	812	77
	More alike conventional than SRI	15	12	1,127	636	2,800	1,116	288
	SRI alike	22	40	1,507	1,400	3,290	884	188
	Total	149	7	1,460	1,400	3,500	858	70
Odisha	Conventional alike	245	-	989	765	6,120	861	55
	More alike conventional than SRI	10	1,000	1,771	1,753	3,060	744	235
	SRI alike	87	23	1,099	900	3,825	801	86
	Total	342	-	1,039	825	6,120	852	46
Uttarakhand	Conventional alike	113	900	1,592	1,600	4,000	509	48
	More alike conventional than SRI	189	20	1,259	1,000	4,000	543	39
	SRI alike	60	-	1,720	1,250	6,000	1,175	152
	Total	362	-	1,439	1,400	6,000	705	37
Total	Conventional alike	470	-	1,254	1,148	6,120	826	38
	More alike conventional than SRI	214	12	1,273	1,000	4,000	615	42
	SRI alike	169	-	1,372	1,200	6,000	997	77
	Total	853	-	1,283	1,148	6,120	817	28



---

# Observations

- Mean yields do differ between states, but not (much) between types of rice cultivation
- Given large standard deviations, a T-Test for differences between mean yields would not show significant differences
- Paired observations of means of all 'conventional' and of all 'SRI' cultivations per village give a significant yield advantage of 5% of SRI compared to conventional (29 pairs)
- So far, overall analysis, but this will also be done per state
- What are the economic advantages of SRI in comparison to conventional?
- Income and labour



# Some economic indicators: Compare 'SRI alike' with 'Conventional alike': **Income**

- SRI yield might not be (much) higher than conventional yield, but Value Added, Gross Margin and Surplus are higher

	Means					
	Yield	Value of production	Value Added	Gross Margin	Household labour	Surplus
	Kg/acre	Rs./acre	Rs./acre	Rs./acre	Rs./acre	Rs./acre
Cluster						
Conventional alike	1,254	12,921	10,036	7,030	3,776	2,915
More alike conventional than SRI	1,273	13,117	12,115	11,360	4,177	7,130
SRI alike	1,372	14,136	12,430	10,934	4,800	5,969
Total	1,283	13,211	11,069	8,961	4,079	4,643



# Details on comparing **labour** in 'SRI alike' with 'Conventional alike'

Total (family, exchange & hired) labour use in rice (Kharif, 2012) in hours/acre

State	Rice cultivation type	Nursery	Land preparation	Marking	Trans-planting	Weeding	Fertilizer & other chemicals application	Harvesting	All operations
Telangana	Conventional alike	6.7	38.2	0.6	153.6	80.0	11.8	52.3	281.6
	More alike conventional than SRI	11.1	86.9	7.2	171.9	99.6	15.2	51.0	424.4
	SRI alike	6.4	56.5	9.4	144.7	87.4	14.2	31.7	315.9
	Total	7.2	46.4	2.6	154.3	83.3	12.5	49.1	302.0
Odisha	Conventional alike	28.0	107.7	0.2	187.4	139.8	15.2	150.4	596.7
	More alike conventional than SRI	28.4	101.0	3.4	160.0	115.2	21.7	179.8	626.0
	SRI alike	27.2	106.2	73.0	154.2	117.3	11.2	149.7	640.9
	Total	27.8	107.1	18.9	178.1	133.4	14.3	151.1	608.9
Uttarakhand	Conventional alike	24.3	67.8	-	36.9	59.5	0.3	62.0	329.9
	More alike conventional than SRI	20.6	82.8	0.1	44.4	83.0	0.0	44.2	348.2
	SRI alike	7.3	66.6	5.3	27.1	76.9	1.1	41.5	262.4
	Total	19.5	75.4	0.9	39.2	74.7	0.3	49.3	328.3
Total	Conventional alike	21.8	80.9	0.3	143.3	105.8	10.8	105.1	455.0
	More alike conventional than SRI	20.1	83.9	0.8	60.3	85.9	2.3	51.0	367.1
	SRI alike	17.3	85.3	40.3	108.3	99.0	8.1	95.2	462.5
	Total	20.5	82.5	8.3	115.6	99.5	8.1	89.6	434.4



---

# Comparing **labour** in 'SRI alike' with 'Conventional alike'

---

- Overall, SRI alike uses on average about the same amount of labour per acre than conventional alike
- SRI alike uses less labour on transplanting and weeding, but more on marking than conventional alike
- However, results differ per state:
  - Telangana: SRI more labour than conventional, including slightly more labour for weeding
  - Odisha: As overall
  - Uttarakhand: Similar as overall results, but less pronounced





---

# Conclusions regarding household survey (1)

- 628 households in 3 states with 1256 rice plots.
- Sufficiently comparable data on only 865 rice plots because of missing data
- Yields according to village RRA appraisal are higher than according to household survey
- Possible to cluster rice cultivation types into 3 types of which one is 'conventional alike' and another 'SRI alike'
- SRI yields are only slightly higher than yields from conventional; more detailed analysis at state level needed



---

# Conclusions regarding household survey (2)

---

- SRI costs of production (purchased inputs & hired labour) are lower, therefore the value added and gross margin is higher than in conventional
- Overall SRI labour use is only slightly higher than in conventional; more family labour, but less hired labour
- SRI saves labour in transplanting and weeding, but needs extra labour because of marking



---

# Conclusions regarding household survey (3)

- However, all noted differences between SRI and conventional rice cultivation, might not mean that these differences are 'caused' by SRI
- For example:
  - Soil quality: SRI alike is slightly more cultivated on good quality soils; on those soils SRI does better than conventional; the opposite is the case on poor soils
  - Distance to the home: on average, plots with SRI alike are somewhat closer to the homestead than plots with conventional alike, providing the possibility for a better supervision (or, are they closer given the need for a more intensive management?)
  - Farm household characteristics, agricultural skills & management capabilities.



---

# Two surveys; RRA village study & related household survey: Points for further analysis

---

- With both data sets, further analyses will be made
  - 'Explain' the occurrence of SRI at village and household level (adoption, adaption & disadoption)
  - Explain differences in performance between SRI alike and conventional alike types of rice cultivation
- Such analyses using the data sets will be complemented with the more detailed studies of Ravindra in Telangana, Sabarmatee in Odisha and Debashish Sen in Uttarakhand

