SRI: An Analysis of Adoption Levels Across 13 States, India?

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Presented by

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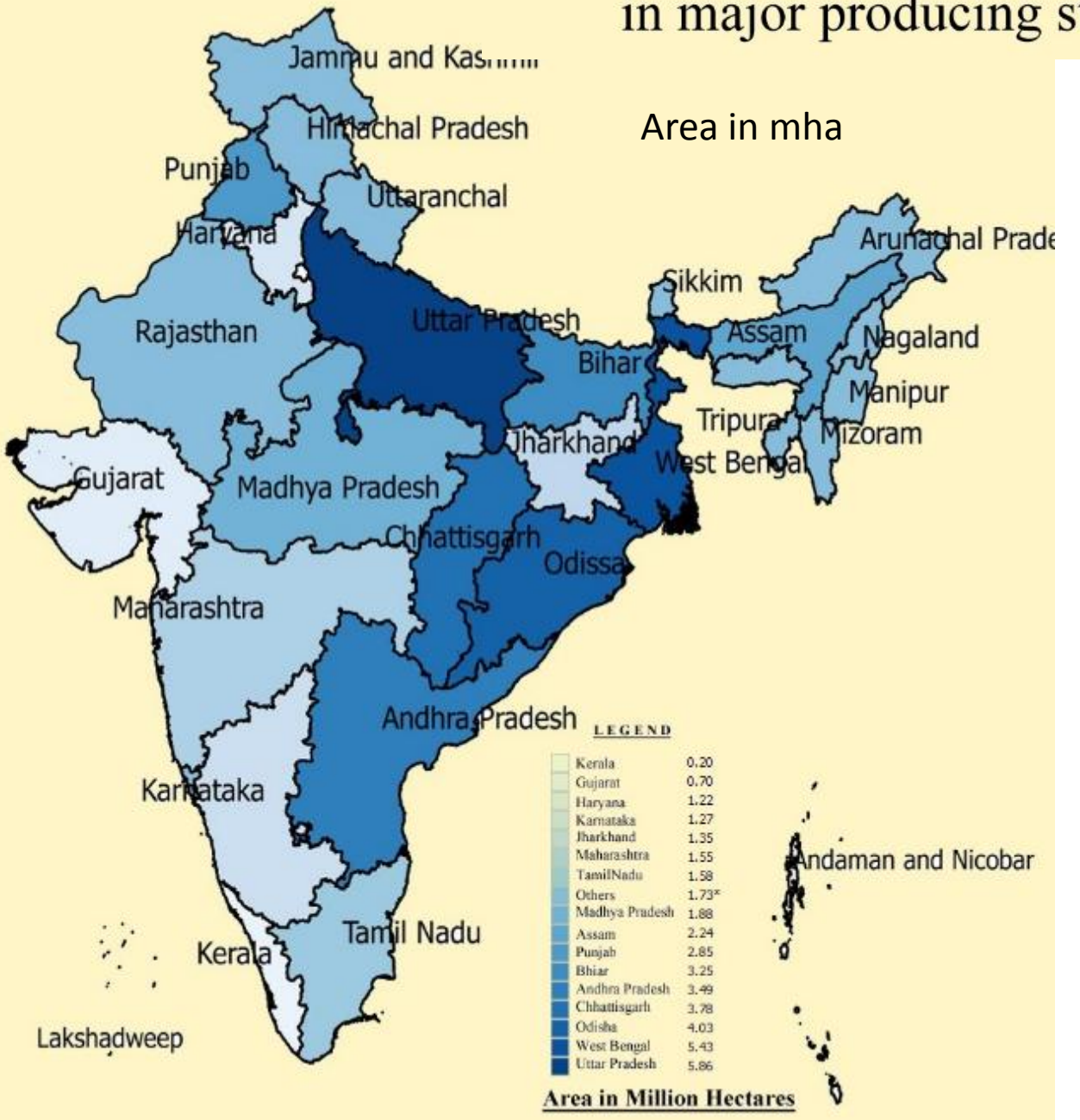
2 The study was undertaken as part of the IWMI-Tata Water Policy Program

Outline

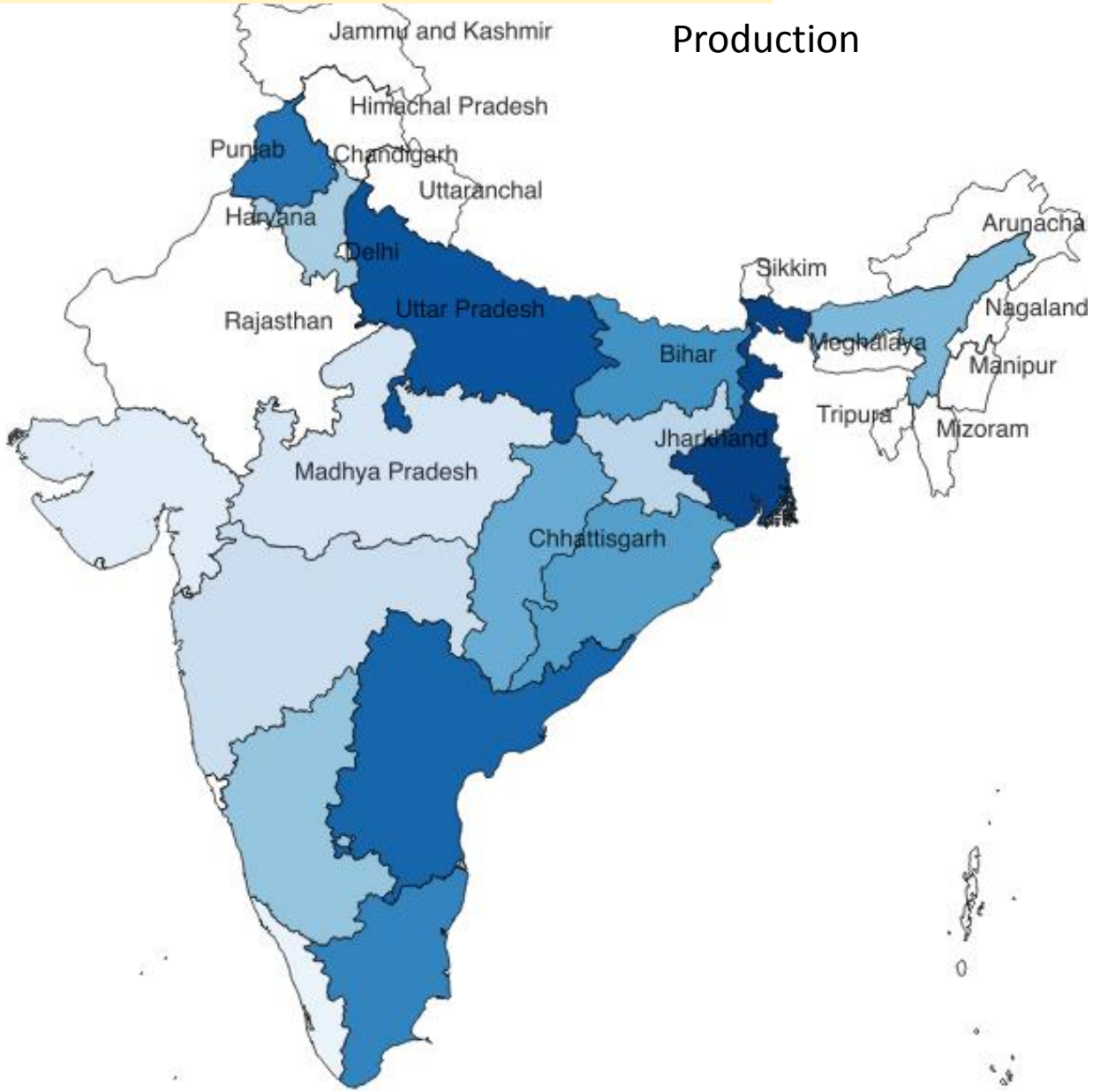
- Introduction
- Rice Production in India
- Issues in SRI
- Methodology
- SRI and core components
- Yield and Profitability of SRI
- Transaction cost
- Factors of adoption – Multinomial logit model
- How we can Targeting adoption of SRI components at region/soil
- Conclusion and policy suggestions

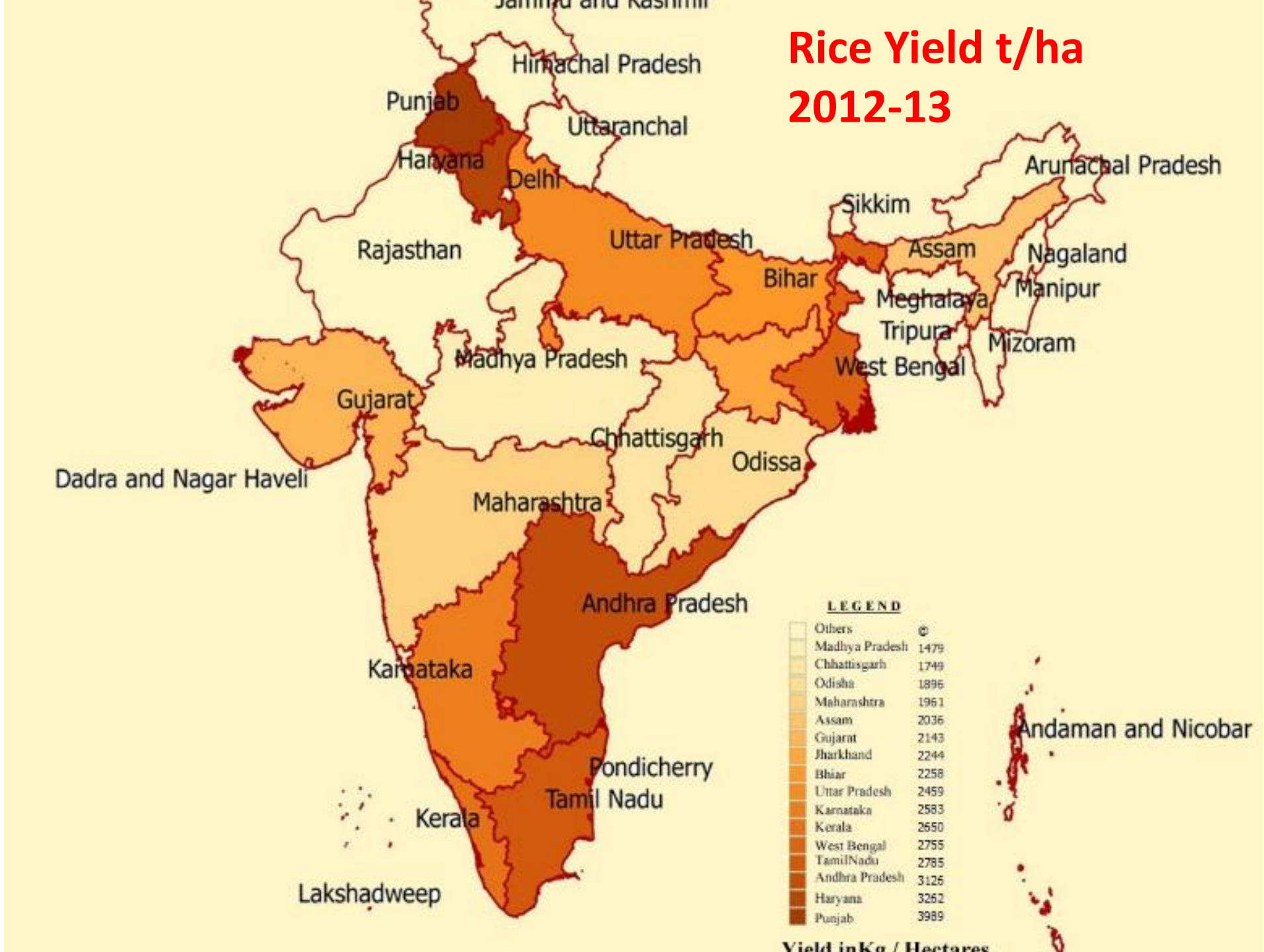
Area, Production, and Yield of Rice during 2012-2013 in major producing states alongwith coverage

Area in mha



Production




Rice Yield t/ha
2012-13
Jammu and Kashmir
Himachal Pradesh
Punjab
Uttaranchal
Haryana
Delhi
Rajasthan
Uttar Pradesh
Bihar
Sikkim
Arunachal Pradesh
Assam
Nagaland
Manipur
Meghalaya
Tripura
Mizoram
West Bengal
Madhya Pradesh
Gujarat
Chhattisgarh
Odissa
Dadra and Nagar Haveli
Maharashtra
Andhra Pradesh
Karnataka
Pondicherry
Tamil Nadu
Kerala
Lakshadweep
Andaman and Nicobar
LEGEND
Others
Madhya Pradesh 1479
Chhattisgarh 1749
Odisha 1896
Maharashtra 1961
Assam 2036
Gujarat 2143
Jharkhand 2244
Bhiar 2258
Uttar Pradesh 2459
Karnataka 2583
Kerala 2650
West Bengal 2755
TamilNadu 2785
Andhra Pradesh 3126
Haryana 3262
Punjab 3989
Yield inKg / Hectares

Past studies

- Claims of yield increase are still being debated
- Profitability and Inconsistent of trail results (Glover, 2001)
- productivity claims go beyond the physiological yield potential of rice (Dobermann 2004)
- Yield increase and reduced water use confirmed by various studies (Latif et al 2009, 2005; Thakur et al 2009; Kumar Sinha and Talati 2007; Sitadevi and Ponnarasi, 2009; Barah, 2009; Karunakaran et al 2010; Adusumilli and BhagyaLaxmi, 2011 and Glover, 2011).

Missing:

?1 insight of actual levels of adoption in different regions

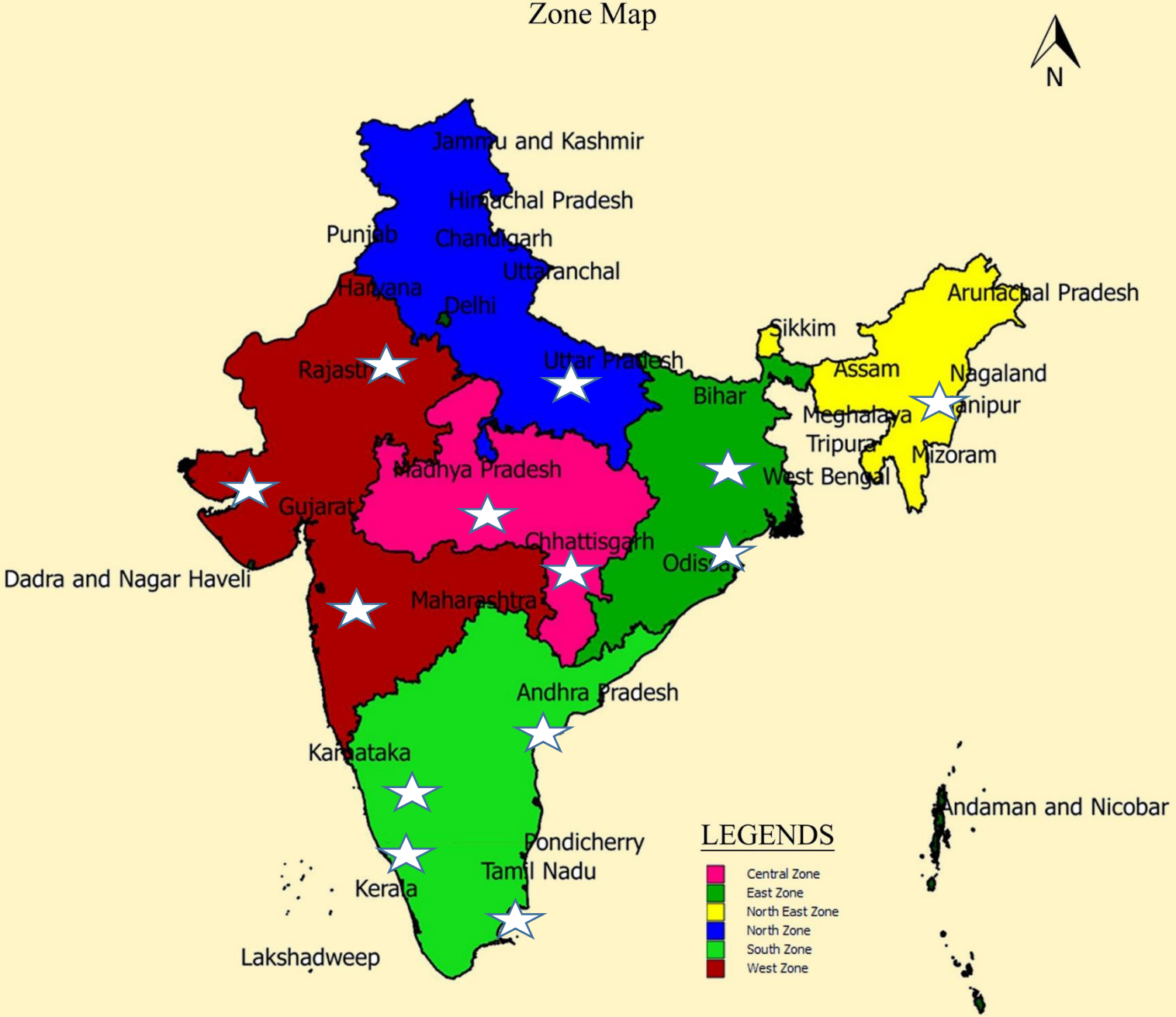
?2 whether to promote core components of SRI as a package or only some of the components with modifications for better adoption.

Objectives of the present study address

i) yield, income and cost advantage of SRI over non-SRI practices,
ii) level of adoption of different components of SRI by the farmers,
iii) drivers of SRI adoption, and
iv) constraints faced by the farmers in the adoption of the SRI

INDIA

Zone Map



Study area and Sampling

- Year 2010-11 in 13 states cover 2234 farmers from
  Southern regions (Andhra Pradesh, Karnataka, Tamil Nadu and Kerala states),
  Western region (Gujarat, Rajasthan, Maharastra states),
  Eastern region (Orissa, Uttarpradesh, West Bengal states),
  Central region (Madya Pradesh and Chhattishgarh state) and
  North eastern region (Assam).
- Local Extension officials & NGOs 70; Scientist associated with SRI progm 40 and 120 key farmers-

Concept of Core components	Conventional method	Criteria for Core components of SRI adoption		
		Full adopter-Score=3	Partial adopter-Score=2	Low adopter-Score=1
Younger seedlings (days) Y	35-45 days	<15	16-20	>20
Number of seedlings O	>4	1	2-3	>3
Square planning (cm) S	15x10 or 15x 15cm	22.5x22.5	Row planting>20	Row planting 15x10 or 20x10
Intercultural operation I	Manual	>2times	1 time	Nil
Adoption Class (sum of scores)		12	7-11	6

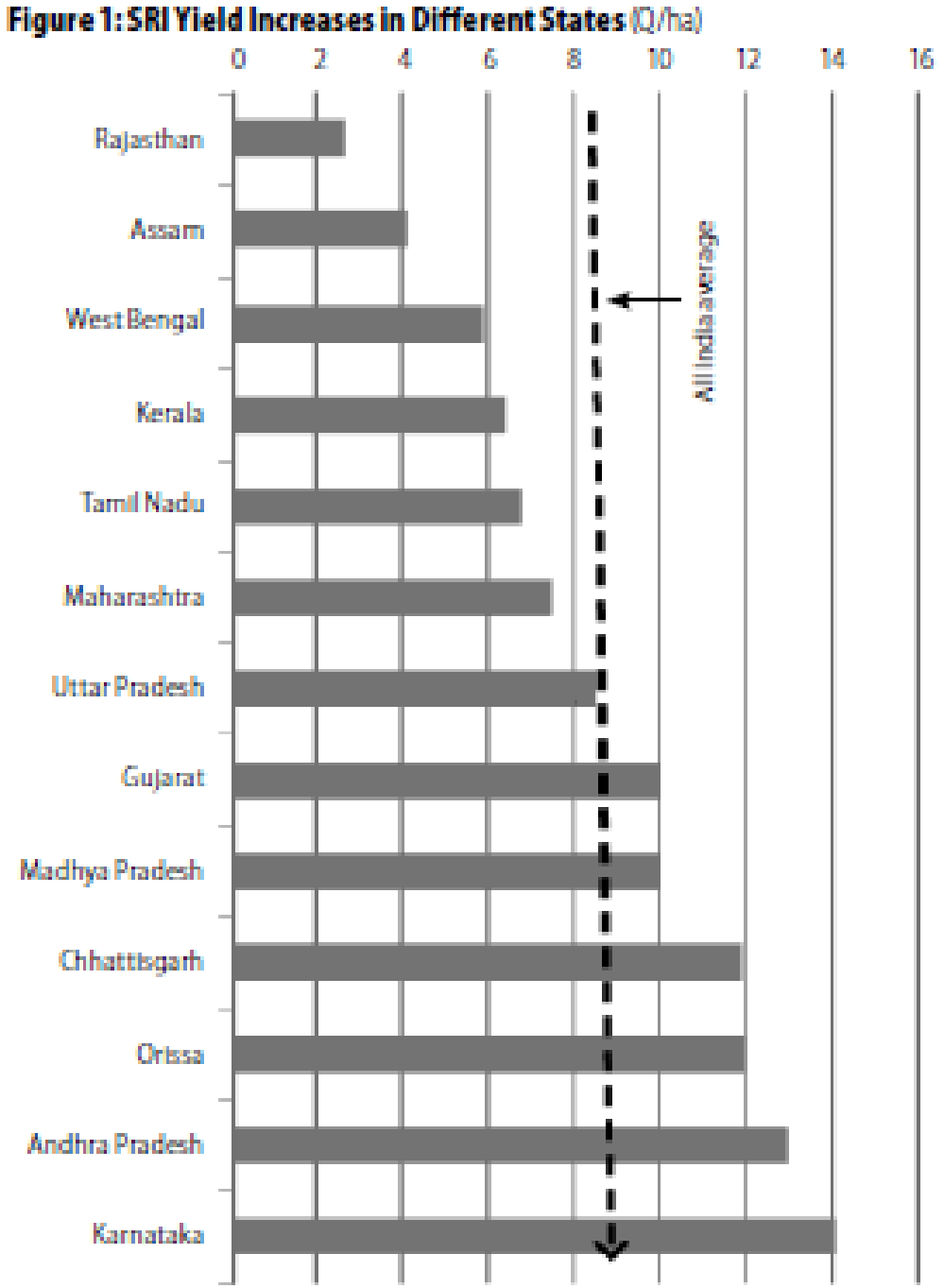
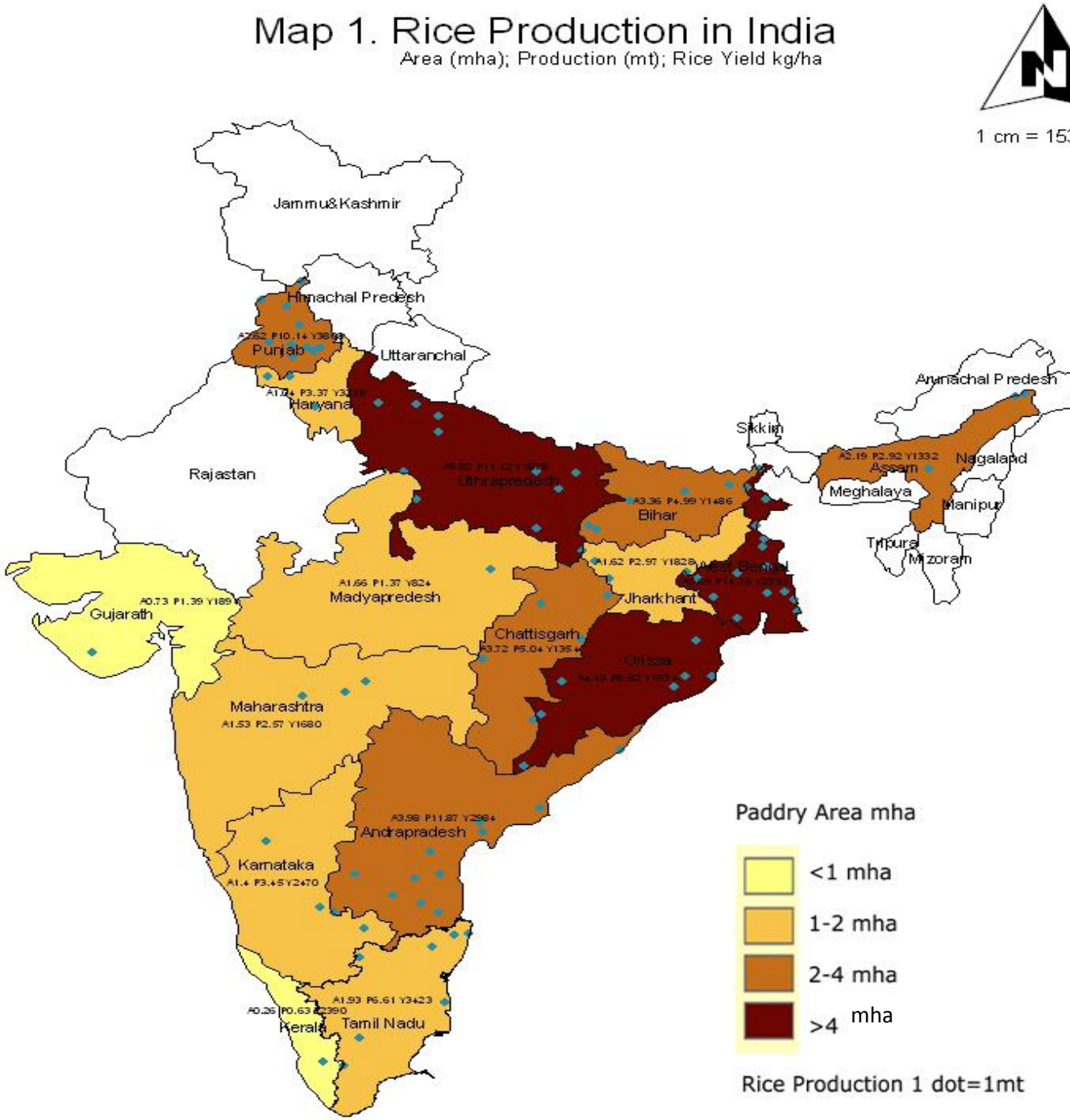
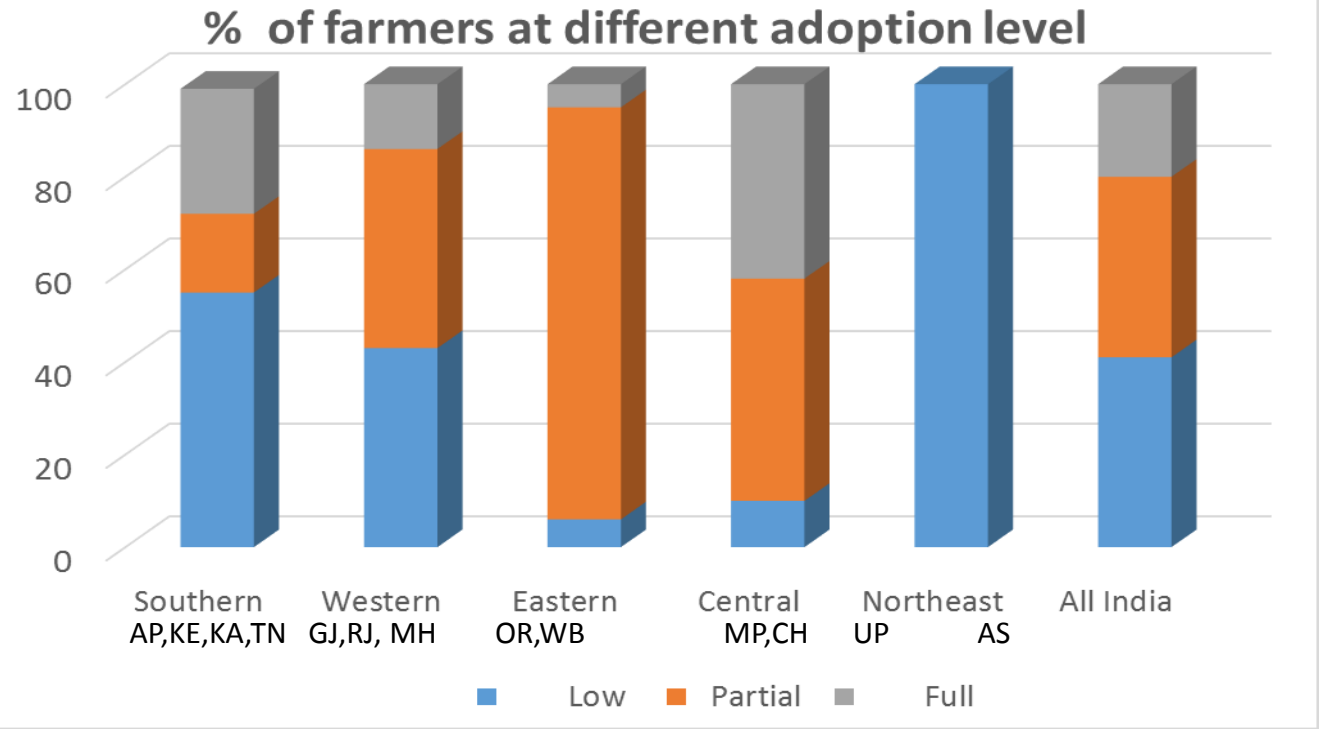
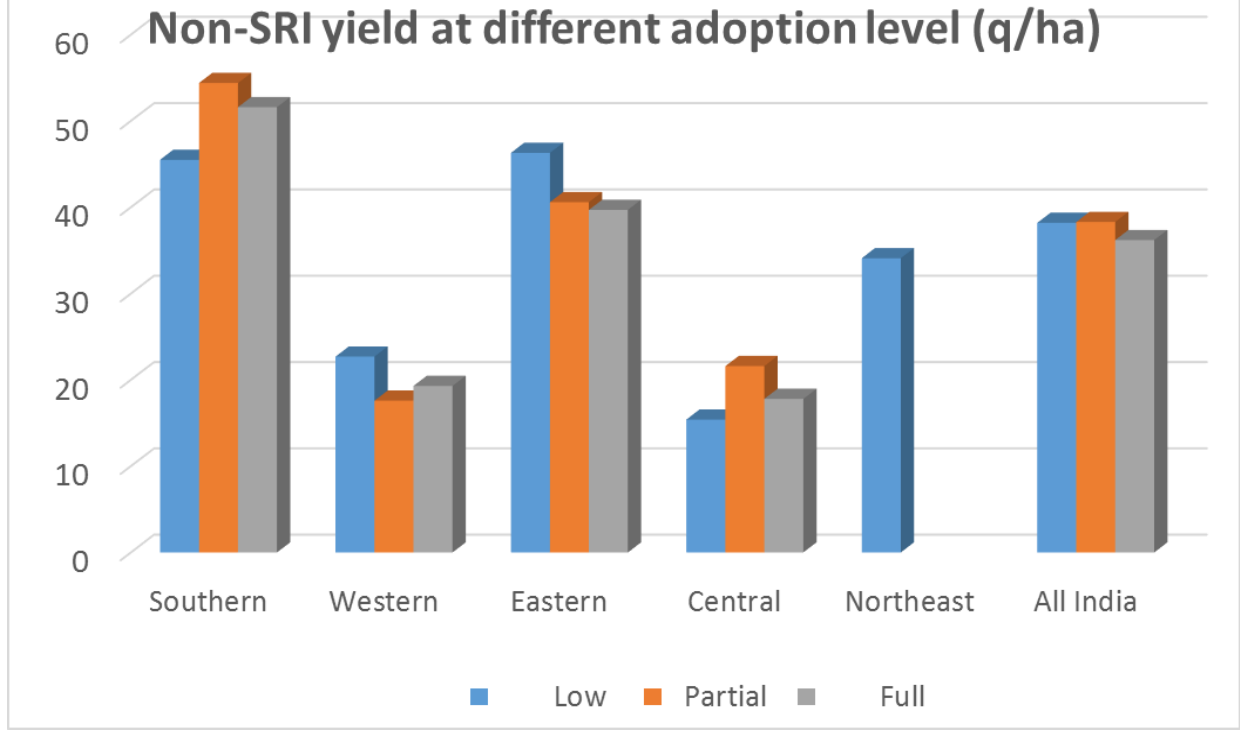
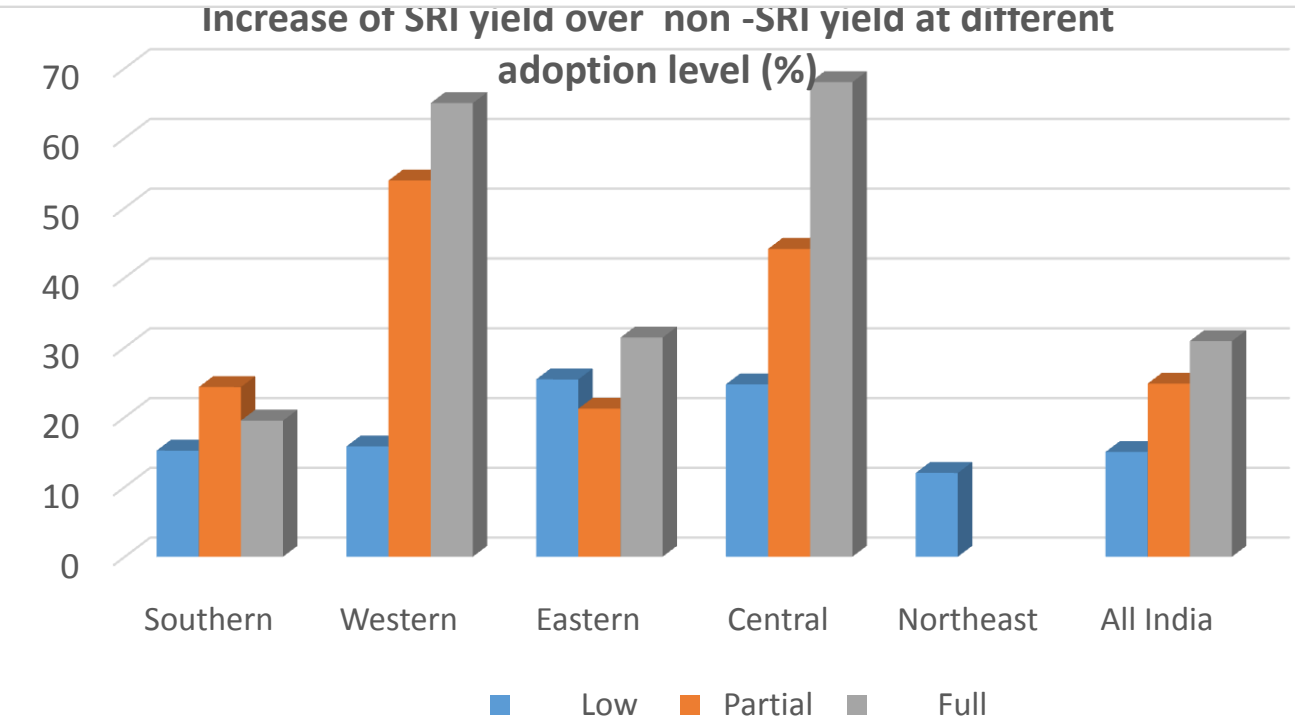


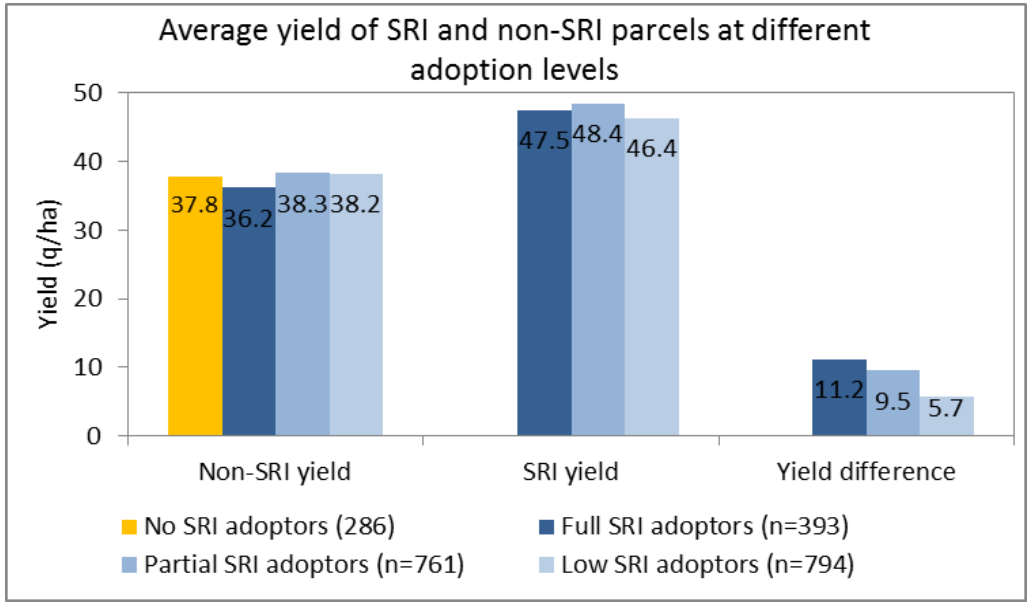
Figure 1: SRI Yield Increases in Different States (Q/ha)
0
2
4
6
8
10
12
14
16
Rajasthan
Assam
West Bengal
Kerala
Tamil Nadu
Maharashtra
Uttar Pradesh
Gujarat
Madhya Pradesh
Chhattisgarh
Orissa
Andhra Pradesh
Karnataka
All India average


Map 1. Rice Production in India
Area (mha); Production (mt); Rice Yield kg/ha
1 cm = 15
Jammu&Kashmir
Himachal Predesh
Punjab
Uttaranchal
Haryana
Rajastan
Uttrapredesh
Bihar
Sikkim
Arunachal Predesh
Nagalaad
Assam
Meghalaya
Manipur
Tripura
Mizoram
Madyapredesh
Gujarath
Jharkhant
Chattisgarh
Orissa
Maharashtra
A1.53 P2.57 Y1680
Andrapredesh
Karnataka
A1.4 P3.45 Y2470
Kerala
Tamil Nadu
Paddry Area mha
<1 mha
1-2 mha
2-4 mha
>4 mha
Rice Production 1 dot=1mt


% of farmers at different adoption level
100
80
60
40
20
0
Southern
AP,KE,KA,TN
Western
GJ,RJ, MH
Eastern
OR,WB
Central
MP,CH
Northeast
UP
AS
All India
Low
Partial
Full


Non-SRI yield at different adoption level (q/ha)
60
50
40
30
20
10
0
Southern
Western
Eastern
Central
Northeast
All India
Low
Partial
Full


Increase of SRI yield over non -SRI yield at different adoption level (%)
70
60
50
40
30
20
10
0
Southern
Western
Eastern
Central
Northeast
All India
Low
Partial
Full


Average yield of SRI and non-SRI parcels at different adoption levels
Yield (q/ha)
50
40
30
20
10
0
37.8
36.2
38.3
38.2
47.5
48.4
46.4
11.2
9.5
5.7
Non-SRI yield
SRI yield
Yield difference
No SRI adoptors (286)
Full SRI adoptors (n=393)
Partial SRI adoptors (n=761)
Low SRI adoptors (n=794)

Differences of yield, cost, gross value of outputs across various adoption levels

N=2236		Differences between SRI and non-SRI parcels		
Fully adopt. Components	Sample size	Yield (q/ha)	Cost of production (Rs/q)	Gross value of output (Rs/ha)
C1,C2,C3,C4	393	11.2	-179	9,592
C2,C3,C4	76	8.7	-112	8,067
C1,C3,C4	57	7.9	-82	9,601
C1,C2.C4	35	17.5	-18	8,478
C1,C2,C3	93	13.0	-171	9,706
C3,C4	185	6.7	-8	6,077
C2,C4	10	10.3	88	5,094
C2,C3	38	10.9	-87	12,256
C1,C3	14	9.9	-70	8,463
C1,C2	29	12.8	-94	11,440
C4	97	10.3	-231	9,015
C3	20	11.2	47	15,885
C2	41	6.9	-16	7,059
C1	41	8.5	-258	8,640
No full adoption of any components	1105	6.6	-196	4,676

Note: C1: young seedling; C2: single seedling; C3: square planting; C4: Intercultural

Difference of SRI and non-SRI yields across regions and adoption levels

Full adoption of components	Yield difference of Sri and non-SRI parcels across regions and adoption levels[1] (q/ha)												
	South			West			East			Central			North east
	Low	Partial	Full	Low	Partial	Full	Low	Partial	Full	Low	Partial	Full	Low
C1,C2,C3,C4		8.4			8.1			8.8			9.9		
C2,C3,C4		13.5			6.4			8.8			0.0		
C1,C3,C4		10.7			4.9			12.4			19.7		
C1,C2.C4		15.5			13.1			13.9			10.2		
C1,C2,C3		17.3						6.4					
C3,C4		10.3			9.9								
C2,C4		12.2			10.2			10.7					
C2,C3		11.4						9.9			2.5		
C1,C4		13.9						12.2					
C1,C3		4.2			2.5			12.8			6.6		
C1,C2		15.2									-0.3		
C4	-5.0	20.0			5.0			7.2			7.2		
C3					4.0			8.4		7.8	17.5		
C2	7.1			22.5			6.4	1.6			5.0		
C1	6.9	11.7		3.1			13.0	4.5		2.0	4.8		4.1
No full adoption		8.4			8.1			8.8			9.9		

Transaction cost for adopting SRI core components

State/Zone	Southern region	Western region	Eastern region	Central region	North Eastern	All India
C1,C2,C3,C4	653		640	710		655
C2,C3,C4	610		495			564
C1,C2,C4	613		630	680		630
C1,C2,C3	600	580	650	670		621
C3,C4	610					610
C2,C4	550	630	475	360		513
C2,C3	540		410			508
C1,C3	570	610	517	560	640	569
C1,C2	425	560	437	560	420	463
C4	408		435			417
C3	415	320	370	218	230	336
C2	260	460	462	540	230	386
C1	400	235	279		340	322
No full adoption of any components	**280**	**190**	**230**	**310**	**200**	**250**

Note: Estimated the cost based on the imputed value of efforts taken by the farmers and managerial time spent on logistic arrangements required to implement the SRI components or its combination

Multinomial logit model

Factors influencing adoption levels of SRI components in different regions

Variables	Eastern		Central		Southern		Western
	Partial	Full	Partial	Full	Partial	Full	Partial
Constant	4.776	1.470	2.092	-15.548	25.206	14.705	-23.866
Farming experience (yrs)	0.014	0.041	-.038	-.070	.032	.040	-.101***
Total Family labour (days/yr)	-.007***	-0.004**	.016	.011	-.003	-.006**	-.004
Black soil	-1.766**	-0.562	21.473	22.717	1.650	.862	21.723***
Clay soil	-3.239***	0.064	---	---	-10.123	-12.279	--
Red Soil	---	---	18.040	35.752	-9.277	-8.878	--
Clay loam soil	0.827	0.307	19.052	36.134	-9.638	-10.935	27.109
Surface irrigation	0.495	-.417	-2.024	-3.348	-11.633	-1.212	4.059*
Ground water irrigation	-1.795**	-1.123	15.732	-1.186*	-9.915	-.032	4.880***
Conjunctive irrigation	0.076	1.310	--	---	-11.576	-1.577	1.762
Model accuracy- Prediction %	88		85		81		84

Note: Low adopter is reference category. *** Significant at 1% level; **Significant at 5% level; * Significant at 10% level

Best suited SRI components and Soil types

States	SRI components	Soil type
Andhra Pradesh	C1,C2,C4	Sandy loam
Karnataka	C1,C2,C4	Black
Kerala	C1,C2,C3,C4	Red
Tamil Nadu	C1,C2,C3,C4	Clay
Gujarat	C1,C2,C3	Black
Rajasthan	C3	Black
Maharashtra	C1	Clay loam
Orissa	C2	Clay loam
Chhattisgarh	C1,C2,C4	Black
Uttar Pradesh	C1,C3	Clay loam
West Bengal	C2,C3,C4	Sandy loam
Madhya Pradesh	C1,C2,C4	Clay loam
Assam	C1	Sandy loam

Note: Though the irrigation sources (such as surface or groundwater) are important for better SRI adoption, it is varying from location to location and hence could not make any inference about the suitability of a particular irrigation source for SRI adoption

Conclusions and policy recommendations

Yield Advantage

- The average yield increase to 22% in SRI parcels. Sothern region dominating in rice production reported 18% increase. Western and Central region had Lowest yield in non-SRI have 29 and 52% higher yields in SRI parcels- need upscale the SRI
- SRI can have significant yield benefits in most regions

SRI Adoption status

- low adoption (41%) and partial adoption (39%) in all the region.
- But yield increase was 31% in in full adoption (all 4 components), 25% in partial and 15% in low adoption categories.

Cost and returns in SRI:SRI had higher gross margin of Rs 7000/ha and lowered the cost of production to Rs 178/q

Modification :need due to surface and groundwater supplies, soil type, drought/flooding and skilled labour availability. Two seedling against one, 15-18 days against 12 days, machine transplanting and one/two intercultural operation with power weeder enhance the up-scaling of SRI ideas in the potential western and central regions

Constraints: Lack of skilled man power, poor water control, high transaction cost towards mobilizing the resources for SRI/modified SRI –addressed through cluster approach and forming SRI groups/ SHGs'

Key policy recommendations

- **Yield Advantage:** With the current rice area of 42 mha study result rise the hope to get additional rice production of 30 mt from Easter region (56%), Southern (27%). The suggestions are;
- **Selective SRI components:** most of the farmers are low or partial adopter. Develop the package with set of selective components for each region/ state which give highest yield advantage and low COP
- **Doing it differently:** modifying the SRI to suit farmers choices resulting yield advantage help them to do own way to suit the filed condition and resource availability
- **Target location / region:** Identify the suitable area using GIS considering the soil and irrigation constraints
- **Machine transplantation:** using the concept of wider spacing, young seedling, one to two seedlings reduce the skilled labour demand. Power weeder also be explored to reduce cost and labour scarcity
- **Capacity building:** farmer training and supply of power/ cono weeder attract more farmers to SRI
- **Long term field experimentation:** Yield variation across region, soil and irrigations need long term field experimentation with different SRI practices for getting better recommendation

Thanks