Performance evaluation of rice varieties grown under puddled transplanted and System of Rice Intensification(SRI)

S.S.Parihar, B.C.Barah, Ravinder Kaur, Radha Prasanna, Niveta Jain, Manoj Khanna, Pankaj, Dinesh Kumar, Subhash Chandra and Bishan Dev

Water Technology Centre

Indian Agricultural Research Institute

New Delhi-110012

Treatments Detail:

(A) Planting method:

- Puddled transplanted-P1
- Puddlled SRI-P2

(B) Varieties:

- Pusa44
- Pusa834
- Pusa1401
- Pusa1509
- PRH10

Design : Split-plot

Replication: 3

Essential steps:

- ***Seed rate 6 kg/ha***
- ***Sowing of healthy & treated seed on raised bed nursery***
- ***Use of organic manure***
- ***Transplant single young (12-14 days) seedling per hill***
- ***Spacing in square fashion (25 x 25cm) giving 16 hills/m2 plant***
- ***Inter culture operation through conoweeder***
- ***Thin layer of submergence along with wetting and drying***

SEED TREATMENT

i) Selecting quality seed using Brine method

ii) seed Inoculation with *Pseudomonus florescence (bio inoculant)*

Selection seed: Brine method

Seed Inoculation

Seed quality check

Nursery bed preparation and Sowing

Nursery bed ready

Compost application

Nursery Sowing

Protecting nursery with net

MUlching nursery

Water flow measurement using Starflow meter

Experimental Layout Design (Split-plot)

Agronomy DRS expt side											
Environment Expt. side	Drainage	S4	S2	S1	S3	S5	S4	S1	S5	S2	S3	Area lefto ut	Drainage Channel
		S1	S5	S3	S4	S2	S5	S3	S2	S4	S1		
					Ext. 3 (Drip irrigation)								
		General area			S1	S3	S2		S5		S4		
					C2	C5	C4		C1		C3		
		Drainage Channel											
		C1	S4	S1	C4	C1	C5		C3		C2		
		C4	S1	C1	S3	S2	S1		S4		S5		
		C1	S1	C4	S5	S4	S3		S2		S1		
		C4	S4	S4	C1	C2	C3		C4		C5		
		Exp 1			Expt 2								
Road side													

Note: "S" stands for SRI, "C" for conventional experiment (puddle transplanting).
Subscript numbers stand for variety numbers (1. Pusa44, 2. Pusa 834, 3. Pusa 140
4. Pusa 1509, 5.PR-10). Age of planting is uniformly kept at 12 or 13 days old seedl

SRI Experiment @ IARI 2013

CROP growth processes

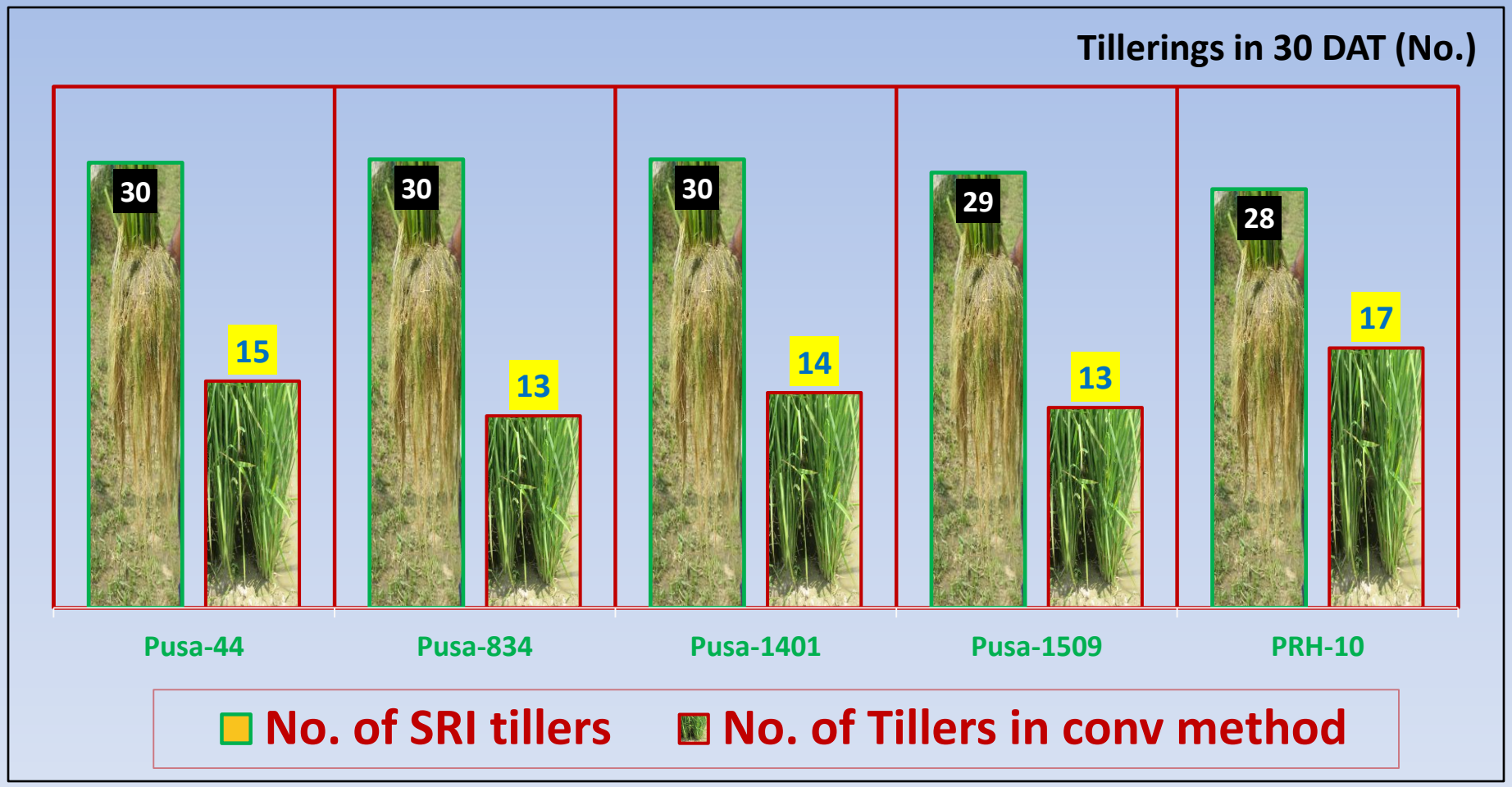
Crop condition

Sixty days old SRI plant

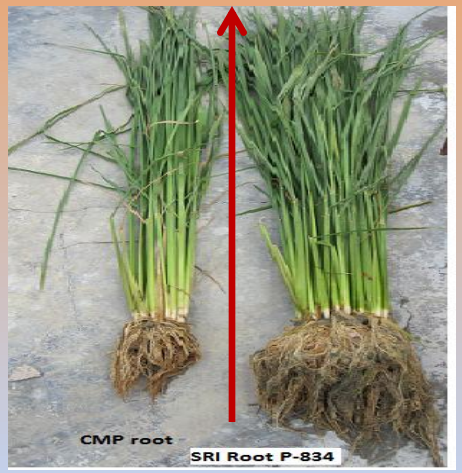
Roots of Pusa-1509 after 45 Days of Transplanting under SRI

Comparison of root biomass under SRI and conventional puddled rice

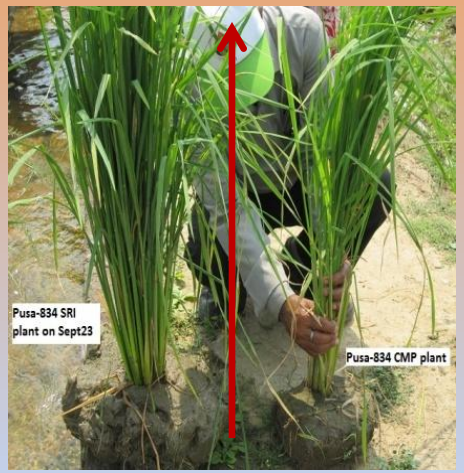
Tillering behaviour after 30 days of transplanting under SRI and puddled transplanted



Comparison of plant growth characteristics under SRI and CMP



Rice Variety Pusa-1509 on maturity under SRI (14 inch long Panicle)



Rice Variety Pusa-1509 on maturity under CMP (10.5 inch Panicle)

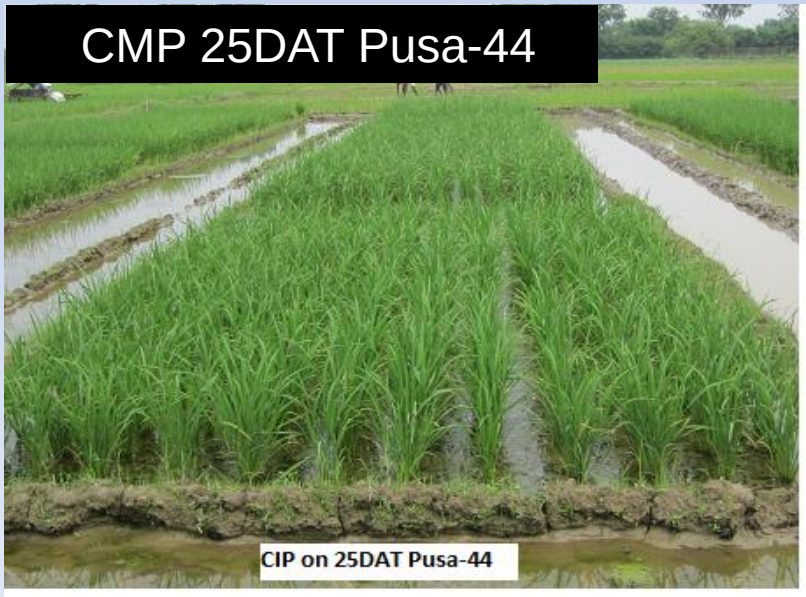
SRI and CMP Root system

Comparing of growth pattern of SRI & CMP of Pusa-1509

CMP 42DAT P-1509

42DAT P-1509 (SRI)

CMP 25DAT Pusa-44



78DAT P-1509 (SRI)

Pusa-1509 on maturity in 78 days (Sept 27)

COMPARING CROP GROWTH under SRI and CMP

SRI growth path Variety P-1509

SRI Pusa-1509 on Maturity Sept 28

LABOUR USE ISSUES IN SRI

Conventional Weeding

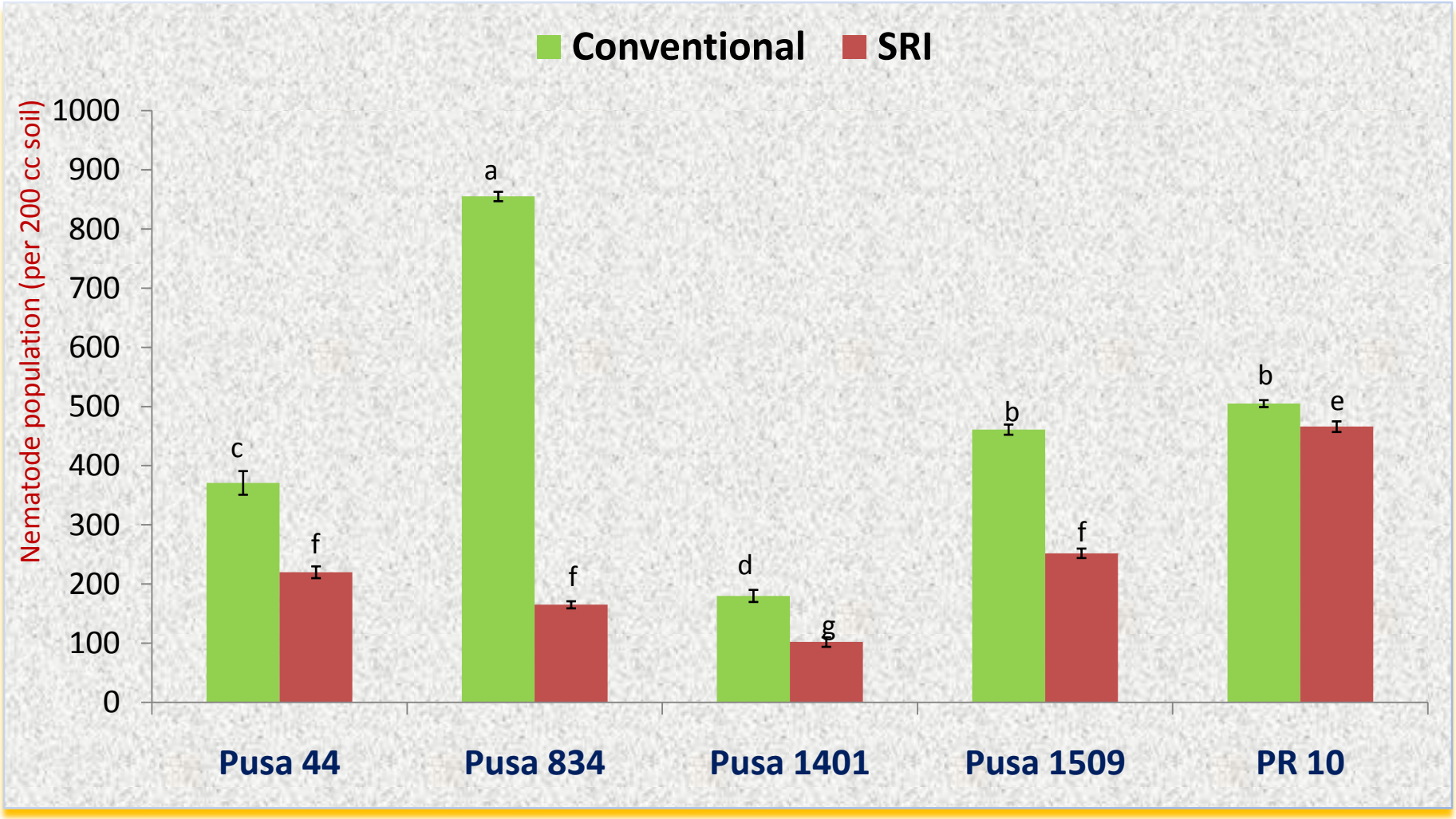
Conventional Transplanting

Cono weeder

SRI Weeding

Performance of IARI rice varieties under puddled transplanted & SRI

Population of *Hirschmanniella oryzae*

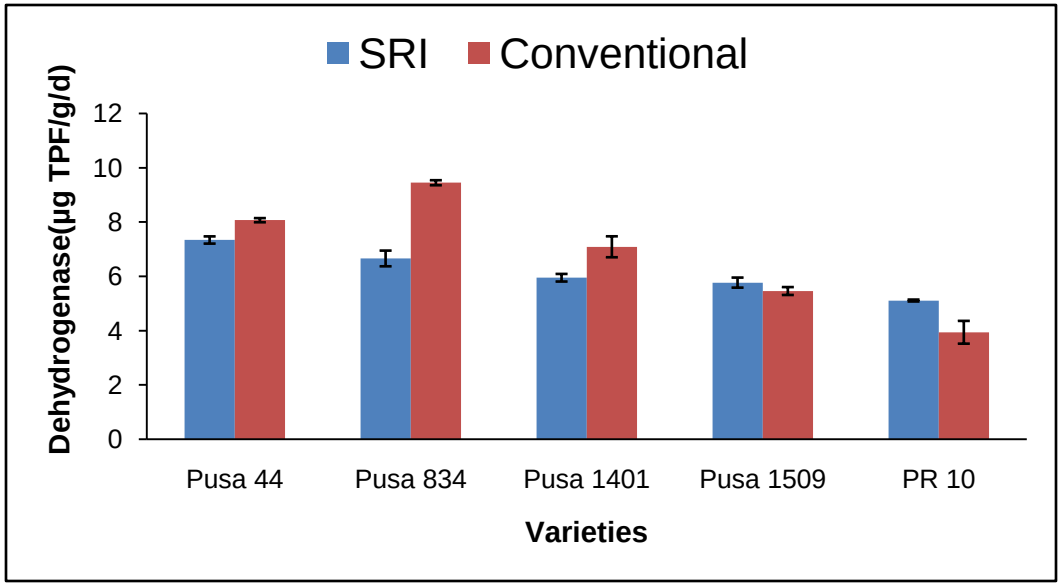


The population of rice root nematode, *H. oryzae* was high in conventional method compared to SRI. Variety Pusa1401 showed least infestation

Microbiological indices , as influenced by rice varieties and mode of cultivation

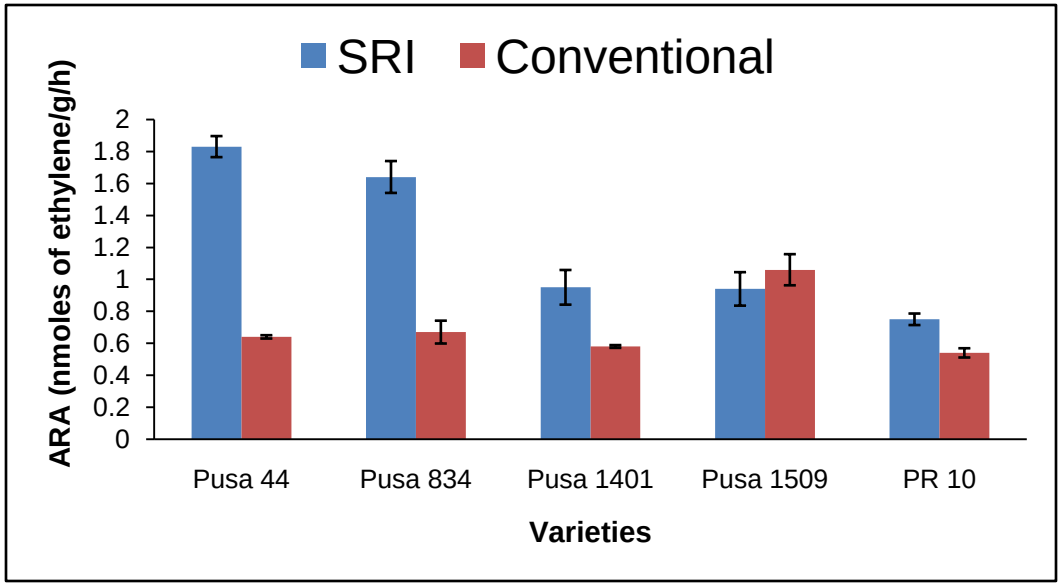
Varieties	Dehydrogenase activity (µg TPF/g/d)		Soil Chlorophyll* (mg/g)		ARA# (nmoles of ethylene released/g/h)	
	SRI (S)	Conventional (C)	SRI (S)	Conventional (C)	SRI (S)	Conventional (C)
Pusa-44	**7.34**	**8.07**	**0.85**	**0.79**	**1.83**	0.64
Pusa-834	**6.66**	**9.45**	0.46	0.50	**1.64**	**0.67**
Pusa-1401	5.95	7.09	0.62	0.77	0.95	0.58
Pusa-1509	5.77	5.46	**0.76**	**0.93**	0.94	**1.06**
PR-10	5.11	3.94	0.51	0.60	0.75	0.54
SEm	0.15	0.30	0.03	0.04	0.05	0.05
CD	0.42	0.83	0.08	0.11	0.14	0.14
SEm (S xC)	0.51		0.05		0.20	
CD (S xC)	1.41		0.14		0.55	

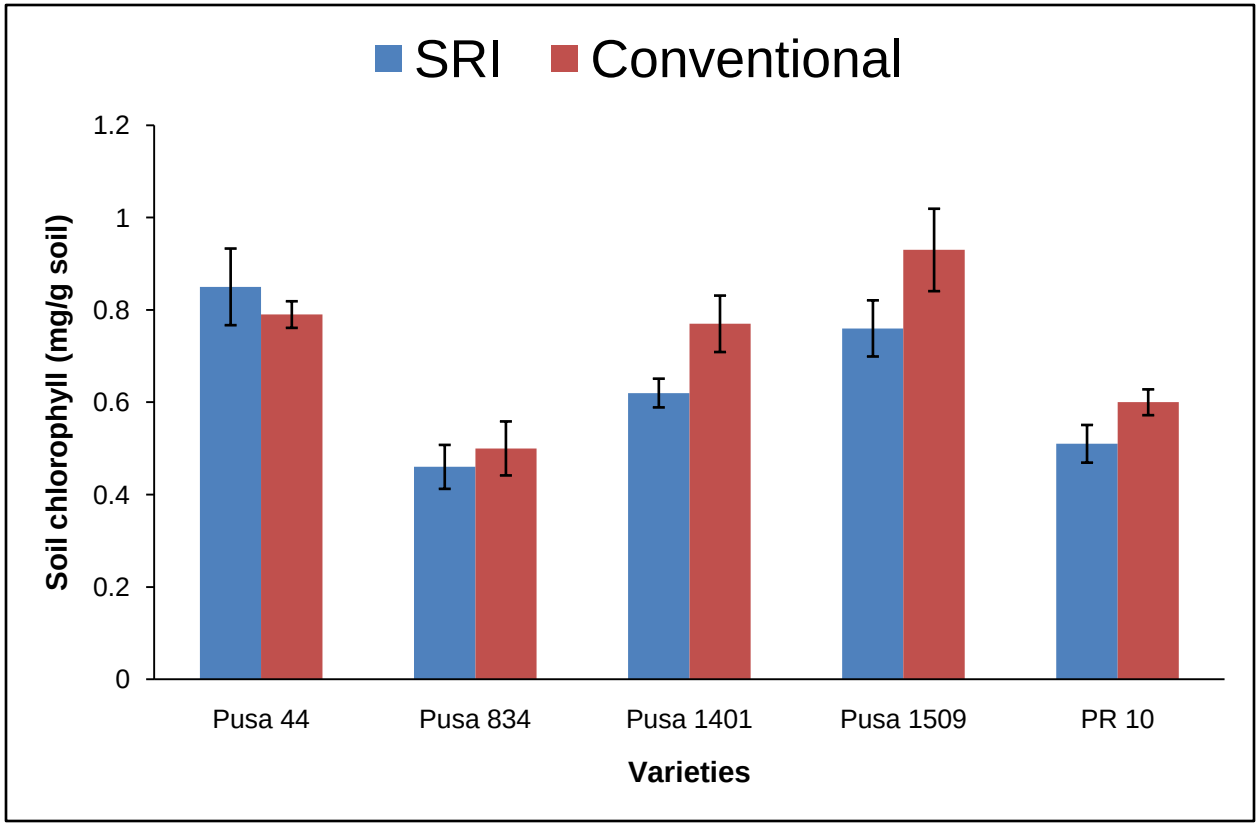
* , index of photosynthetic biomass; # Index of biological nitrogen fixation; values in **bold** font are the two highest values; red colored font values are significantly higher in terms of mode of cultivation
(Transplanting done on 23rd July and sampling on 25th Sept.)



Dehydrogenase enzyme activity is an indicator of biological activity, which strongly increases under anaerobic conditions.
This is illustrated in our experiment, wherein higher values are recorded in conventional flooded mode of rice cultivation

Nitrogen fixation is negatively correlated with oxygen levels (as enzyme involved is oxygen-sensitive) and SRI samples showed significantly higher values

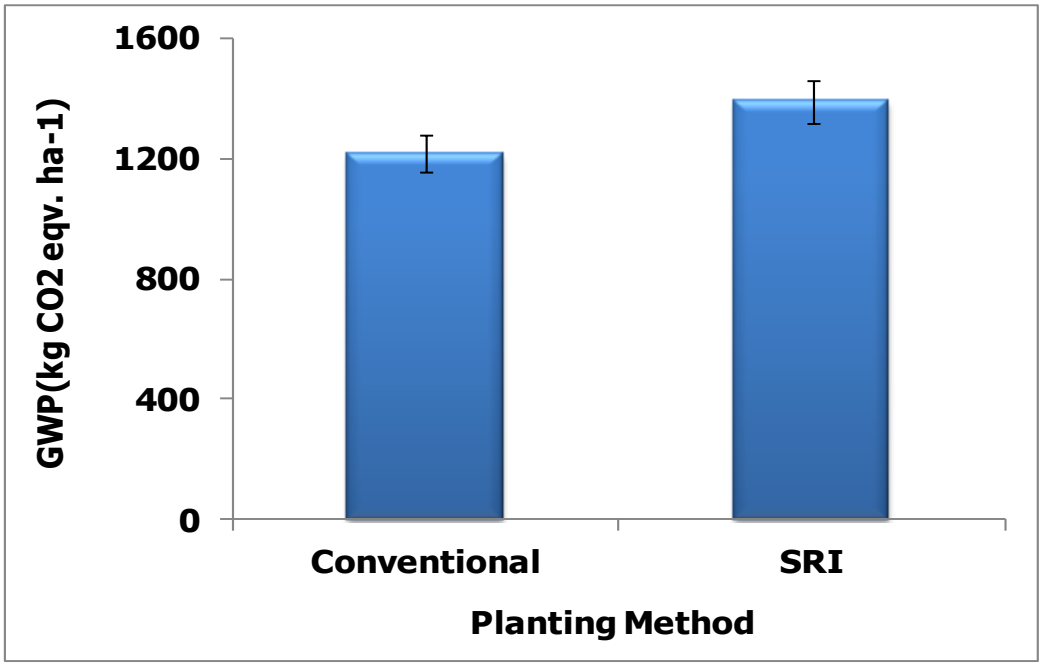




Soil chlorophyll, which represent an index of photosynthetic biomass, which was significantly higher under conventional flooded mode of rice cultivation for all the varieties.

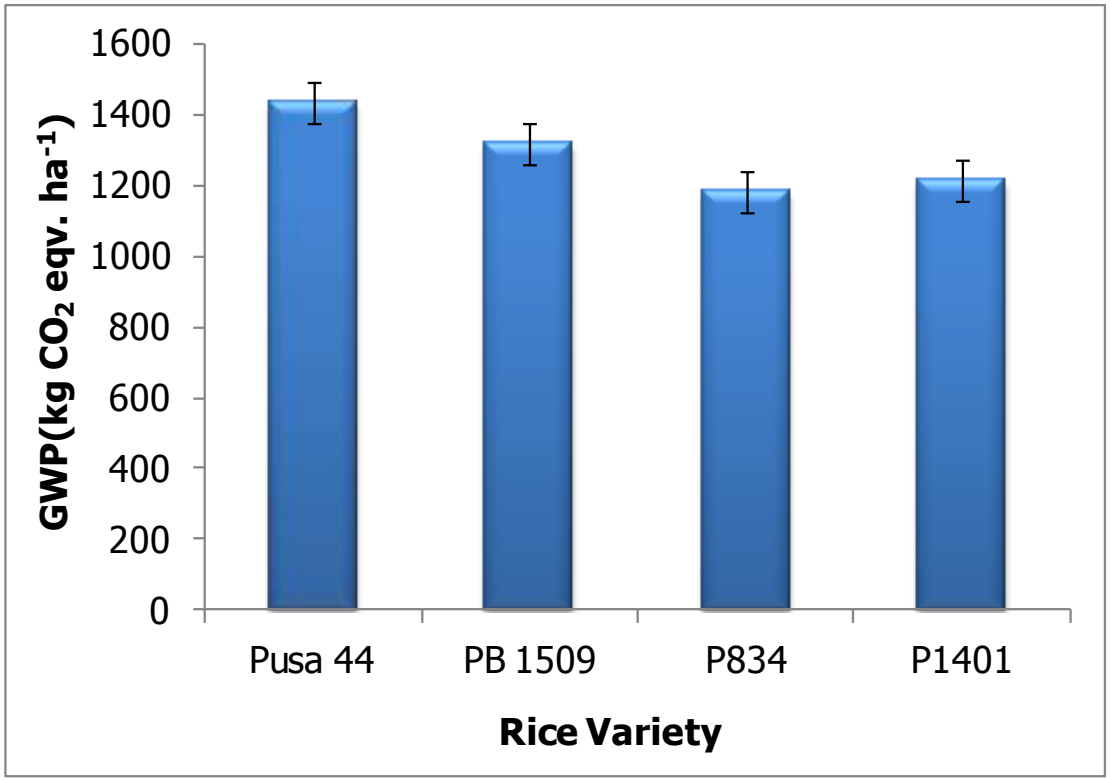
A significant role of varieties was observed in all the microbiological parameters which can be partially attributed to the **variation in the type and amounts of root exudates produced by the different varieties and their influence on the microflora in rhizosphere**

Global Warming potential of SRI



- **GWP of SRI method was 14% higher in 2013**
- **Methane emission increased by 10% because of anoxic conditions due to abundant rainfall during August and September (628mm) and available carbon from vermi compost**

Global Warming potential of rice varieties



- No significant difference in N2O emission
- Methane emission decreased by 6-20% compared to Pusa 44
- Maximum methane reduction was in Pusa 1509

Grain Yield (t/ha) of rice varieties grown under different planting methods

Planting	Varieties					
	Pusa 44	Pusa 834	Pusa 1401	Pusa 1509	PRH 10	Mean
Puddled -SRI	7.48	6.43	6.48	6.21	7.50	6.82
Puddlled-transpl.	6.81	6.01	6.06	5.87	6.90	6.33
Mean	7.14	6.22	6.27	6.04	7.20	-
Increase in yield under SRI	0.67	0.42	0.42	0.34	0.60	-
CD (p=0.05)	Planting-0.23; Variety- 0.25					

- Amongst varieties, Pusa44 and PR10 gave significantly higher yield than other varieties .
- Yield under SRI was higher than traditional puddled transplanted.

Water use (cm/ha) / field water use efficiency (kg/ha-cm) of rice varieties under different planting methods

Variety	Planting method		% water saving over transplanting
	Puddled Trans.	Puddled SRI	
Pusa44	177.9/38.28	133.8/55.90	25.0
Pusa834	170.6/35.23	124.8/51.52	27.0
Pusa1401	172.8/35.07	126.7/51.14	27.0
Pusa1509	170.3/34.47	123.5/50.28	29.0
PRH10	175.6/39.29	130.3/57.56	26.0

- SRI system resulted in higher FWUE irrespective of the varieties grown than puddled transplated.
- There was also a significant saving of water under SRI

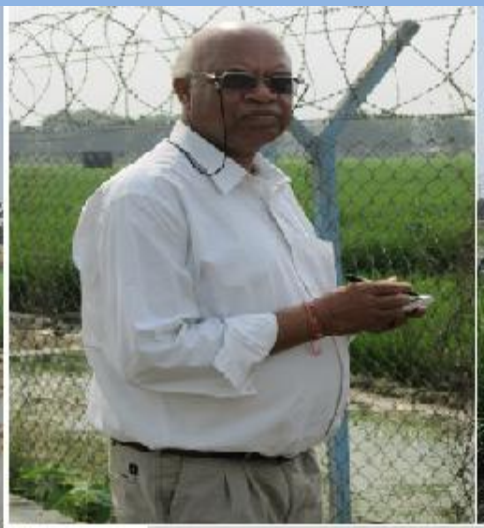
Gross revenue and return

Gross revenue Rs./ha		Return Rs/ha		% Diff.
CMP	SRI	CMP	SRI	over SRI
98521	117316	60856	85160	40%
85934	100481	48269	68325	42%
87553	100976	49888	68820	37%
83372	96026	45707	63869	39%
96710	116102	59045	83946	42%
Output price: Rs.1250/q				

Visitors gallery

Visitor Suresh Pal at SRI Pusa 1509

SRI Experiment @ IARI 2013:
Visitors Interaction solicited



Thank You