

***Increasing Water Savings
while Raising Rice Yields
with the System of Rice
Intensification (SRI)***

**Panel on WATER PRODUCTIVITY AND REUSE
2nd International Rice Congress
New Delhi, October 9-13, 2006**

**Norman Uphoff, CIIFAD
Cornell University, USA**

The System of Rice Intensification (SRI) is *'a work in progress'* – not finished

SRI methods usually enable rice farmers to:

1. Raise rice production by 50% or more
2. While making reductions in their:
 - Seed requirements -- by 80-90%
 - Irrigation water -- by 25-50%
 - Dependence on agrochemicals
 - Costs of production -- by 10-25%
 - No need for new varieties of seeds
3. Raise net income/ha by 50-100% or more
4. Have favorable environmental impacts

The Origins of SRI

SRI was developed in Madagascar 20+ years ago by Fr. Henri de Laulanié, S.J., who spent 34 years working with farmers, observing, experimenting, and having also some serendipity (Laulanié, 1993)

SRI methods were first validated outside of Madagascar in 1999-2000 by:

- Nanjing Agricultural University in China
- Agency for Agric. Research & Dev. in Indonesia
- Taken up by NGOs in Cambodia, Philippines, Sri Lanka, Bangladesh, Sierra Leone, Cuba, etc.

SRI has now been demonstrated in 24 countries, and it is spreading there and to other countries



**Fr. de Laulanié
making field visit**



**Sebastien Rafaralahy and
Justin Rabenandrasana,
Association Tefy Saina**

Summary of results from SRI vs. BMP evaluations in China and India (t ha⁻¹), 2003 or 2004

Province/state	No. of on-farm comparison trials (area)	BMP ave. yield	SRI ave. yield	SRI advantage (% incr.)
Zhejiang (CNRRI)	(16.8 ha of SRI rice with 2 hybrid varieties)	8.8*	11.9*	3.1* (35.2%)
Sichuan (SAAS)	8 trials (0.2 ha each)	8.13*	11.44*	3.31* (40.7%)
A. Pradesh (ANGRAU)	1,525 trials (average 0.4 ha; range 0.1-1.6 ha)	6.31	8.73	2.42 (33.8%)
Tamil Nadu (TNAU)	100 trials (SRI and BMP trials each 0.1 ha)	5.66	7.23	1.57 (27.7%)

* Note that Chinese comparisons were made using hybrid rice varieties.

SRI gets MORE from LESS by mobilizing biological processes

SRI requirements include:

- More labor while learning the method
-- *but SRI can also become labor-saving*
- Water control needed for best results
- Access to biomass for compost to get best results – *but can use fertilizer*
- Skill and motivation from farmers
- Crop protection in some cases

Country	Evaluation done by/for:	Yield Increase	Water-Saving	Cost Reduction	Increase in Net Income	Comments
BANGLA DESH IRRI-funded evaluation	BRAC/SAFE BRRRI/Syngenta BD Ltd (Hossain, 2004)	24%	NC	7%	59% (32-82%)	On-farm evaluations funded by IRRI PETRRA project (N=1,073)
CAM-BODIA National Survey	GTZ (Anthofer et al., 2004)	41%	Flooding at TP reduced 96.3%→ 2.5%	56%	74%	Survey of SRI and non-SRI users randomly sampled in 5 provinces (N=500) ; SRI use has grown to >50,000 farmers in 5 years
Long-term Users	CEDAC (Tech, 2004)	105%	50%	44%	89%	Farmers who had used SRI for 3 years (N=120)
CHINA	China Agric. University (Li et al., 2005)	29%	44%	7.4% [ext. service promoting fertilizer & new seeds]	64%	SRI use in village had gone from 7 in 2003, to 398 in 2004; farmers considered labor-saving main benefit (N=82)

Country	Evaluation done by/for:	Yield Increase	Water-Saving	Cost Reduction	Increase in Net Income	Comments
INDIA Tamil Nadu	Tamil Nadu Agr. Univ. (Thiyagarajan et al., 2004)	28%	40-50%	11%	112%	On-farm comparisons in Tamiraparani Basin, supervised by TNAU and extension service (N=100)
Andhra Pradesh	Andhra Pradesh Agr. Univ. (Satyanarayana, 2005)	38%	40%	NA	NA	On-farm trials supervised by ANGRAU and State extens. service (N=1,535)
West Bengal	IWMI-India (Sinha and Talati, 2005)	32%	Rainfed version of SRI	35%	67%	SRI use in villages had gone from 4 farmers to 150 in 3 seasons (N=108)
INDONESIA	Nippon Koei (Sato, 2006)	84%	40%	24%	412%	3 years of evaluation in E. Indonesia; trials conducted on 1,363 ha (N=1,849)

Country	Evaluation done by/for:	Yield Increase	Water-Saving	Cost Reduction	Increase in Net Income	Comments
NEPAL	Morang District Agric. Dev. Office (Upreti, 2005)	82%	43%	2.2% [but rotary hoes not widely available]	163%	Morang district users from 1 in 2003 to >1,400 in 2005 (N=412)
SRI LANKA	IWMI (Namara et al., 2004)	44%	24%	11.9-13.3%	90-117%	Survey of SRI users and non-users, randomly sampled in 2 districts (N=120)
VIET-NAM	National IPM Program (Dông Trù village)	21%	60%	24%	65%	Record-keeping by Farmer Field School alumni on SRI results
AVERAGE		52%	44%	25%	128%	

Basic SRI Practices:

- Start with young seedlings – 8-12 days old (<15 days) to preserve their potential for profuse growth of tillers and roots
- Use single seedlings widely spaced – planted in square pattern, quickly, gently
- Apply minimum water – enough to keep soil moist, no standing water in fields
- Weed with a 'rotating hoe' to aerate soil while returning weeds to the soil
- Provide organic matter -- as much as possible for soil organisms and plants

Two Different Paradigms of Production

- GREEN REVOLUTION strategy:
 - (a) Changes the genetic potential of plants, and
 - (b) Increases the use of external inputs -- apply more water, fertilizer, insecticides, etc.
- SRI instead changes the ways that plants, soil, water and nutrients are managed:
 - (a) To promote the growth of root systems and
 - (b) To increase the abundance and diversity of soil organisms to better realize their benefits

These changes → better PHENOTYPES



**Ms. Im Sarim, Cambodia,
with rice plant grown
from a single seed,
using SRI methods
and traditional variety
-- yield of 6.72 t/ha**



**Morang District,
Nepal - 2005**

**Eastern
Indonesia ---
Nippon Koei
Irrigation
Project
2004**





Mahto Oraon, Malai village, Gumla district, Jharkhand state, India -- Khandagiri, 110-day variety with 65 tillers, grown as 'rainfed' SRI rice



Farmer in Burkina Faso with SRI plant – summer 2006



Roots of a single rice plant (MTU 1071) grown at Maruteru Agricultural Research Station, AP, India, kharif 2003



Cuba – Two plants the same age (52 DAP) and same variety (VN 2084)



Madagascar SRI field, traditional variety, 2003

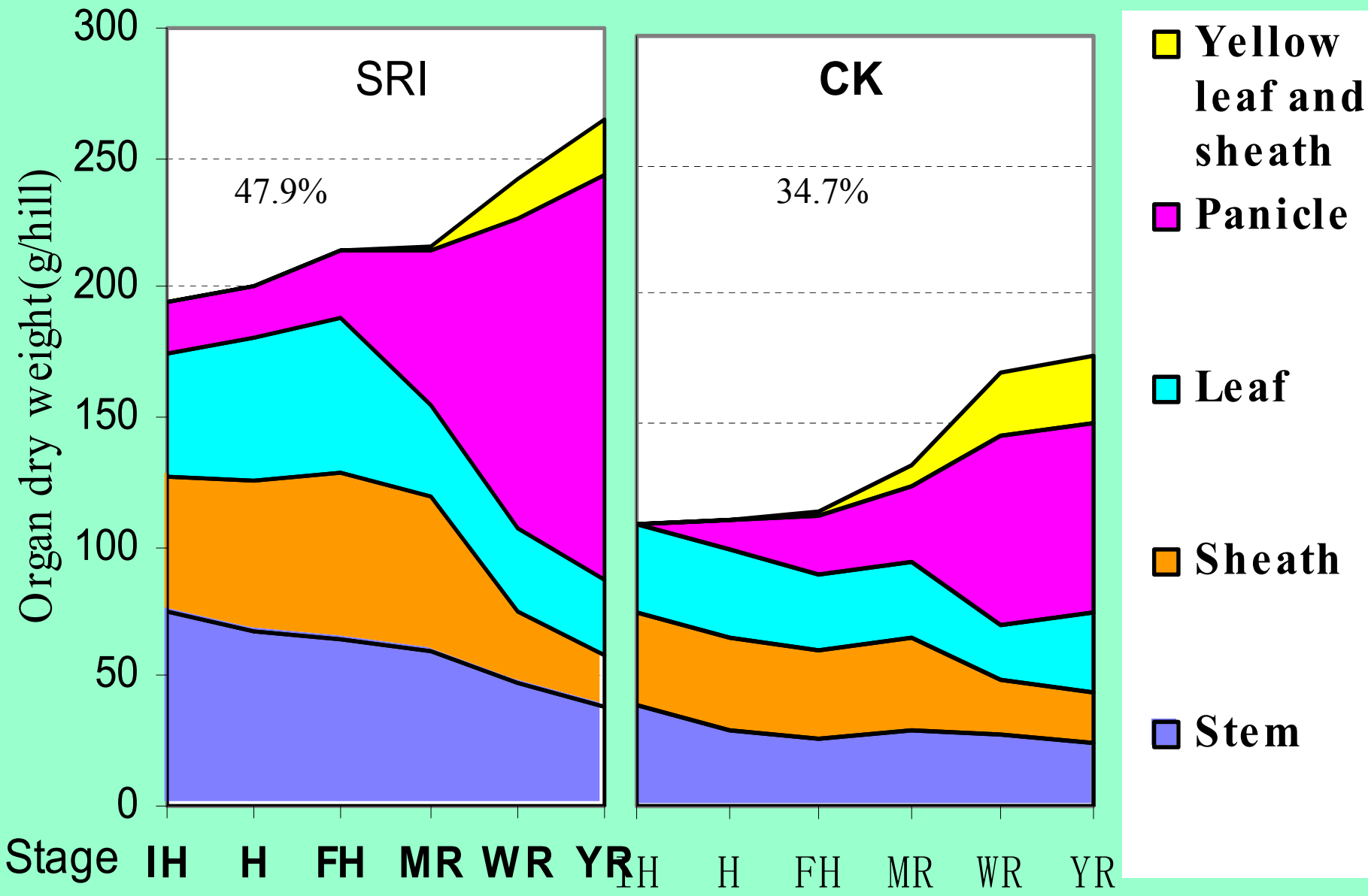
First SRI Trial in Zambia

Planted by Esek Farmers' Cooperative Society, Solwezi, Northwest Province, 12/15/05 and harvested 6/30/06. Area was 12.5x12.5 m², and the dried paddy harvest of 96 kg was equivalent to a yield of 6.144 t/ha. No fertilizer was used, only organic matter for soil fertilization. Production was basically rainfed, but a small catchment dam built by the farmers themselves provided some supplemental irrigation later in the season.





**SRI crop in
Sri Lanka**



“Non-Flooding Rice Farming Technology in Irrigated Paddy Field”
 Dr. Tao Longxing, China National Rice Research Institute, 2004

Resistance to Abiotic and Biotic Stresses:

- Drought tolerance/resistance
- Resistance to lodging to better tolerate wind, rain and storm damage
- Cold tolerance – has been seen
- Salinity tolerance? – no evidence yet
- Cope better with climate change?
- Widespread reports of resistance to pests and diseases – *trophobiosis*?



Rice fields in Sri Lanka: same variety, same irrigation system, and *same drought* : conventional methods (left), SRI (right)

Rice in Tamil Nadu, India: normal crop is seen in foreground; SRI crop, behind it, resists lodging





Rice in Đông Trù, Vietnam: normal methods on right; SRI with close spacing in middle; SRI with wider spacing on left

YSR announces 4-cr. programme for popularising SRI method

World Wide Fund for Nature, ANGRAU take up pilot project

K. Venkateshwarlu

TARAMATIPET (RANGA REDDY DT): Bowled over by the success of the System of Rice Intensification (SRI), Chief Minister Y. S. Rajasekhara Reddy on Tuesday announced a Rs. 4-crore programme of training and having demonstration plots for popularising this novel paddy cultivation method in every village in the State. The Government will also think of supporting purchase of weeders.

Dr. Reddy who landed right on the farm of G. Nagaratnam Naidu here, appeared pleased with the way paddy was raised using SRI method, held a tuft of freshly harvested crop and showed it to media persons. "We will leave no stone unturned in popularising SRI during the ongoing Rythu Sadassu".

The method being adopted by 212 farmers in 10 districts of the State under a pilot project taken up jointly by the World Wide Fund for Nature and Acharya N. G. Ranga Agricultural University involved water and soil fertility management, planting of seeds in a particular manner and weed control.

The crop raised used less of water and the yield was high. It had nothing to do with seed variety called "Sri Vari" as is being popularly perceived.

Interacts with farmers

Later Dr. Reddy preferred to sit down with the farmers who have adopted the SRI cultivation and heard them share their experiences. Mr. Naidu said under SRI, he planted only 2 kg of seed, used less water and obtained 92 bags of rice per acre. Balama-nema of Mahbubnagar, Varalaxmi of Anantapur, K.V. Rao of Guntur had similar success stories to narrate.

Dr. Reddy said the Government's campaign on discouraging farmers from going in for

- 212 farmers implementing the method in 10 districts in the State
- It involves water and soil fertility management, planting of seed in a particular manner and weed control
- Discouraging farmers from growing paddy is meant for conserving water and not for restricting free power, says Chief Minister

paddy in rabi was basically meant for conserving water for the coming years when the rainfall could be less. It was not for restricting free power supply, which would continue for the next four years.

Taking a dig at the previous Telugu Desam Government, he said a party, which was not able to supply power for ten minutes, was now finding fault with Congress Government's policy on free power supply covering 95 per cent of farmers.

Only income tax payees and big farmers having more than three pumpsets were being asked to pay charges. "This decision has the approval of farmers in all the 22 districts but TDP wants to support big farmers." The Government also encouraged farmers to go in for crop diversification for which Rs. 17 crores has been earmarked as subsidy.

Agriculture Minister, N. Raghuvuera Reddy and Major Irrigation Minister, P. Lakshmaiah were present. Gujja Biksham, Policy Advisor, Global Freshwater Programme, WWF introduced the farmers and Vinod Goud project coordinator, WWF dialogue project spoke.



BOWLED OVER: Chief Minister Y.S. Rajasekhara Reddy harvesting a tuft of System of Rice Intensification (SRI) paddy at a farm in Taramatipet in Ranga Reddy District on Tuesday. Ministers N. Raghuvuera Reddy and Ponnala Lakshmaiah are also seen.

— PHOTO: D. GOPALAKRISHNAN

COSTS OF CULTIVATION PER HECTARE – TNAU STUDY

	Practices	Tractor hours @ Rs. 150 / hr		Bullock pair @ Rs. 200 / hr		Men's Labour @ Rs. 40 / man-day		Women's Labour @ Rs. 40 / man-day		Cost (Rs.)	
		Conv.	SRI	Con	SRI	Conv	SRI	Conv.	SRI	Conv.	SRI
	Nursery Preparation	1	-	-	-	6	3	0.5	5.5	2,110	681
	Main Field Preparation	7.5	7.5	2	2	12	12	-	-	2,005	2,005
	Manures & Fertilizers	-	-	-	-	7	7	10	10	7,254	7,254
	Transplanting	-	-	-	-	5	5	55	75	2,400	3,200
	Weeding	-	-	-	-	-	38	80	-	3,200	1,520
	Irrigation	-	-	-	-	7.5	6	-	-	300	240
	Plant Protection	-	-	-	-	2	2	2	2	660	660
	Harvesting	1	1	-	-	12.5	12.5	75	75	3,500	3,500
	Total	9.5	8.5	2	2	52	85.5	222.5	167.5	21,429	19,060

Cost saving in SRI system over conventional system = Rs. 2,369 (11 %)

Economics of Cultivation (ha^{-1}) – TNAU study

		Conventional practices	SRI practices
	Income from grains (Rs. 5.00 / kg)	US\$ 659	US\$ 870
	Income from straw (Rs. 0.25 / kg)	US\$ 49	US\$ 63
	Gross return	US\$ 708	US\$ 933
	Cost of cultivation	US\$ 466	US\$ 414
	Net return	US\$ 242	US\$ 519
	B : C ratio	1.52	2.25

LESS CAN PRODUCE MORE

by utilizing biological potentials & processes

- **Smaller, younger rice seedlings** become larger, more productive mature plants
- **Fewer rice plants** per hill and per m² give higher yield if used with other SRI practices
- **Half as much water** produces more rice because aerobic soil conditions are better
- Greater output is possible with use of **fewer or even no external/chemical inputs**
- Even more output within a **shorter time**

There is nothing magical about SRI – all can be explained in sound scientific terms

For Further Information:

- **BANGLADESH:**
F. H. Abed (BRAC)
- **BHUTAN:** K. Lhendup
(Sherubutse College)
- **CHINA:** S. H. Cheng
and L.X. Tao (CNRRI)
- **INDIA:** B. Barah (NCAP)
 - **AP:** M. Kumar (DRR),
P.V. Satyanarayana (MT)
 - **TN:** M. S. Swaminathan
(MSSRF)
 - **Tripura:** B. Majumdar
(Dept. of Agric.)
- **INDONESIA:** A. Fagi
(AARD)
- **NEPAL:** R. Uprety
(DADO)
- **PAKISTAN:** M. Gill
(OFWM)
- **PHILIPPINES:**
L. Sebastien (PhilRice)
- **THAILAND:** A. Mishra
(AIR)
- **WEST AFRICA:**
K. Nwanza (WARDA)

THANK YOU

- Web page:
<http://ciifad.cornell.edu/sri/>
- Email: ciifad@cornell.edu or
ntu1@cornell.edu or
- tefysaina.tnr@simicro.mg