




SRI 2.0: How is the System of Rice Intensification Evolving and what are we Learning?

Erika Styger
SRI-Rice, Cornell University

CIIFAD Seminar – November 9, 2011

Our Challenges

Improve agricultural productivity

Improve food security

Reduce poverty

Environmentally sustainable practices

Withstand changing climate conditions

What is SRI?

- The System of Rice Intensification (SRI) is a methodology
  - increases the productivity of irrigated rice cultivation
  - changes the management of plants, soil, water and nutrients, while reducing external inputs
- SRI provides principles and guidelines – to adapt to the local environment
- SRI is not a fixed technology

Source page web: http://sririce.org

SRI cultivation practices



Young seedlings (8-12 days)



1 seedling/hill



Wide spacing 25x25cm or more

Conventional rice cultivation



Older seedlings (25-45 days)



3-5 seedlings/hill



Close hill spacing 10x15 cm

SRI cultivation practices



Alternate wetting and drying

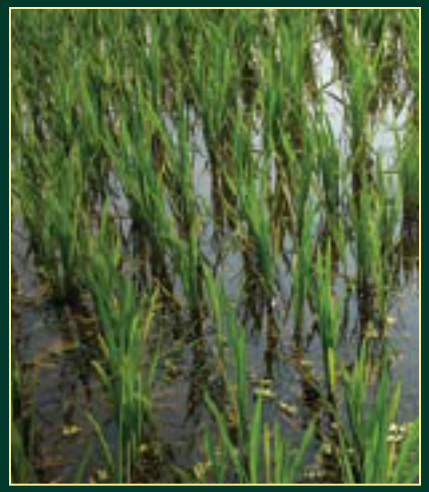


Fertilizing with organic matter



Mechanical weeding/ IPM

Conventional rice cultivation



Continuous flooding



Use chemical fertilizer



Herbicide use / hand weeding

Principles of SRI method

1. Favor early, quick and healthy plant establishment
2. Reduce plant population
3. Enrich soils with organic matter – keep soils aerated – favor soil microbial development
4. Reduce water applications – through alternate wetting and drying water management


SRI practices induce a phenotypical change in rice
SRI
Conventional
SRI
Conventional
SRI
Conventional
in IRAQ's Al-Mishkhab Research Center, Najaf

Physiological and morphological changes of SRI plants

- Tillers are thicker (+38%), Plants are higher (+24%)
- Leaves are longer (36%), wider (36%), thicker and contain more chlorophyll, higher photosynthesis rate
- Greater canopy angle (33° vs 18°)

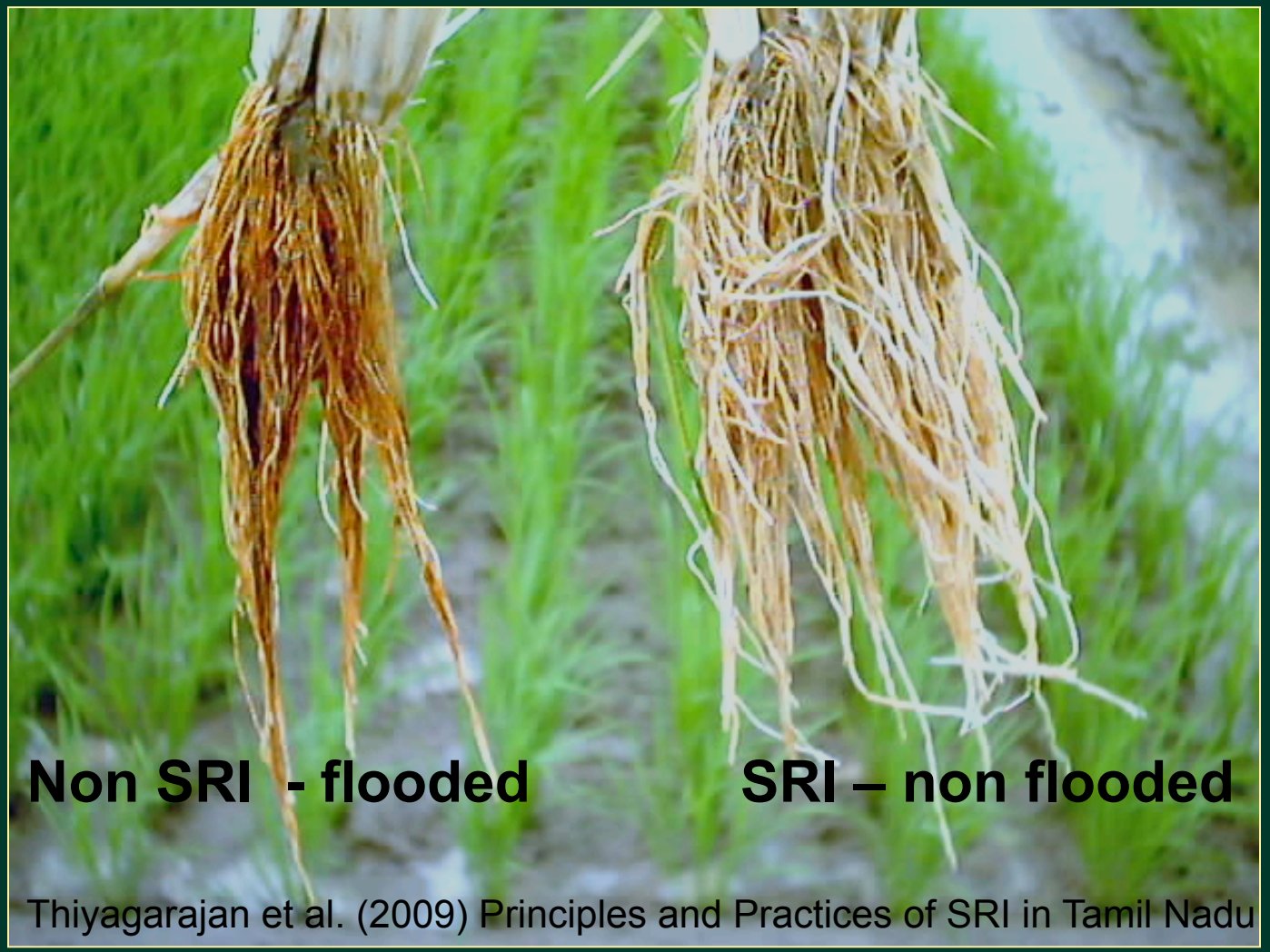




Thakur, A.K et al (2011) Effects for rice plant morphology and physiology of water and associated mgt practices of SRI and their implications for crop performance, PAWE 9:13-24

- Roots are deeper, longer, double the volume and weight/ hill

Thakur, A.K et al (2011) Effects for rice plant morphology and physiology of water and associated mgt practices of SRI and their implications for crop performance, PAWE 9:13-24



Thiyagarajan et al. (2009) Principles and Practices of SRI in Tamil Nadu

Yield performance

- More/similar number of panicles/ m^2
- Longer panicles (+20%)
- More grains/panicle (+40%)
- Fewer empty grains
- 1000 grain weight is same/ slightly heavier



Non-SRI SRI

----- Increased Yields (often >50%)

Source : http://sririce.org

Additional Benefits

- Water savings: 30-50%
- Seed reduction: > 90%
- Fertilizer reduction: 20-40%
- Pesticide reduction
- Improved tolerance for pests and diseases
- Crop cycle 1-2 weeks shorter
- Improved drought tolerance
- Improved resistance to lodging
- Costs/ha (- 40% to up to +20%)
- Increased income /ha: +30 to +100%

Source : http://sririce.org

Motivations for SRI adoption differ

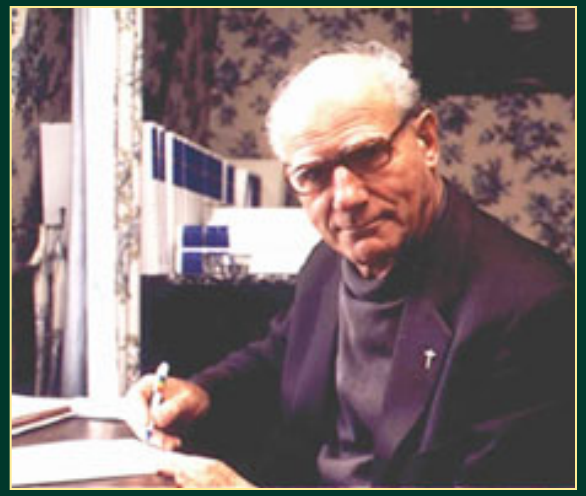
- Higher yields: food security most places
- Water saving: depletion of ground water
  India
- Pesticide reduction: heavy pesticide users
  Vietnam, Costa Rica
- Seed saving: multiplying traditional varieties
  Thailand, India, Mali
- Cost reduction: competitive rice production
  Dominican Republic

What is different?

Conventional Ag	SRI
• High plant density	• Low plant density
• No particular attention to early plant development	• Focus on early plant development
• Flooded fields – anaerobic soil conditions	• Intermittent irrigation – aerobic soil conditions
• New seeds/varieties	• Use own seeds/ revalue traditional seeds
• Plant nutrition: Chemical fertilizer	• Soil health: add OM for better plant nutrition and growth
• Buy inputs for higher production	• Start with what you have, improve upon it
• Researcher develops innovations, is expert	• Farmer develops innovations, is expert
• On-station research	• On-farm research

SRI 1.0

- 6 Practices proposed by Father de Laulanié, Madagascar
- Introduction of SRI methodology to Asia, Africa and Latin America since 2000
- Controversy (2004) - validity of SRI



F. Henri de Laulanié, Madagascar



DR Ambassador to Ecuador, June 2011



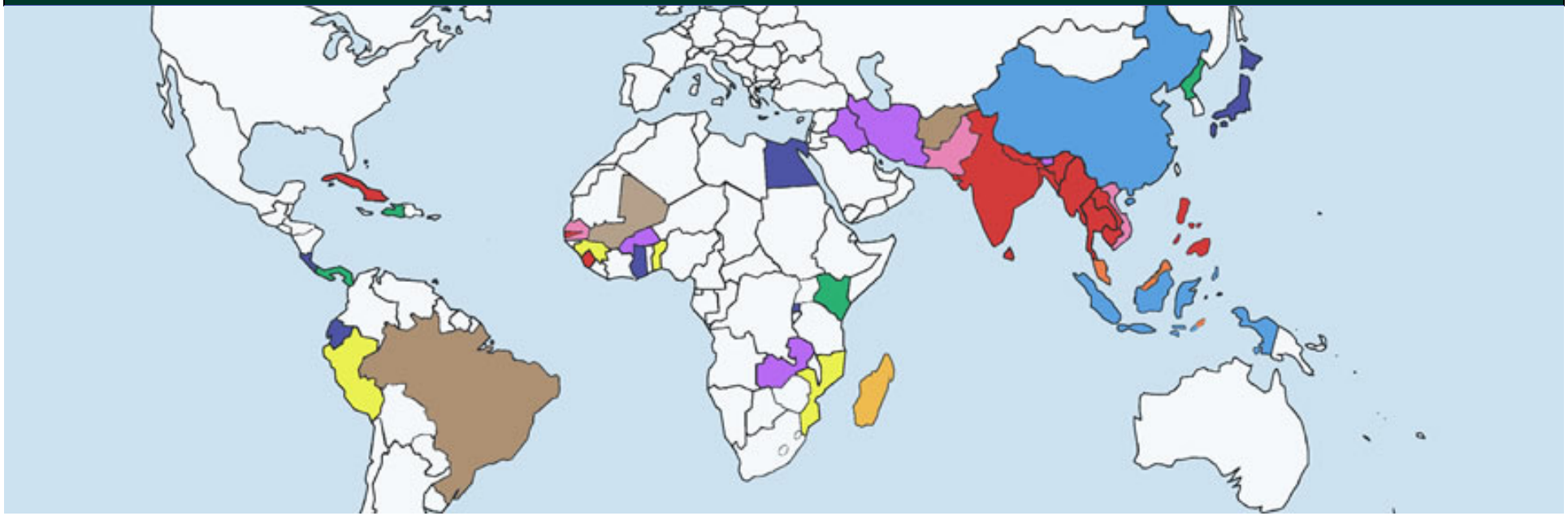
Mahamoudou Abdou, Timbuktu, 2007

Spread of SRI up to 1999



Madagascar

2011: Benefits of SRI management now validated in 44 countries of Asia, Africa, and Latin America



Before 1999: Madagascar
1999/2000: China, Indonesia
2000/01: Bangladesh, Cuba, Laos, Cambodia, Gambia, India, Nepal, Myanmar, Philippines, Sierra Leone, Sri Lanka, Thailand
2002/03: Benin, Guinea, Moz., Peru
2004/05: Senegal, Pakistan, Vietnam
2006: Burkina Faso, Bhutan, Iran, Iraq, Zambia
2007: Afghanistan, Brazil, Mali
2008: Rwanda, Costa Rica, Ecuador, Egypt, Ghana, Japan
2009: Malaysia, Timor Leste
2010: Kenya, DPRK, Panama, Haiti
2011: Korea, Taiwan

SRI 2.0

1. SRI methodology has been validated across different agro-ecological zones
2. Farmers lead innovation
3. SRI principles are applied to other crops
4. SRI principles are integrated with other agro-ecological approaches

SRI 2.0

1. SRI methodology has been validated across different agro-ecological zones
2. Farmers lead innovation
3. SRI principles are applied to other crops
4. SRI principles are integrated with other agro-ecological approaches


CON 3.6 t/ha SRI 9.5 t/ha
Tropical Climate, Medium Altitude: Bhutan


CON 6.5 t/ha
SRI 9.5 t/ha
Tropical Savanna Climate, Cuba

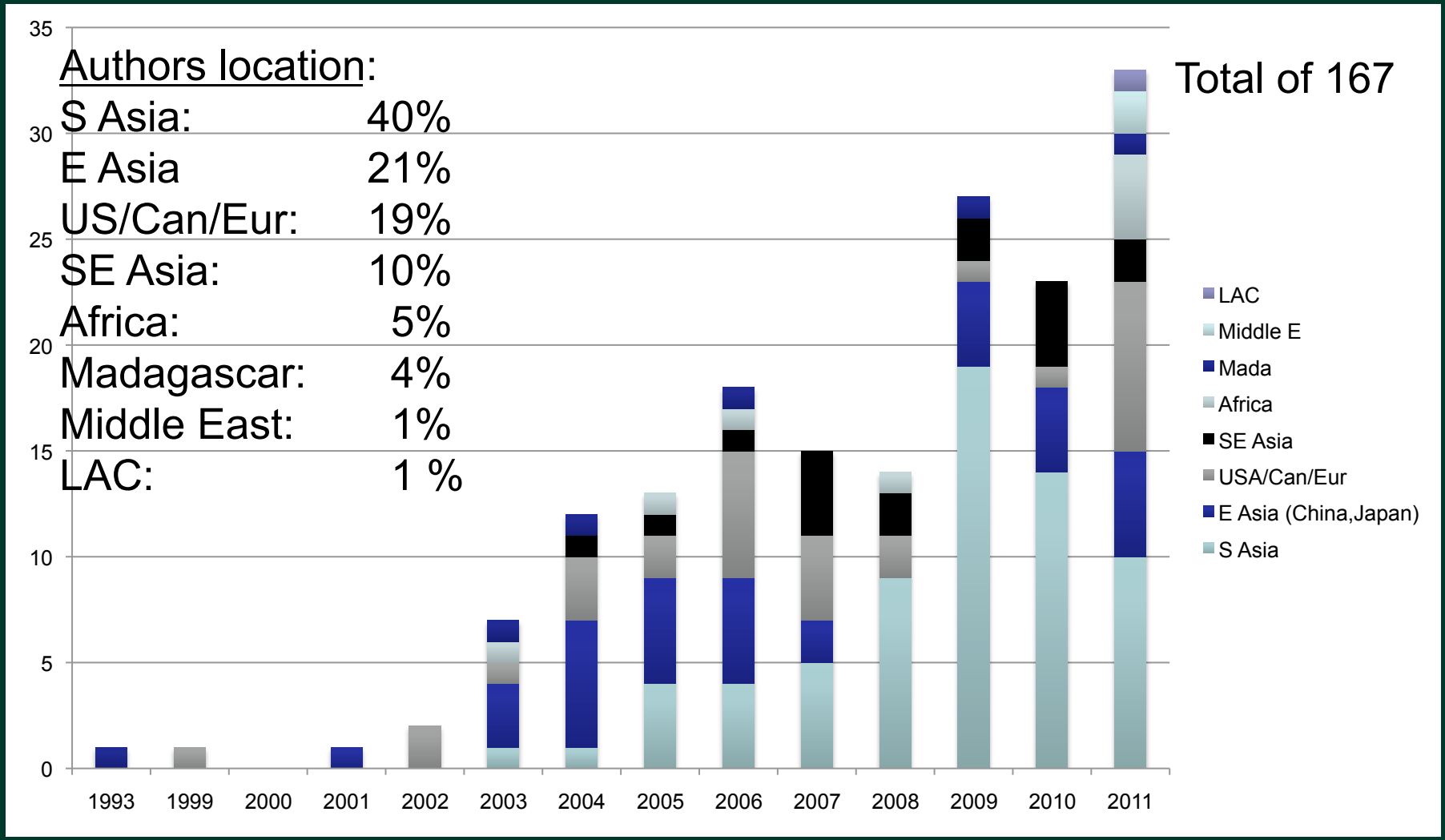

CON 5.6 t/ha
SRI 9.3 t/ha
High Altitude, semi-arid climate (1700m) Afghanistan


CON: 5.5 t/ha
SRI 9.1 t/ha
Arid Climate, Mali


CON: 1.8 t/ha
SRI 4.0 t/ha
Tropical Climate, Low Altitude; Cambodia – Rainfed SRI

Peer reviewed SRI articles*

(per year and region – not all articles from China included)



* Available through Mann Library; copies available at SRI-Rice

SRI 2.0

1. SRI methodology has been validated across different agro-ecological zones
2. Farmers lead innovation
3. SRI principles are applied to other crops
4. SRI principles are integrated with other agro-ecological approaches

SRI works well for resource-constrained smallholder farmers

- SRI is a knowledge-based methodology
- Farmers easily understand SRI
- Smallholders can work with their own resources and improve productivity of land, water, labor
- Spontaneous diffusion
- Farmers become the experts
- Farmer empowerment – leads to creation and spread of innovations (e.g. SRI principles for other crops)

Farmer innovations when using SRI practices

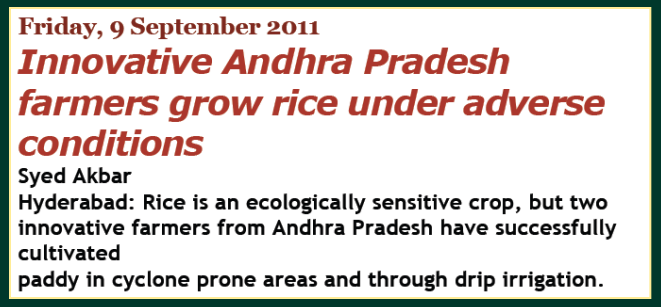
Soil preparation	Seed Selection	Nursery	Transplanting	Irrigation	Fertilization	Weeds	Pest & Diseases
Not specified	Not specified	Not specified	2 leaf stage 1 plant/hill Widely spaced	Alternate wetting and drying	Organic matter as base fertilization	Mechanical	Not specified
Conventional: Plowing, puddling Land leveling important Innovations: Minimum tillage No-till Raised bed	Select best panicles in field Eliminate top and bottom of panicles to select best grains for seeds Seed treatment with organic compounds e.g. vermicompost, Pelleting for direct seeding Seed soaking to eliminate	Raised bed nursery Good soil quality Not densely sown Watered 1-2x/day	1 leaf stage Direct seeding Parachute planting Broadcast and thinning with weeder Spacings adapted to soils &variety (20x20 – 35x35) Triangular spacing (China)	Daily irrigation Irrigation with intervals of 3-8 days	Compost Animal manure (cow, chicken, goat) Residue integration Foliage application from Agroforestry Cover crops Rotations Chemical fertilizers as needed	Incorporation of weeds into soil through mechanical weeder Early weeding important	Integrated pest management methods

Orange: 6 main practices, Blue: additional steps, **White**: local adaptations

> 50 technical manuals in > 15 languages available at sririce.org

How do we learn from innovating farmers?

- Farmer SRI innovations are ahead of research
- Difficult to know what farmers are doing
- Time gap between field results and awareness by researchers, development professionals, policy makers and donors
- The press is often a first voice for farmers (India)



Friday, 9 September 2011

Innovative Andhra Pradesh farmers grow rice under adverse conditions

Syed Akbar

Hyderabad: Rice is an ecologically sensitive crop, but two innovative farmers from Andhra Pradesh have successfully cultivated
paddy in cyclone prone areas and through drip irrigation.



Small scale farmers can help in climate adaptation

English.news.cn 2011-06-21 12:37:27 Feedback | Print | RSS |

by Prime Sarmiento

MANILA, June 21 (Xinhua) -- Farmer Ligaya Oria has never thought the onions she grew would be used in delicacies, nor did she expect to talk about her life as a farmer in front of a huge audience who included workers, social celebrities and government officials.

Challenges

Development

- Formal reporting is often not important for development organizations and farmers
- NGOs need assistance for good data collection, and to report and publish results

Research

- Publication of research results lags behind field experience by a few years
- Research questions should be informed by farmer experiences –
- or focus on understanding the mechanisms that influence plant productivity

Useful research questions

- Direct effects of SRI practices: crop cycle, pest and disease resistance, drought resistance, GHG emission, grain quality
- Crop and plant management: plant establishment: phyllochron dynamics, root-shoot interaction, phytohormon and rhizosphere dynamics, varietal response
- Soil and water management: minimum soil disturbance, GHG emissions, efficient soil biodiversity, soil aeration –- impact on plant productivity
- Socio-economic impact assessment: social development of farming communities, effects on gender, poverty, and food security.

SRI 2.0

1. SRI methodology has been validated across different agro-ecological zones
2. Farmers lead innovation
3. SRI principles are applied to other crops
4. SRI principles are integrated with other agro-ecological approaches


System of Finger Millet Intensification
PRADAN, Jharkand, India
First Report on SCI in 2005
SFmI
(A404)
TRADITIONAL (A404)
TRADITIONAL (LOCAL VARIETY)
1
2
3

System of Wheat Intensification (SWI)

India, Ethiopia and Mali
since 2006





Gembichu, Tigray Province, Ethiopia, 2009-10

SWI Seeding

2 seeds/hill
15x15cm or 20x20 cm in lines
(Bihar, India)







Weeders adapted to dry soil conditions

used for wheat, rainfed rice, mustard etc.





SWI fields in Bihar State, India









System of Wheat Intensification (SWI)

India, Bihar: from 1.6 t/ha to 3.6-4.5 t/ha

World Bank Project Jeevika:

2008: 415 farmers, 2009: 25,000 farmers, 2010: 48,000 farmers

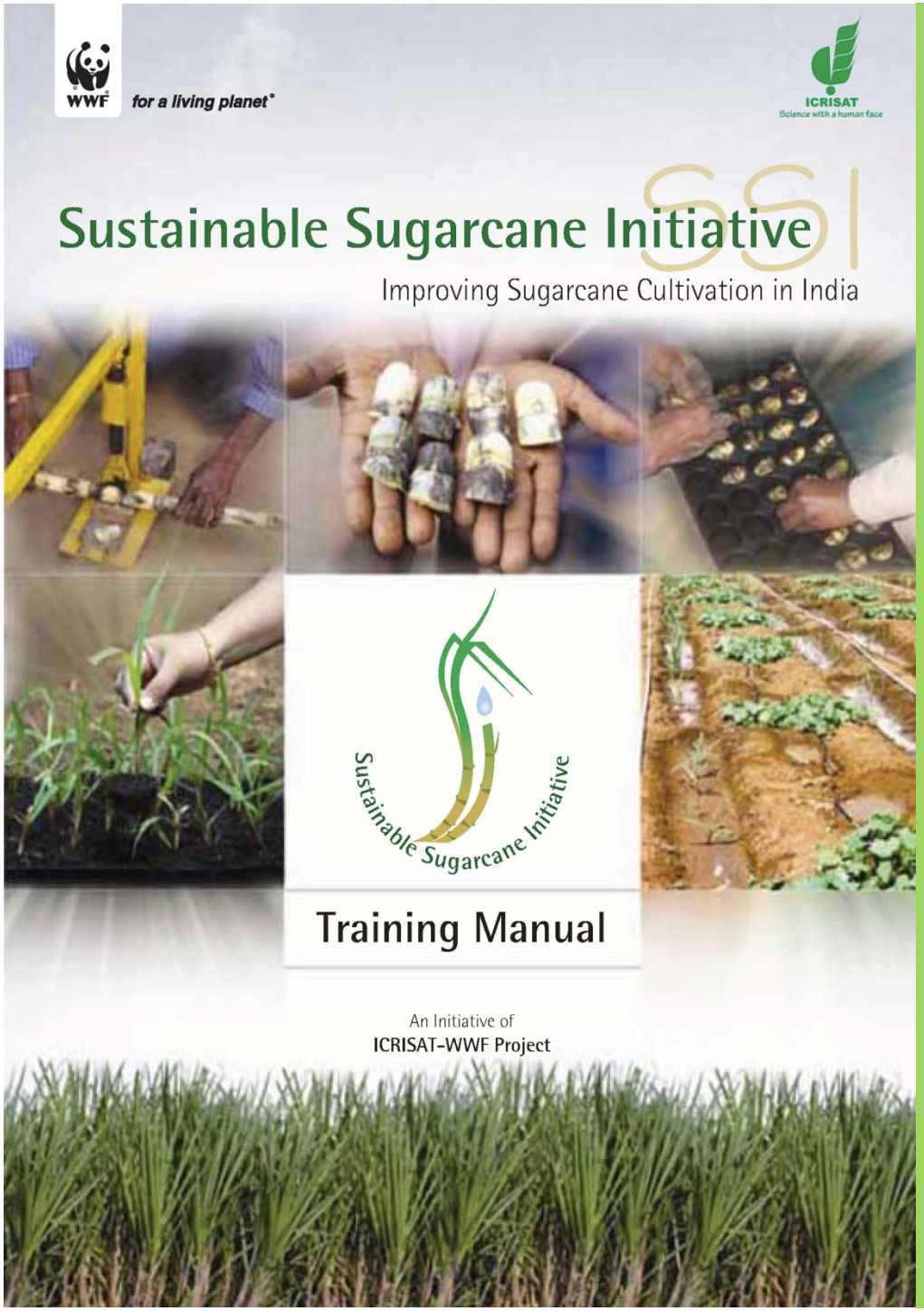
Mali, Timbuktu: from 2-2.5 t/ha to 4.5-5.0 t/ha

(Styger and Ibrahim, unpublished)









Sugarcane

With SRI method

Yields are by > 50% improved

30% reduction in water use

25% reduction in chemical fertilizer

Developed in India (2005)

Ethiopia – “Planting with Space”



- Wheat
- Barley
- Teff
- Rice

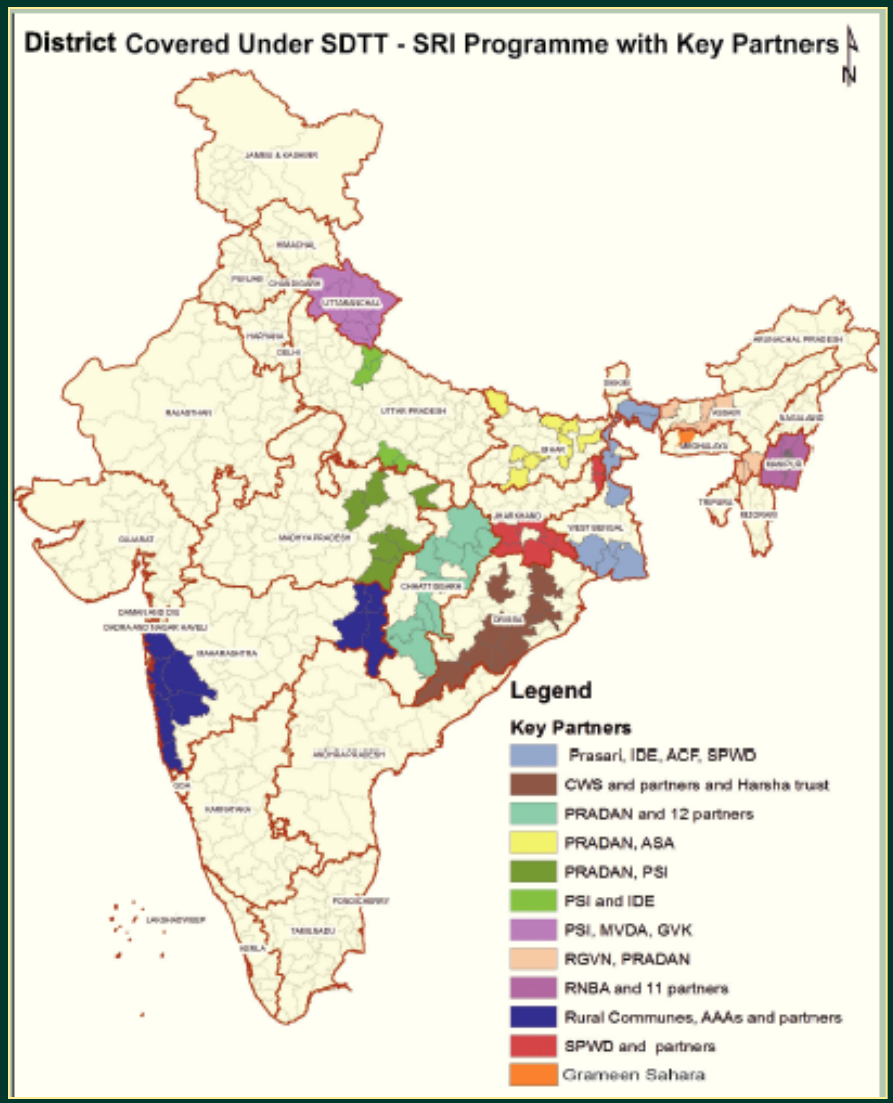
- Onion
- Tomato
- Chili
- Cabbage
- etc

Source : http://sririce.org

SDTT Sir Dorabji Tata Trust

- Funding of SRI programs in 12 States
- Including Wheat, Sugarcane, Finger millet, Mustard, Vegetables





Source: http://sdtt-sri.org/

SRI 2.0

1. SRI methodology has been validated across different agro-ecological zones
2. Farmers lead innovation
3. SRI principles are applied to other crops
4. SRI principles are integrated with other agro-ecological approaches

Evolving concepts in agriculture

- Traditional systems: not efficient enough
- Green Revolution: input based, limitations
- Ecological approaches for sustainable agriculture intensification: potential to explore



Integrate ecologically- based approaches

- Conservation Agriculture
  - Minimal soil disturbance, soil cover, rotation
- SRI Principals for Crop Production
  - Crop productivity, water saving, soil protection
- Integrated Pest Management (IPM)
- Agroforestry
  - Using interactive benefits combining trees, shrubs with crops and/or livestock
- Ecoagriculture / Watershed Management
  - Landscape approach to NRM, agricultural production, biodiversity mgt and livelihood support

Conclusions

- Think and work more holistically – consider farming systems within the landscape
- Focus on win –win –win approaches – environment, production, social impact
- Get closer to the farmer – pay attention to farmers' innovations and build on them
- SRI is an 'easy' ecological approach that shows quick benefits and provides an entry point to tackle more time-consuming and complex environmental management issues at the larger scale

Thank You!



SRI-Rice : http://sririce.org
Email: sririce@cornell.edu, eds8@cornell.edu

SRI farmers from the village of Donghoi, Timbuktu, Mali

Thakur et al (2011) Methods

- SRI – Standard Management Practices (SMP)
- SRI: AWD during vegetative stage, single seedling, 12 days old, 20 x 20 cm, Cono-weeding 3x,
- SMP: continuous flooding, three seedlings, 25 days old, 10 x 20cm, hand-weeding 3x
- For both same fertilization: 5t/ha organic manure, 80kg/ha N, 40 kg/ha P_2O_5, 40 kg K_2O

SSI: Sustainable Sugarcane Initiative

- Raise single budded chips in nursery (150kg/ha vs 10t/ha)
- Transplant young seedlings (25-30 days old)
- Maintain wide spacing (5 x 2feet)
- Provide sufficient moisture, but no flooding – drip irrigation
- Encourage organic fertilization and IPM
- Practice intercropping at beginning (4-5 months)
- Yield : 250t/ha vs 120 t/ha (TNAU,2011)



TNAU: SSI experimental plot with drip irrigation