The System of Rice Intensification (SRI)

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What is SRI?

- The **System of Rice Intensification (SRI)** is a climate-smart, agroecological methodology for increasing the productivity of irrigated rice cultivation by changing the management of plants, soil, water and nutrients, while reducing external inputs.

- Developed in the 1980s in Madagascar by Father Henri de Laulanié

Source page web: http://sririce.org
Young seedlings (8-12 days) 1 seedling / hill  Wide spacing 25x25cm and more

Older seedlings (25-45 days) 3-5 seedlings / hill  Close hill spacing 10x15 cm

Conventional rice cultivation
SRI cultivation practices

Alternate wetting and drying
Organic matter as base
Mechanical weeding

Conventional rice cultivation

Continuous flooding
Use chemical fertilizer
Herbicide use / hand weeding
SRI methodology

- Early, quick and healthy plant establishment
- Reduce plant population – to reduce competition for resources
- Enrich soils with organic matter – keeping soils aerated favors soil microbial development
- Reduce water applications – through alternate wetting and drying water management
Summary of SRI Benefits

- Yield Increase: often >50%
- Water savings: 30-50%
- Seed reduction: > 90%
- Chemical fertilizer reduction: 20-40% (to 100% = organic SRI)
- Less pests and diseases (less pesticides)
- Improved tolerance to drought and strong winds

http://sririce.org
SRI practices induce a phenotypical change in rice in IRAQ's Al-Mishkhab Research Center, Najaf: SRI on left, Non-SRI on the right
Physiological and morphological changes of SRI plants

- Tillers are thicker (+38%), Plants are taller (+24%)
- More tillers / hill (+100%)
- Greater canopy angle -- 33° vs 18°

Physiological and morphological changes of SRI plants

More tillers per plant

More Roots, which are deeper and longer

Non-SRI SRI

Non SRI - flooded conditions

SRI – non flooded conditions

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

- More or similar number of panicles/ m²
- Longer panicles (20%)
- More grains/panicle
- Fewer empty grains
- 1000 grain weight is heavier

----- Increased Yields (often >50%)
SRI Benefits have now been seen in over 50 countries of Asia, Africa and Latin America.
Major rice growing systems in the World

<table>
<thead>
<tr>
<th>System</th>
<th>Upland</th>
<th>Floodprone</th>
<th>Lowland</th>
<th>Irrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>World area:</td>
<td>14% area,</td>
<td>8% area,</td>
<td>32% area,</td>
<td>47% area,</td>
</tr>
<tr>
<td>World supply</td>
<td>4% supply</td>
<td>2% supply</td>
<td>19% supply</td>
<td>75% supply</td>
</tr>
<tr>
<td>Yield t/ha:</td>
<td>1 t/ha</td>
<td>1.5 t/ha</td>
<td>2.3 t/ha</td>
<td>5 t/ha</td>
</tr>
</tbody>
</table>

Source: AfricaRice, 2010
Tropical Climate, Medium Altitude: Bhutan

CONV. 3.6 t/ha  SRI  9.5 t/ha

Tropical Savanna Climate, Cuba

CONV. 6.5 t/ha  
SRI  9.5 t/ha

Afghanistan

High Altitude, semi-arid climate (1700m)

CONV. 5.6 t/ha  
SRI  9.3 t/ha

Arid Climate, Mali

CONV. 5.5 t/ha  
SRI  9.1 t/ha

CONV: 1.8 t/ha  
SRI  4.0 t/ha

Tropical Climate, Low Altitude Cambodia – Rainfed SRI
Growing Other Crops with SRI principles (SCI)

1. Early establishment, 2. Reduce competition, 3. Improve soil fertility, 4. Irrigate only as needed (reduced water application)
Mechanization for SRI

Lack of available, reliable, low-cost equipment is a bottleneck for scaling up SRI beyond the current 10 million+ primarily small-scale SRI farmers who are using these methods worldwide. These include:

• Weeders
• Transplanters, or
• Direct seeders
Weeders

- Hand-pushed and motorized
- Single row to multi-row
- Animal traction, hand tractors, tractors

**Challenges:**
Acquisition and intra-row weeding
Homemade weeder from India
Innovations from Malaysia
Weeding: How and Why

• First weeding at 10-20 days after transplanting, repeat every 7 to 10 days
• Incorporates weeds into soil
• Aerates soil
• Stimulates root growth
• Redistributes water across the plot
Japanese weeder with intra-row weeding capability?
Markers

Markers are used to indicate where to plant to achieve a square planting pattern of 25cm x 25cm.
Rice transplanters

- **Conventional transplanters** plant a few seedlings/ hill, irregular and close spacing between hills in a row
- **Challenges:** SRI transplanters should be able to handle small single seedlings with precise spacing 25 cm between plants.
- No good and widespread SRI transplanter developed yet
Non-rice transplanters used for SRI rice plantings

Vegetable grower in New Jersey, USA
Rainflow vegetable transplanter can handle small single seedling, and precise spacing between plants

Pakistan, FarmAll Technology
Vegetable transplanter used on permanent raised beds
MSRI: Mechanized SRI
Asif Sharif, FarmAll Technology Ltd, Pakistan

- Fully mechanized - no-till, permanent raised beds – organic fertilization
- Yields: >10t/ha
- Water productivity: 0.92 kg/m3
SRI Rice in New Jersey USA, 2013

Young single seedling, wide spacing, organic fertilization, drip irrigation
SRI Rice in New Jersey USA, 2013

Arborio rice
Direct Seeders for Rice

Challenges for direct seeding with SRI:
Seeders with 25 cm x 25 cm spacing between hills that can reliably deliver 2 seeds/hill still need to be designed.
Direct seeding with the Drum Seeder

Drum seeders provide line seeding but do not achieve precise distance between hills.
Mechanization needs

- Weeders, transplanters and direct-seeders need to be adapted to the SRI system (spacing, number and age of seedlings)

- Solid, simple and affordable equipment needs to be developed and made available to small-holder farmers in Asia, Africa and Latin America

- Reliable sources of information on building or acquiring equipment need to be made available
Why Share Designs?

1. We can use, test and compare the same design (or component such as a rotor)

2. Compare results and make modifications

3. Suggest/develop new equipment

4. Communicate ideas clearly and quickly

5. Incorporate designs from sources such as Conservation Agriculture
Computer Aided Designs allow sharing, standardizing (or modifying) components for multiple SRI research programs and SRI demonstration sites.
Conoweeder design
Thank you!
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