SCI/SRI: sound crop science principles (1)

and

What type of *intensification* are we talking about?

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Delhi,

June 2014

Intensification in a historic context

Following World War II Europe was economically in shambles / crisis:

- Industrial capacity damaged /destroyed
- Serious food shortages
- Archaic agricultural sector of many inefficient smallholders: need to restructure and modernize.
- Government policies supported by “Marshall aid”.

Agricultural sciences and policies: the "intensification" doctrine

- Scaling up through mechanisation
  - Increased farm size
  - Increased specialisation

- Cropping system intensification
  - "Improved", short statured varieties: new seeds
  - Increased plant densities (high seed rates)
  - Mineral fertilisers (nitrogen in particular)
  - Irrigation / drainage
  - Regular crop protection treatments

Issues not, or poorly, addressed by the "intensification" doctrine

- Soils and soil organic matter
- Roots and root systems
- Soil biota
- Interactions between : soils x roots x biota

SRI/SCI: a confrontation between

science / theory–steered technologies

(the modern, green revolution agriculture;

a top-down orientation)

and

field-level (empirical) farming practices

(as evolved through generations of farmers;

a bottom-up orientation)

The SRI / SCI package of practices as compared with conventional, *best* practices

SRI/SCI agro-ecological:

- very low seed rates
- very young transplants:
  8 to 15 days old
- single transplants/hill
- wide spacing:
  20x20 to 50x50 cm
- no flooding, moist soil
- compost
- 3 to 4 rounds rotary hoe

Modern, conv. (irrigated):

- high seed rates
- young transplants:
  about 21days; or older
- 3-5 transplants/hill
- narrow spacing:
  10x10 to 20x20 cm
- continuous flooding
- min. fertilizer + N topdr.
- 2 rounds rotary hoe / herbicide

SRI versus conventional best practices

SRI rice: widely-spaced, tillering plants, heavy panicles

Conventional rice: closely spaced plants: high density, small panicles

Liberia : a good SRI crop

(photo Robert Bimba)

Similar principles for other crops

SWI: Farmer “Steendijk” in Holland

Root development under SRI/SCI

(data courtesy A. Thakur)

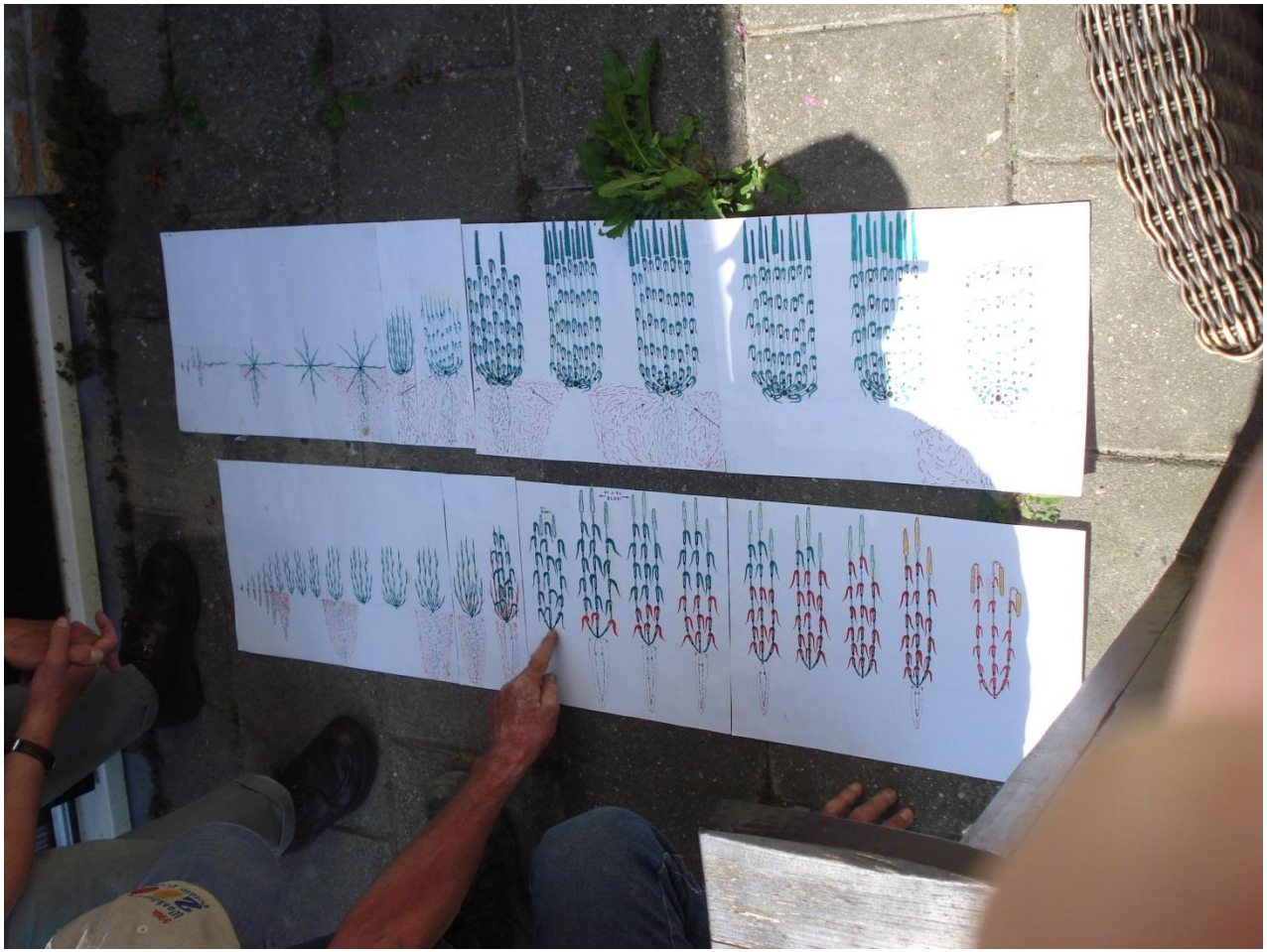
	Plants / m2	Plants / hill	Root dry weight (g) per hill	Root dry weight (g) per m2
Conventional rainfed rice	150	3	4.2	206
Rainfed SRI	25	1	7.5	187
Rainfed SRI + suppl. Irrigation	25	1	10.2	254

Root development: a time and space effect

on left a plant that remained in the nursery for 52 days;
on right a plant transplanted in a widely spaced grid after 9 days

Conventional (densely) seeded wheat vs low density, dark green SWI (Uttarakhand; India)

Farmer Steendijk's diagram: SWI versus Conventional



SRI/SCI research: major results

- Most crop varieties (local and improved) respond positively to SRI / SCI practices.
- Drastically reduced (1/5th to 1/10th) seed rates increase the physiological efficiency of phenotypes.
- Expanded root development per plant leads to an increased efficiency in moisture and nutrient uptake from the soil (Thakur et al., 2013).

Implications for further (SRI) agronomic research

- Water management at different crop growth stages.
- Water management in relation to weed control.
- Timing and intensity of (mechanical) weed control.
- Impact of ratio “below / above ground” plant development on physiological processes.
- Nitrogen requirements (N-cycle) in relation to root development and soil health.

Conclusions and implications of SRI/SCI

Overall effects:

increased yields;

reduced costs (savings on seeds; on chemicals: mineral fertilizers / plant protection and on labor).

SRI research is exposing major knowledge gaps in Green revolution / conventional / modern agriculture.

Conclusion: Conventional (science-steered) intensification has seriously overshot its target thereby even endangering sustainability !

What kind of *intensification* do we need to feed the world?

Farmer relevant *knowledge*

or

Academic *theories* and *models*