Research on System of Rice Intensification – Initial Experiences

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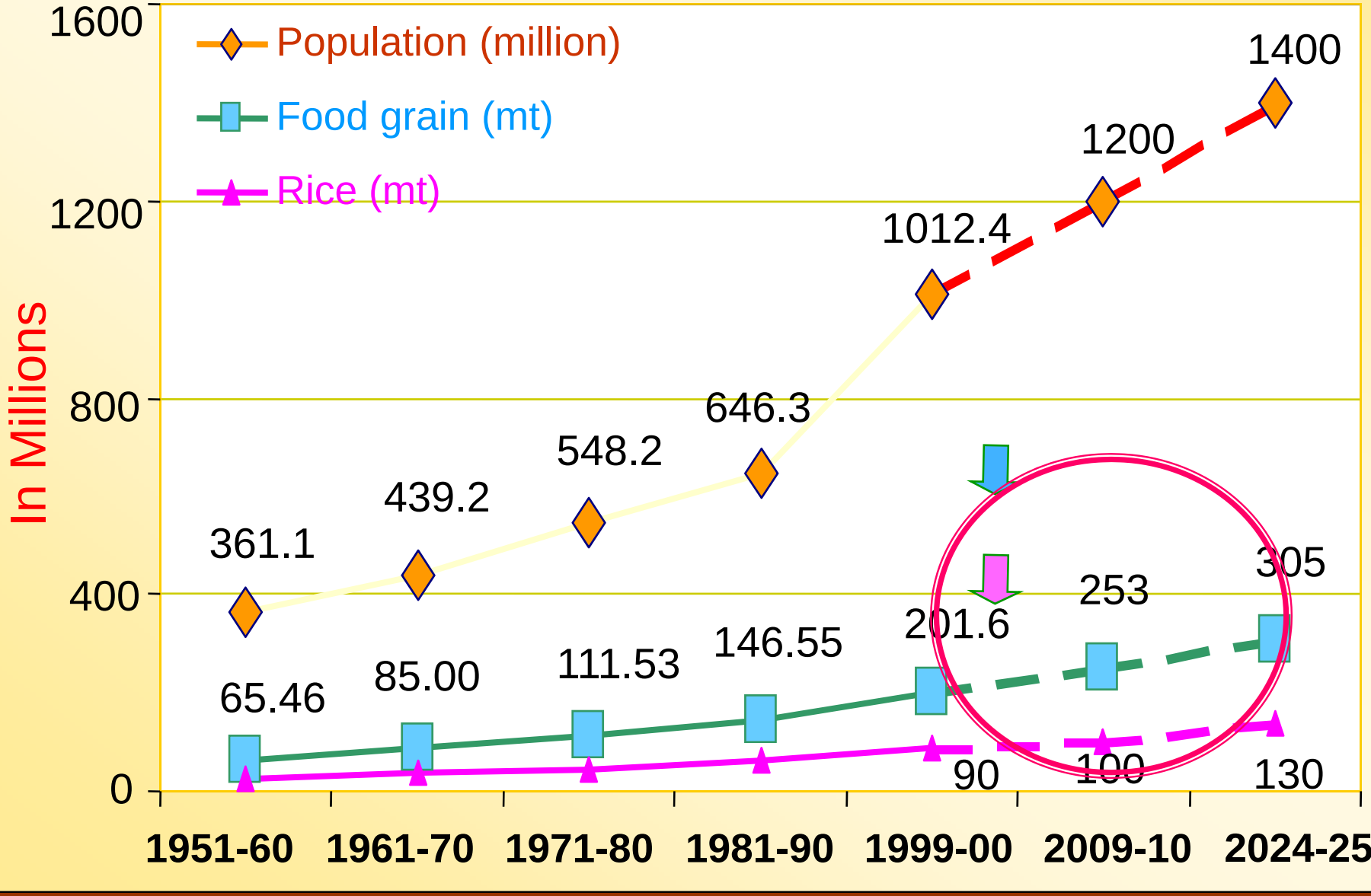
Rice in India

- **It is the staple food for > 70% Indians, and it holds the key for food security.**
- **Grown in 42.5 m.ha with a production of 88 m.t.**
- **Occupies 25% of cropped area and contributes about 24% to AGDP.**
- **Earns about 7000 crores of foreign exchange.**
- **It is a source of livelihood for millions of farm families.**

Population, production of food grains, and rice trends and projections

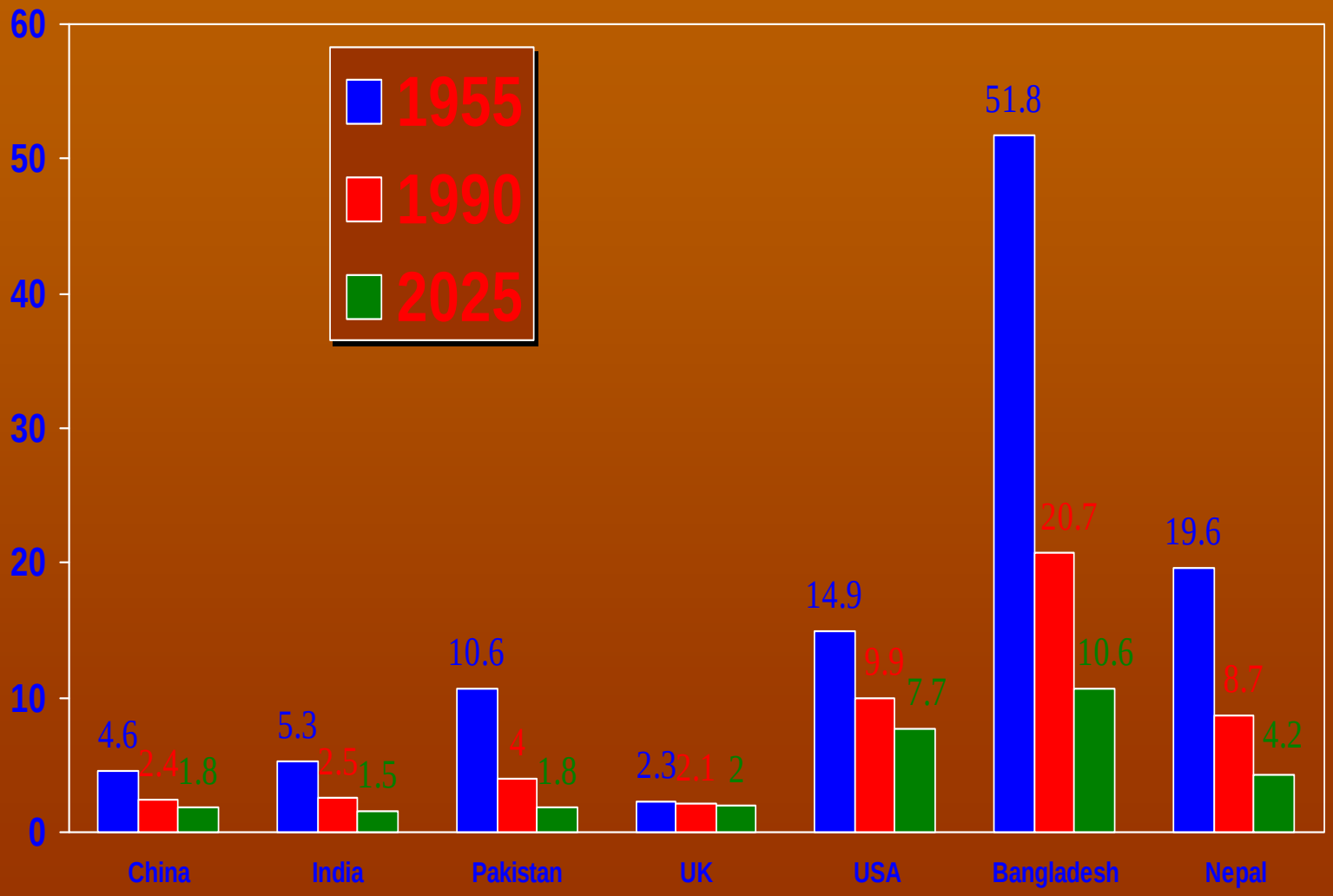


Challenges for enhancing rice production

- Declining resource base
  - Land
  - Water
  - Labour
- Deteriorating soil health
- Increasing environmental concerns
- Increasing cost of cultivation

Among these water is

Per capita water availability in selected countries (000 m^3)



Rice and Water

- 80% of fresh water is used for agriculture.
- More than 50% of this is consumed by the rice crop.
- Rice consumes about 4000-5000 liters of water to produce 1 kg of grain.
- Irrigated rice cannot be ignored as it contributes significantly to food security.
- Little scope to save water from other irrigated dry crops.
- Hence, pressure would be on rice cultivation to cut down the water requirement.

What is SRI ?

- **It is a set of modified practices for growing rice which was developed in Madagascar in 1983 by Father Henri Laulanie**

Features	
Planting young seedlings	8 – 12 days old
Planting single seedling/hill	Along with soil
Wider Spacing	25 cm x 25 cm
Organic manuring	Compost , Gm , Straw
No standing water till PI stage	Alternate wetting and drying
Aerated Soil	Weeding by Cono-weeder

Claims of SRI method

- **High yields (up to 10 – 20 %)**
- **Water saving (up to 50%)**
- **Improved soil health**
- **Improved input use efficiency**
- **Lower seed requirement**

Keeping in view of the above, need to validate these claims, research work was initiated by DRR in 2003

DRR trial - A prelude to multi-location trials

Season	-	Rabi 2003
Treatments	-	Normal transplanting, SRI with 12d old seedlings, SRI with 25d old seedlings, normal planting with wider spacing (25 x 25 cm).

Results:

Yields in SRI were higher in SRI by 16.6%

Planting young seedlings is beneficial

Hybrids performed better than varieties

Hybrids – Yield increase 46 - 48%

Varieties – Yield increase 5 – 17%

Pusa Basmati did not perform well under SRI.

Multi-location trials on SRI under AICRIP were conducted during kharif 2004 , 2005 and 2006 seasons (21 locations)

State (2005)	Location
Andhra Pradesh	Rajendranagar (Hyderabad)
Assam	Karimgunj, Titabar
Bihar	Patna, Sabour
Chhattisgarh	Jagdalpur
Gujarat	Nawagam
Himachal Pradesh	Malan
Jharkhand	Ranchi
Karnataka	Mandya, Siriguppa

State (2006)	Location
Orissa	Chiplima
Punjab	Kapurthala
Pondicherry	Karaikal
Tamil Nadu	Aduthurai, Coimbatore
Tripura	Arundhatinagar
Uttar pradesh	Varanasi
Uttaranchal	Pantnagar, Almora
Meghalaya	Umiam

Contd….

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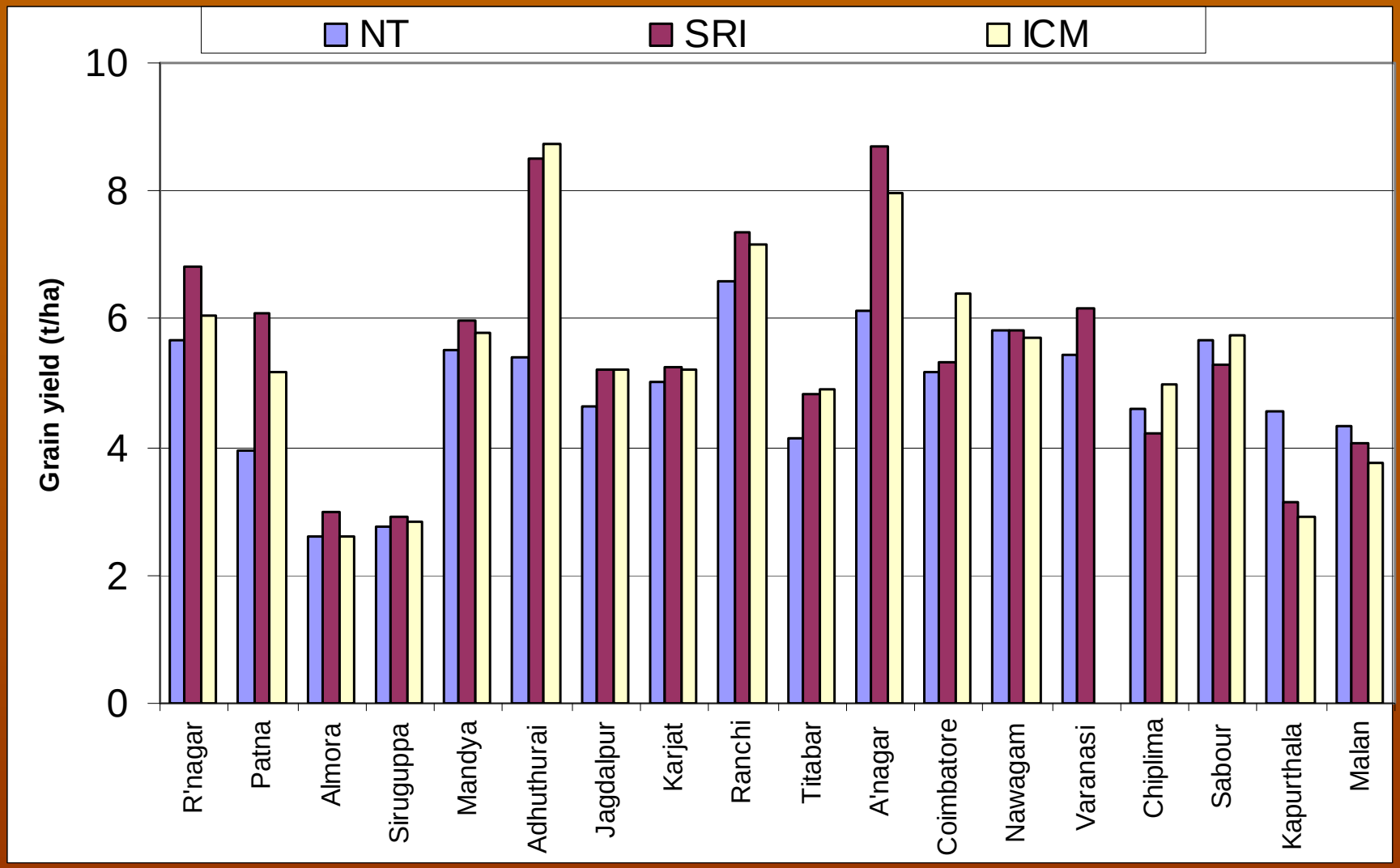
Results of Multi-location Trials Kharif 2004 -- Locations :21

- **Performance of SRI varied from location to location**
- **SRI gave higher yield (7-42 %) than control at 11 locations with mean of 12 %**
- **Varieties responded differently**
- **SRI and ICM were on par at 4 locations**
- **At Kapurthala and Malan, normal method was better than SRI**
- **KRH-2 performed better**
- **Increased yield was due to increased no. of panicles.**



Grain yield under different methods of crop establishment – Kharif 2004

Multi-location Evaluation of SRI
Results of Kharif 2005

- SRI was significantly better than normal transplanting at 10 locations (Yield increase -5.0-69 .9 % with a mean of 25%
- SRI and ICM were on par at 7 locations.
- SRI performed better in southern and central India
- SRI recorded lower yields than normal planting at 4 locations (Karaikal, Kapurthala, Pusa, Malan)
- Yield increase of SRI was higher in acidic soils as compared to alkaline soils

Contd….

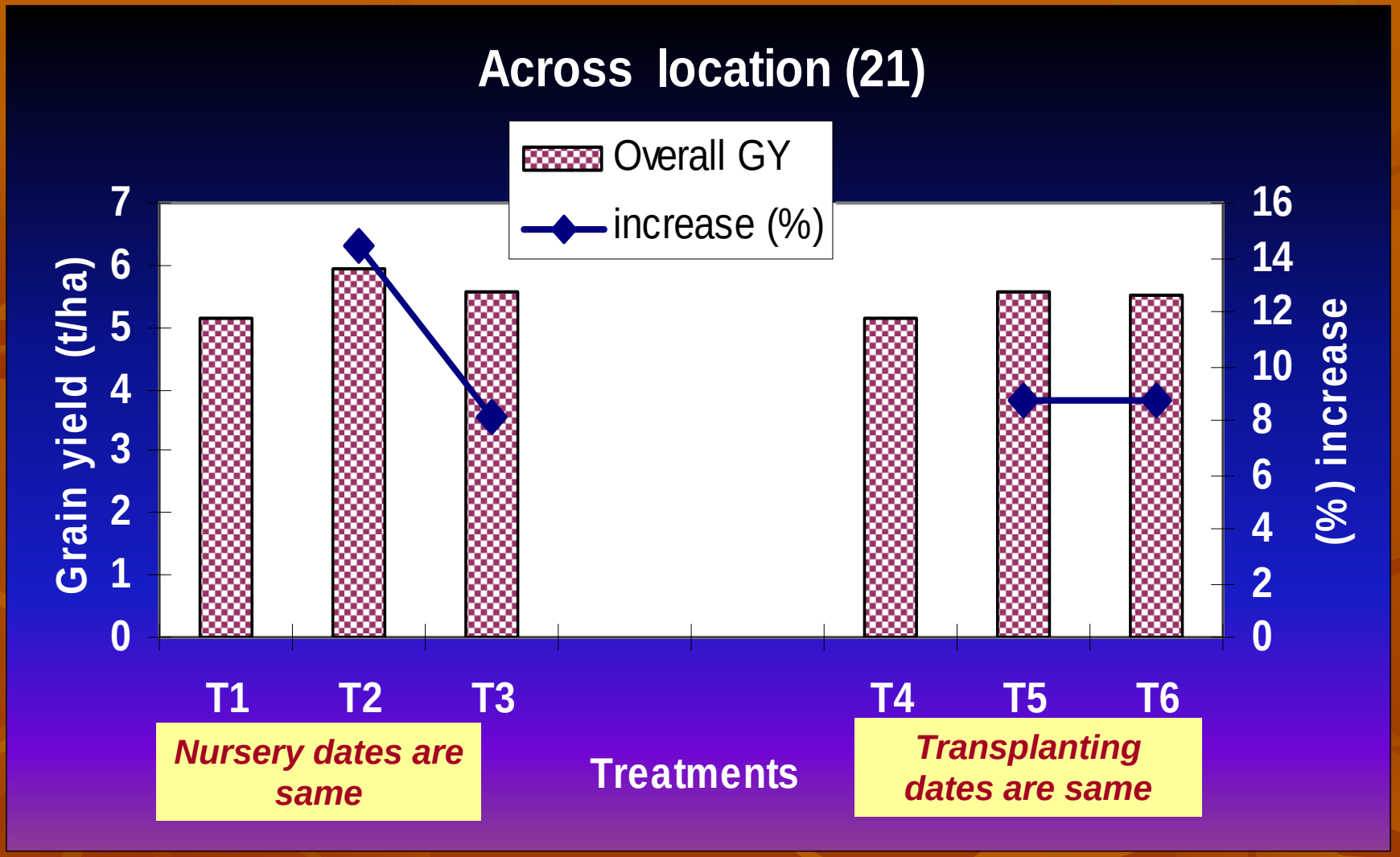
Crop establishment method for increasing yield in TP rice (SRI, ICM & TP), Kharif 2006

Locations - 27 Significant at 21 locations

- ***SRI method promising at 13 out of 21 locations***
- ***ICM comparable with SRI – 3 (KNP, UMM, MLN)***
- ***Standard transplanting at 5 locations (MND, KRK, MRT, CHP, PDY)***
- ***Mean increase in grain yield across locations (21)***

With SRI – 11% With ICM – 8%

SRI performance is better when nursery sowing date is same as compared to transplanting date.



Performance of different methods of crop establishment in different regions

Vigorous root system (right) under SRI

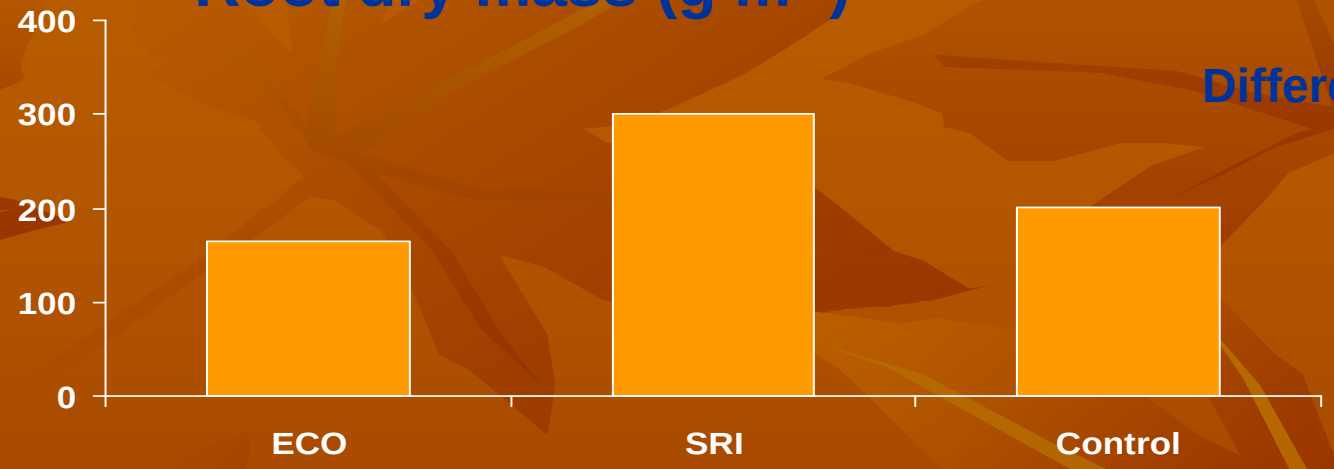
60 d old plants under SRI and normal TP

Collaborative research by DRR and ICRISAT

- Treatments were SRI, ECO-SRI (fully organic methods) and normal transplanting
- Water supplied to each plot was measured with water meters
- Nutrients added to all treatments were calculated on N basis
- No pesticides were applied, as there was no serious pest attack

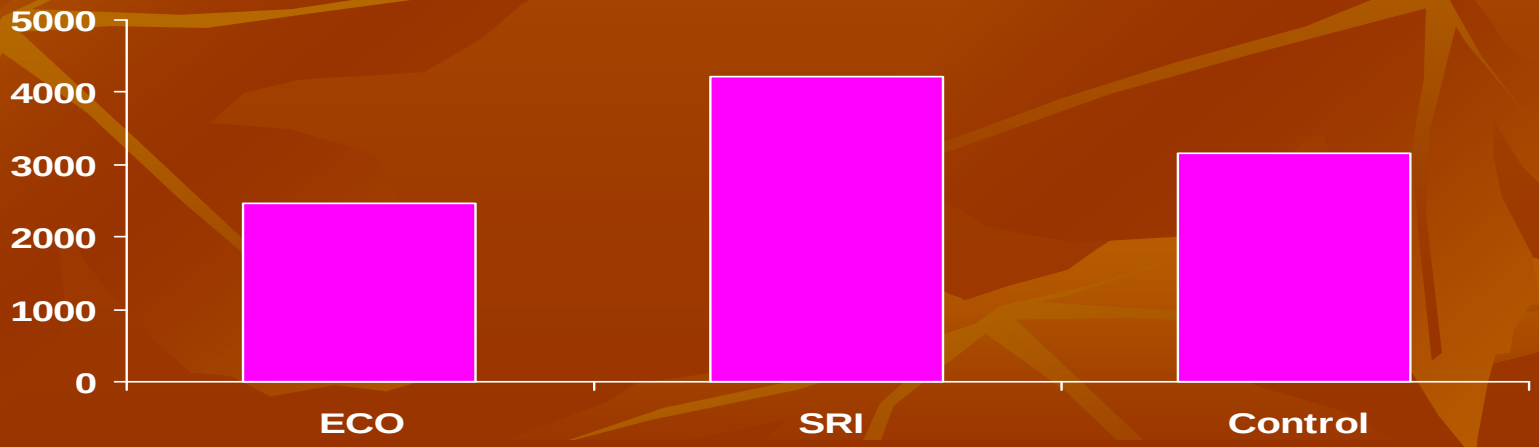
Mean Root Mass and Root Length Density, Rabi 2006, DRR Fields

Root dry mass (g m^{-3})



Differences: **

Root length density (cm m^{-3})



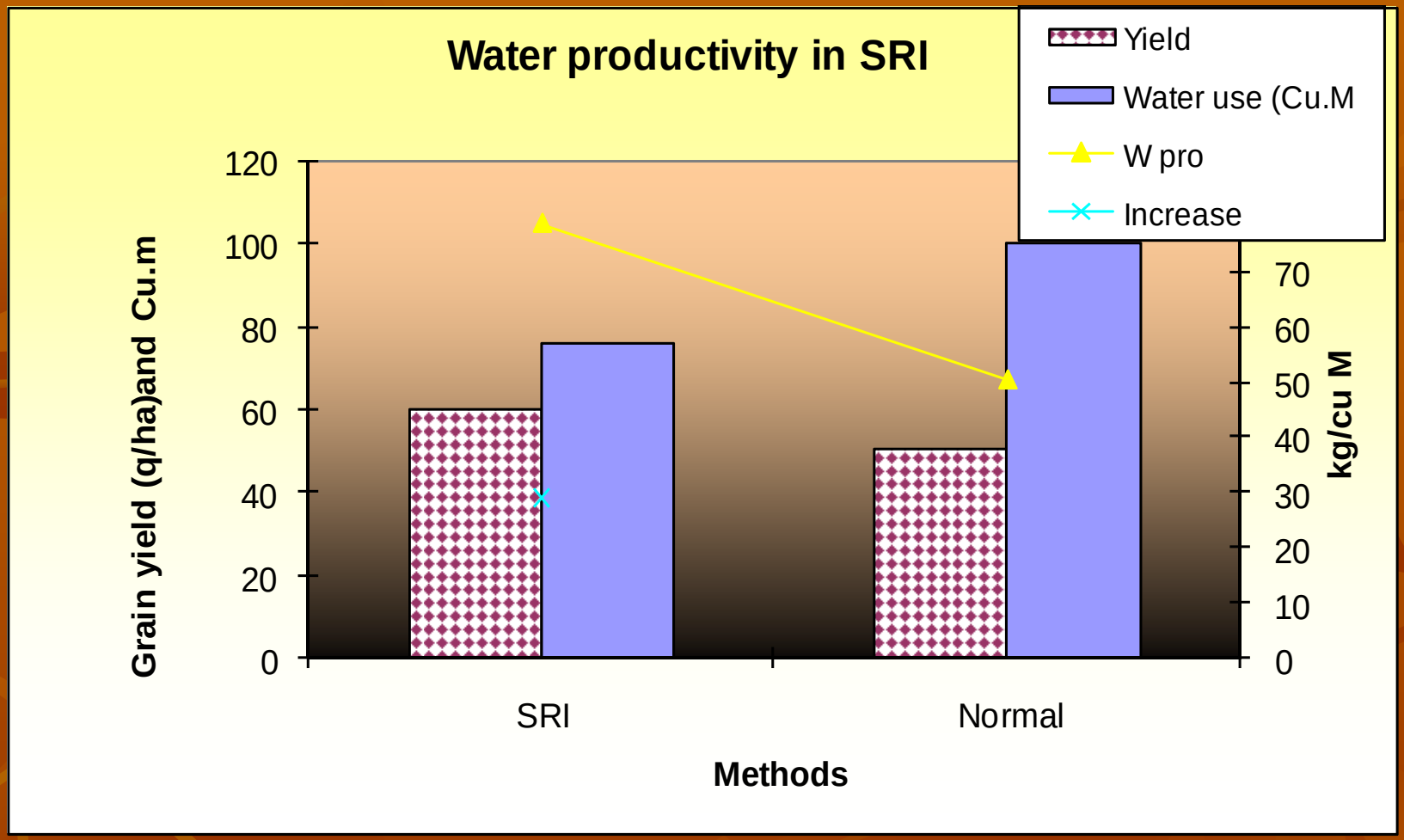
Differences: *

Other Salient Observations

- **Managing soil moisture in SRI plots and keeping them weed-free was the biggest challenges**
- **SRI plots remained unimpressive even up to flowering**
- **Pest damage was lower in SRI plots than in normal plots**
- **Plants in SRI plots were greener than those in normal plots**
- **Grain yield increase by 10% in SRI**
- **Water use decreased by 29% (SRI 79 Cum)**

Way Forward/Take-Home Message

- Root mass, root length density of plants in SRI plots was higher than that of controls and need more studies (over depth).
- Bigger, better (non-black) and deeper roots together with the generally high microbial activity may explain higher yield in SRI and needs to be studied
- More studies needed, particularly through long-term experiments, including addressing the issues of soil nutrient depletion in SRI plots and adoption of SRI by farmers to help policy makers towards its scaling up

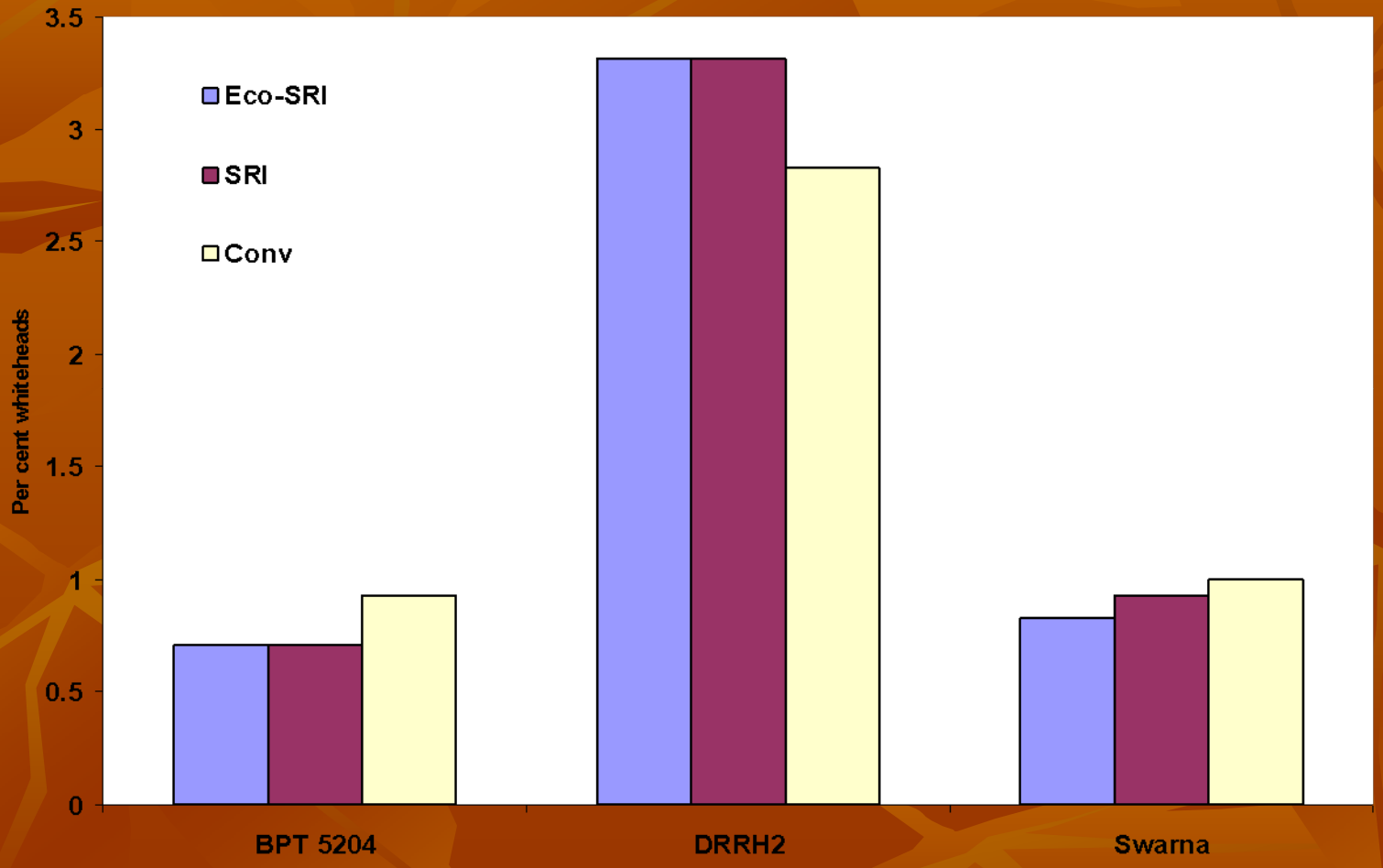


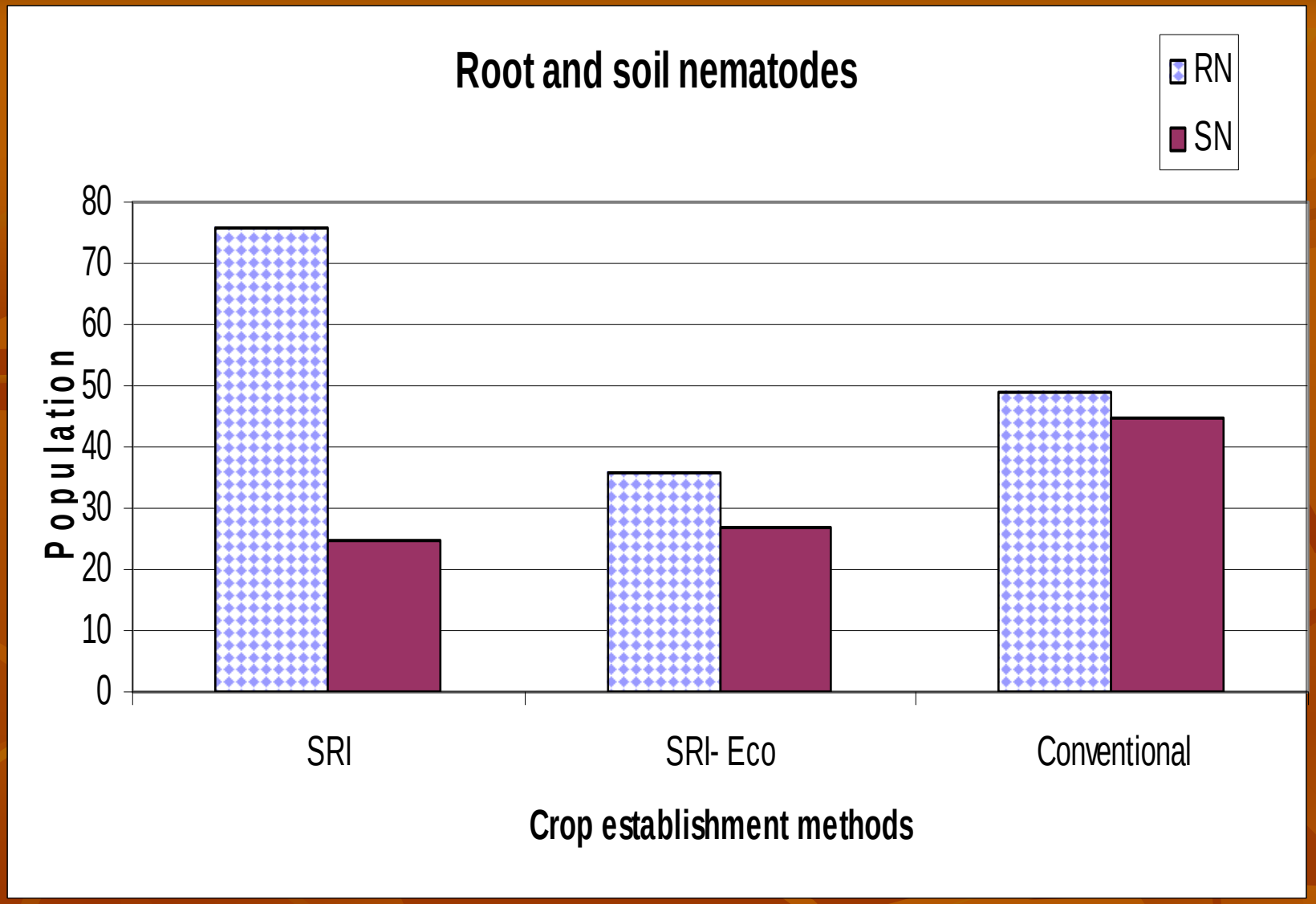
- Grain yield increase by 10% in SRI
- Water use decreased by 29% (SRI 79 Cum)
- Water productivity up by 20%

Water productivity in SRI vs. flooded rice


SRI-SHANTI

Stem borer damage at flowering stage





Nematode population as influenced by crop establishment methods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Conclusions

- SRI practice is significantly superior to the conventional method in more than 50% locations indicating that it does not do well at all locations.
- The performance of SRI was variety-specific, and hybrids performed better than varieties irrespective of date of sowing.
- The mean yield advantage observed under SRI over the conventional method varied from 10 to 16 per cent.
- SRI performance was not satisfactory at Malan and Kapurthala.
- Acidic soils responded better to SRI method.

Future Thrust Areas for Research on SRI

- Varietal response to SRI and designing suitable plant type
- Identification of areas/zones most suited for SRI method
- Precise quantification of savings in water
- Effective weed management and refinement of machinery
- Detailed studies on soil health and microbial activity
- SRI vis-à-vis pest and disease incidence and their management.
- Detailed economics of SRI and cost : benefit analaysis.


Thank you one and all
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