# Research on System of Rice Intensification (SRI) in India and Priorities for the Future

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# Rice in India

- A staple food for >70% Indians, and it holds the key for food security
- Grown on 43 m. ha with a production of 93 million tons
- Occupies 25% of India's cropped area and contributes about 24% to agric. GDP
- Earns about Rs. 7,000 crores of foreign exchange
- Under NFSM, rice production is to be increased by 10 million tons by 2011-12

# Challenges for enhancing rice production in India

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

**Among these, water is becoming a critical factor and will become scarcer and scarcer**

# Rice and Water

- 80% of fresh water is used for agriculture
- More than 50% of this is consumed by the rice crop
- Rice presently requires about 4000-5000 liters of water to produce 1 kg of grain
- Improvements in irrigated rice cannot be ignored as it contributes significantly to food security
- The need of the hour is to improve water use efficiency of the rice crop

# Water-saving strategies and options in rice cultivation

## Genetic approaches

- Designing water-use efficient varieties and hybrids

## Management approaches

- Zero tillage
- Alternate wetting and drying (AWD)
- Raised bed method
- Direct seeding
- Aerobic rice
- Integrated Crop Management ( ICM)
- System of Rice Intensification (SRI)

# What is SRI ?

- **A set of modified practices for growing rice developed in Madagascar in 1983-84 by Father Henri Laulanié**

| Features | |
|---|---|
| Planting young seedlings | 8 – 12 days old |
| Planting single seedling/hill | Along with soil mgmt |
| Wider spacing | 25 cm x 25 cm |
| Organic manuring | Compost , GM , straw |
| No standing water until PI stage | Alternate wetting and drying |
| Aerated soil | Weeding by cono-weeder |

# Claims of SRI method

- Very high yields
- Water saving (up to 50%)
- Improved soil health
- Improved input-use efficiency
- Lower seed requirement
- Reduced duration of the crop
- Improved grain quality parameters

# Activities of DRR

- Lead in research activities
- SRI trials across the country under AICRIP
- Organizing model training courses
- Technical co-operation with WWF and NGOs
- Bringing out publications on SRI

# Results of DRR Trials

- Yields in SRI trials were 16.6% higher than with normal transplanting
- Hybrids performed better than varieties under SRI
  - Hybrids – Yield increase was 46 - 48%
  - HY Varieties – Yield increase was 5 – 17%
- SRI with young seedlings was the best method as compared to SRI with 25 day-old seedlings and normal planting with wider spacing
- Soil biology effects: SRI plots generally had higher MBC, MBN and dehydrogenates (by 7-25%), but only in the post- rainy season

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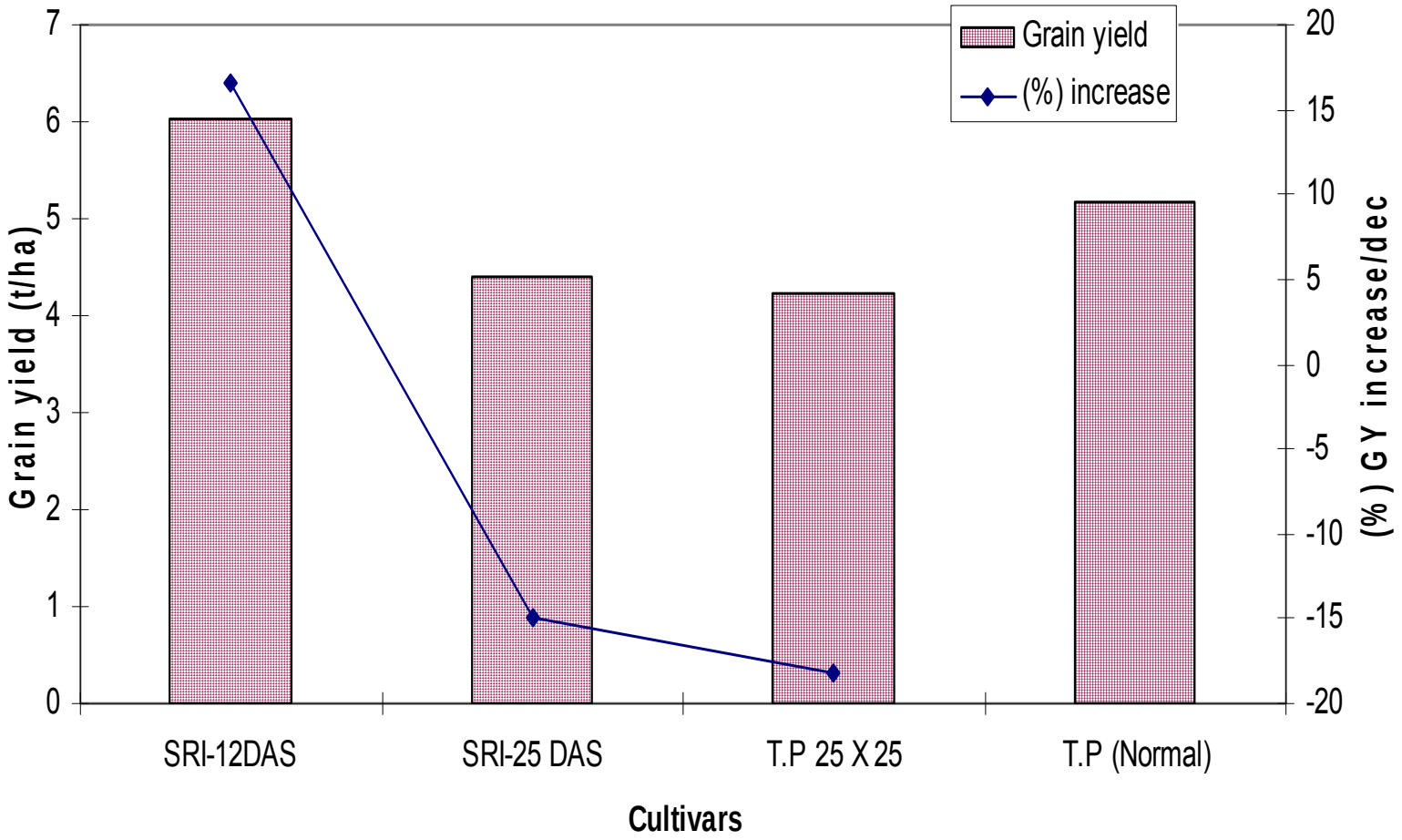
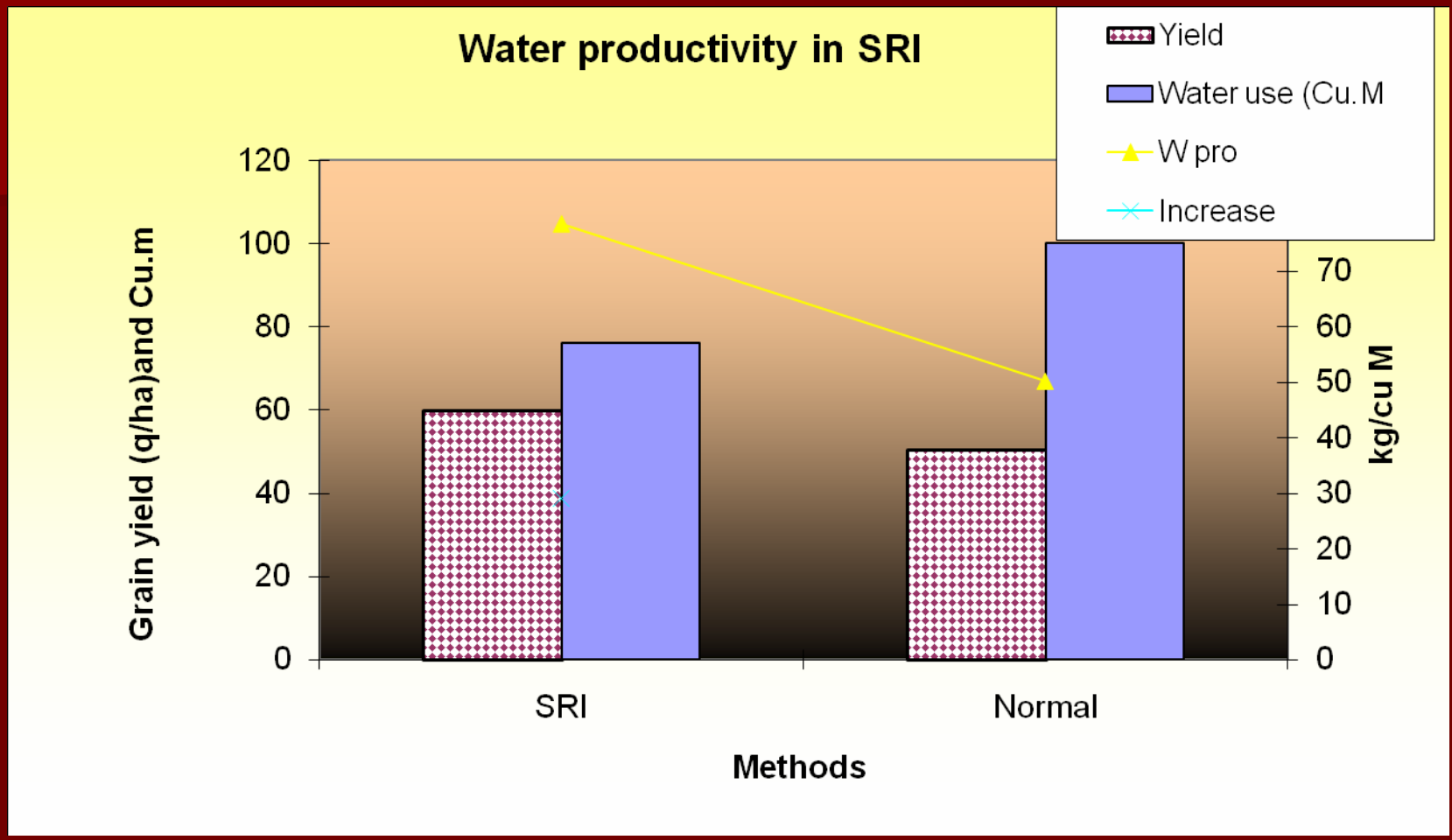


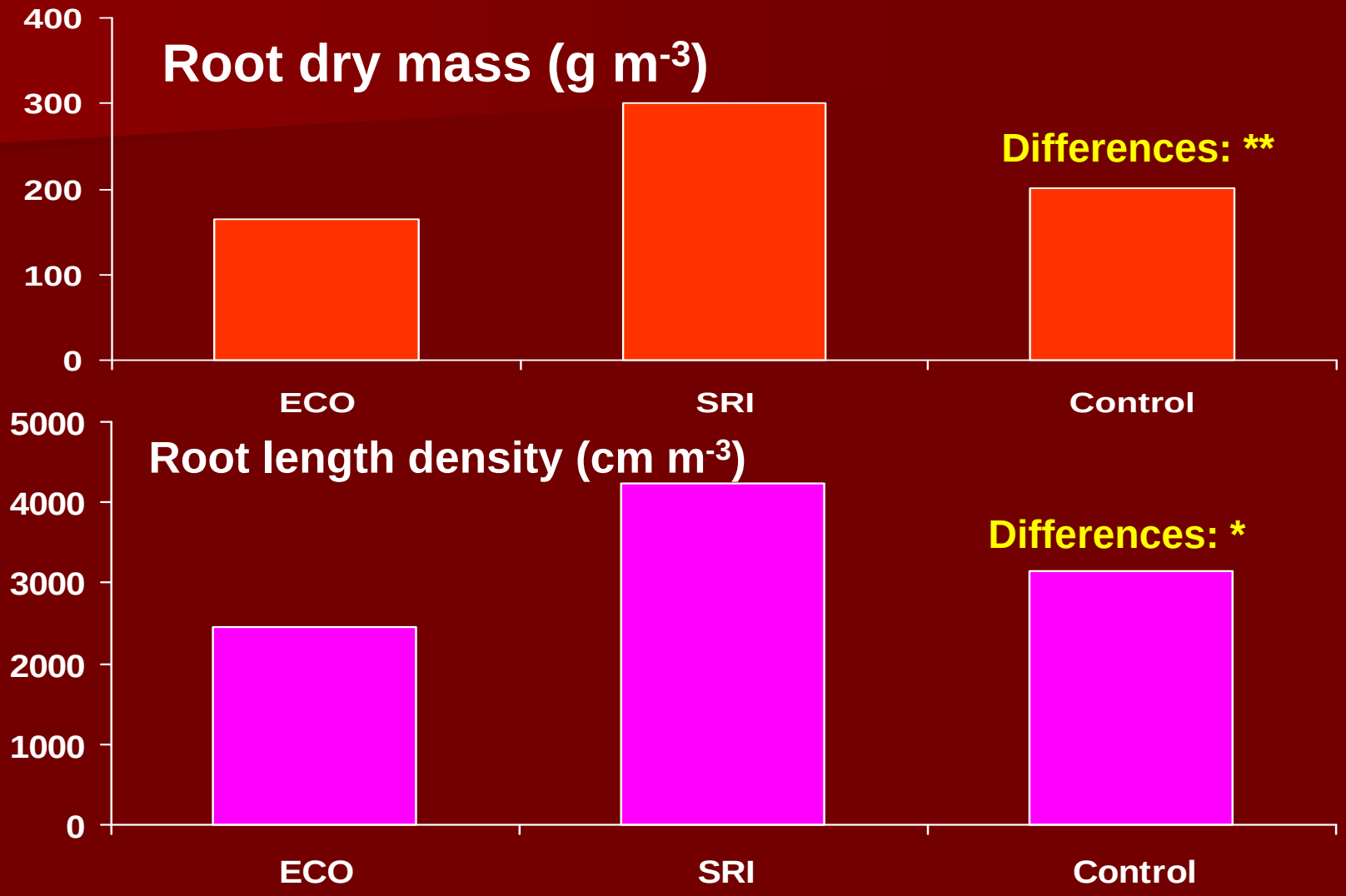

# Grain yields under different methods of crop establishment

# Water productivity as influenced by SRI vs. normal (flooded rice)



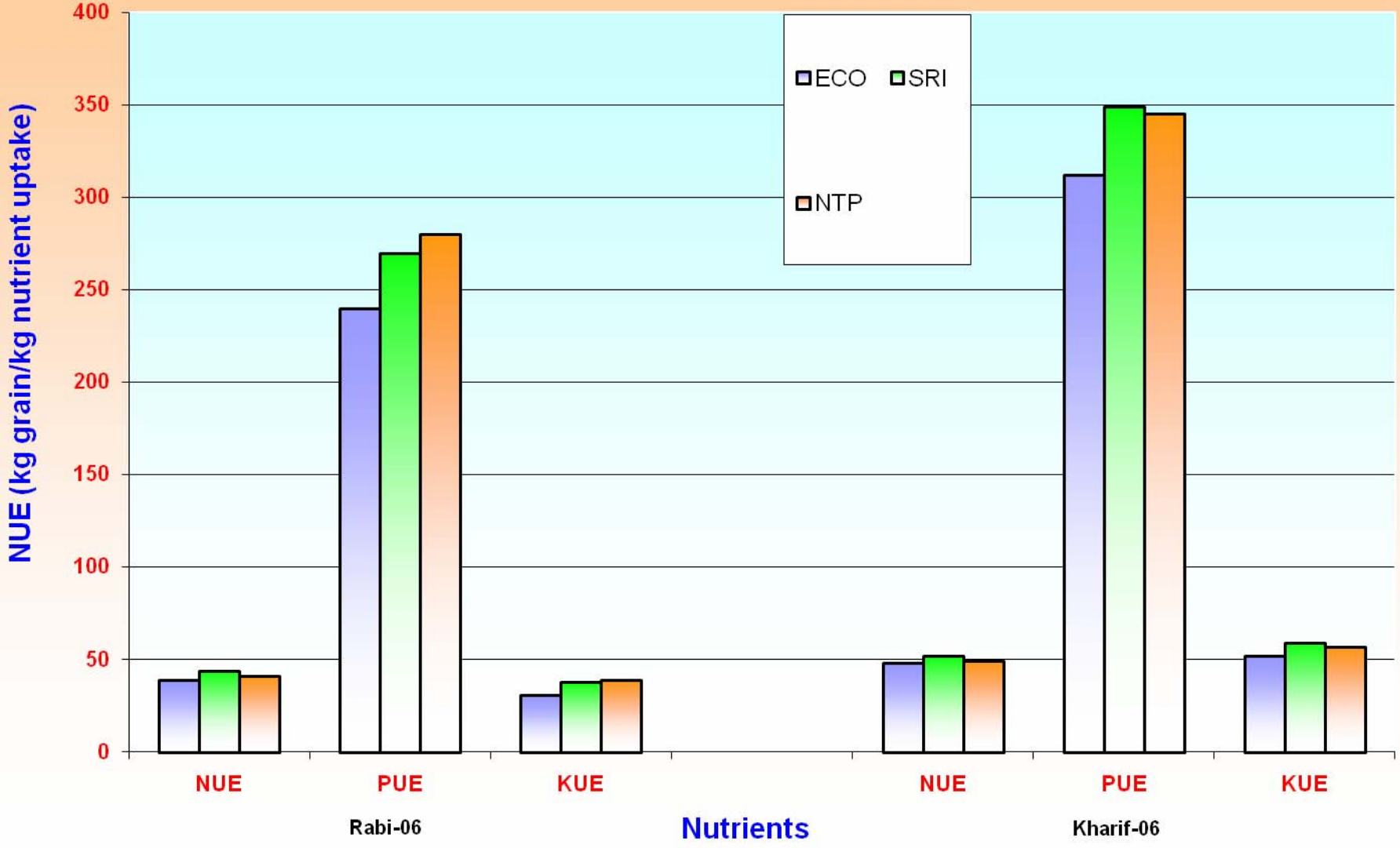

- Grain yield increase by 10% in SRI
- Water use decreased by 29% (SRI 79 Cum)
- Water productivity increased by 20%

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




**Root dry mass and root length density were higher in SRI**

# Nutrient use efficiency (NUE) under different treatments



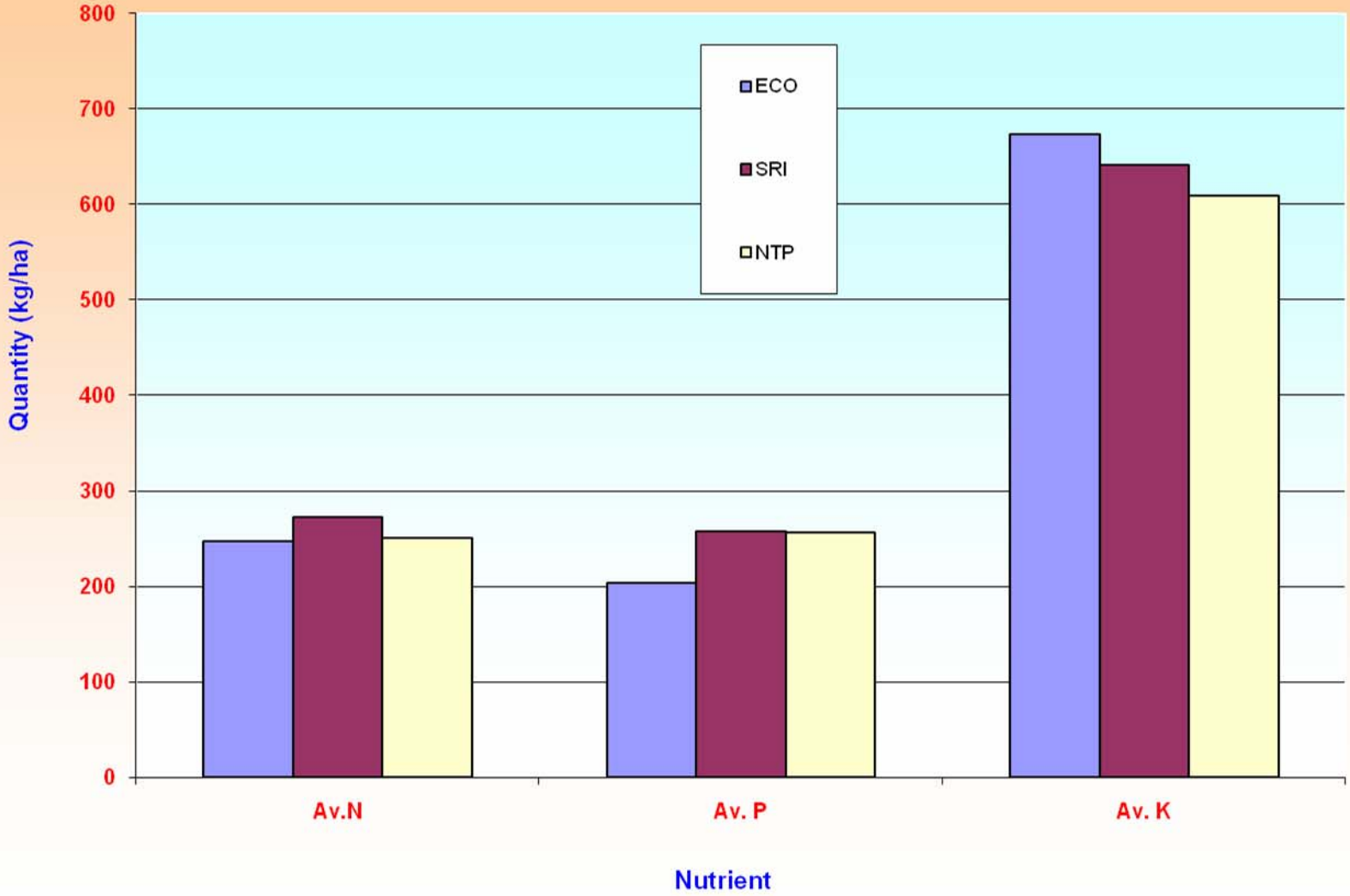

- In general, SRI recorded higher nutrient use efficiency

# Soil available nutrients (kg/ha) after 2 seasons

| Methods | Available N | Available $P_2O_5$ | Available $K_2O$ |
|---|---|---|---|
| ECO-SRI | 247 | 204 | 674 |
| SRI | 272 | 258 | 641 |
| NTP | 251 | 256 | 609 |
| CD (0.05) | NS | 26 | 35 |

- Available nutrients remained same in SRI and NTP

# Soil available nutrients after 2 seasons



# Nutrients status with SRI

- Plants from plots of flooded rice were **pale green** (indicating lower SPAD or chlorophyll values ); SRI plants were generally **darker green**
- SRI recorded significantly **higher SPAD values** (40.08) as compared to conventional (36.03) and SRI-Eco trials (35.44) indicating more **N uptake** and **chlorophyll** content



One of the yield-enhancing parameters

# Multi-location trials on SRI

Comparison among the following methods (*Kharif* 2004 -07)

- System of Rice Intensification (SRI)
- Integrated Crop Management ( ICM)
- Normal Transplanting (NTP)

# Details of the treatments

- **SRI**
- 5 kg/ha seed rate
- Fertiliser as per recommendation (organic + inorganic)
- Weeding by cono weeder 2-3 times
- Reduced water application
- Varieties: HYVs and hybrid

- **Conventional method**
- 30 kg/ha seed rate
- Same
- Weeding by manual labour
- Flooding the fields
- Same

Saving in seed and water

# Multilocation Trials on SRI under AICRIP

- Conducted during kharif 2004 to 2007 seasons

## Number of Locations - 21

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

Contn…

# Multilocation Trials on SRI under AICRIP

| State | Location |
|---|---|
| Orissa | Chiplima |
| Punjab | Kapurthala |
| Pondicherry | Karaikal |
| Tamil Nadu | Aduthurai, Coimbatore |
| Tripura | Arundhatinagar |
| Uttar Pradesh | Varanasi |
| Uttaranchal | Pantnagar, Almora |
| Meghalaya | Umiam |

# Summary of Multi-location trials (2004-07)

| Item | Yield Advantage | No. loca-tions | Names of the locations |
|---|---|---|---|
| SRI > NTP | 5 - 65.2 % | 19 | ADT, ARI, ARD, JGD, KRT, PTN, RNG, SRG, TTB, CHT, CBT, PNT, UMM, MLN, MND, MTU, NWG, PSA |
| ICM > STD | 5 - 42 % | 17 | TTB, SRG, RNC, PTA, KJT, CHP, ARI-R'Nagar, ADT, UMM, PNT, CBT, PSU, NWG, MND, MLN, KJT, JDP |
| SRI > ICM | 5 - 10 % | 17 | SRG, RNC, PTN, NWG, ARD, ARI, RPR, KRJ, JGD, CHT, ADT, UPS, PDY, MTU, MND, CBT, ALM |
| ICM > SRI | 5 - 10 % | 5 | KRK, KRG, CHP, SBR, KPT |
| STD > SRI | 5 - 10 % | 3 | KPT, KRK, SBR |

# Mean Grain Yield Increase under SRI and ICM over NTP

| Year / Season | SRI > NTP | ICM > NTP |
|---|---|---|
| *Kharif* 04 | 12.0 | 10.0 |
| *Kharif* 05 | 7.0 | 5.0 |
| *Kharif* 06 | 12.0 | 6.0 |
| *Kharif* 07 | 20.5 | 14.1 |
| Overall GY | 12.6 | 8.8 |

# Multilocation Evaluation of SRI

- Treatment differences were significant at 18 locations
- SRI gave higher yield (7.0 to 42%) compared to control at 11 locations with a mean of 12.0%
- SRI was better than ICM at 3 locations
- SRI and ICM were on par at 4 locations
- ICM was better than SRI at Coimbatore and Aduthurai
- NTP was better than SRI at Kapurthala and Malan

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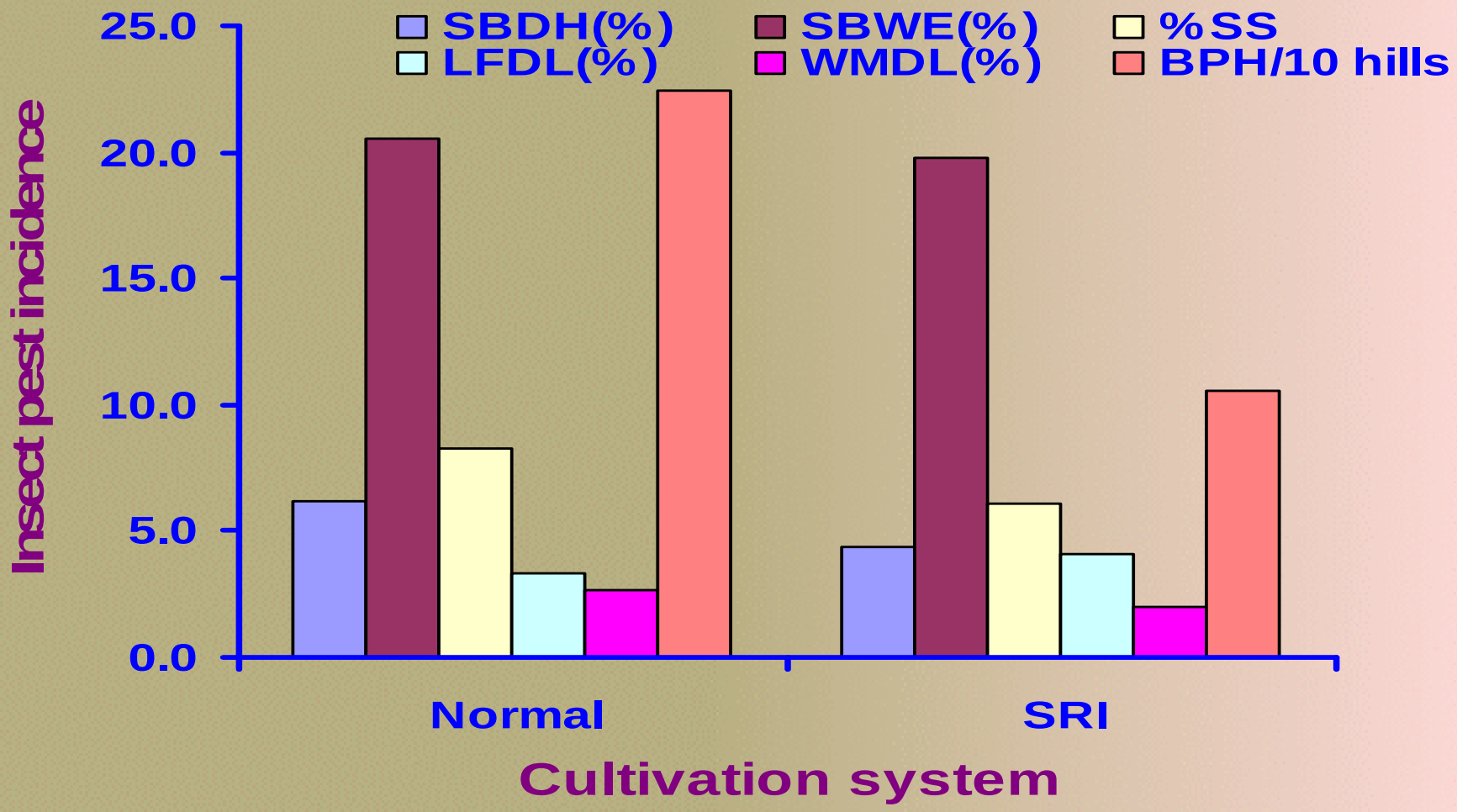
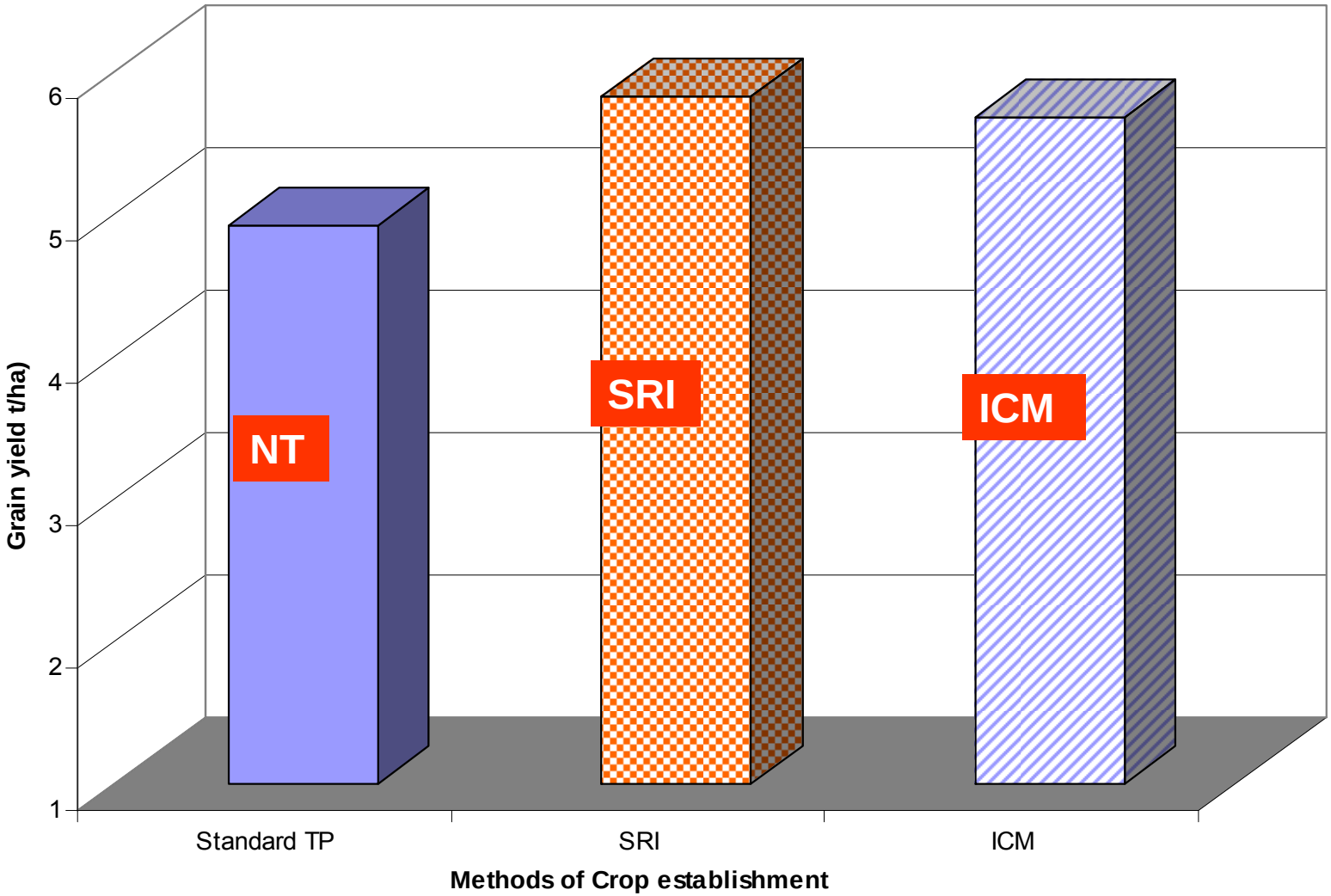
# Insect pest incidence




Paper presented in 3rd National symposium on SRI at Coimbatore, 1-3 December 2008




# Average grain yield under different methods

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- Yield increase was due to increased panicle number/unit area
- Performance of SRI was better in Southern and Central India
- SRI yields under clay loam soils were higher than sandy loam soils
- Yield increase of SRI method under acidic soils was higher than under alkaline soils
- SRI method is suited to late transplanting (up to August)

# Major constraints experienced at operational level

- Initial resistance to planting young seedlings
- Difficulties in weeding
- Non-availability of suitable cono weeders at right time
- Non-availability of organic manures
- Difficulties in proper control of water
- Poor drainage in heavy rainfall areas

# Research priorities for the future

- Delineate areas most suitable for adoption of SRI
- Identify the varieties/hybrids that are most suitable for SRI practice
- Development of machinery for weeding, planting and harvesting
- Detailed studies on nutrient and microbial dynamics of soil health aspects of SRI
- Quantification of saving in water and other inputs
- Efficient production of organic materials for soil fertility management
- Studies on SRI vis-à-vis disease and pest management
- Standardization of eco-friendly methods of pest and disease management with SRI

# Conclusions

- Performance of SRI is location-specific
- Varieties respond differentially to this method
- SRI is a water- and seed-saving methodology
- SRI can be a best option to promote hybrid rice as hybrids perform better under SRI, and it can help farmers save significantly on hybrid seed costs
- SRI has potential to improve soil health and give environmental protection
- Further research is needed to understand the factors contributing to higher yield, soil health parameters, and various aspects of sustainability


# Thank You