

# **Water Savings in Rice in Indo-Gangetic Basin and China**

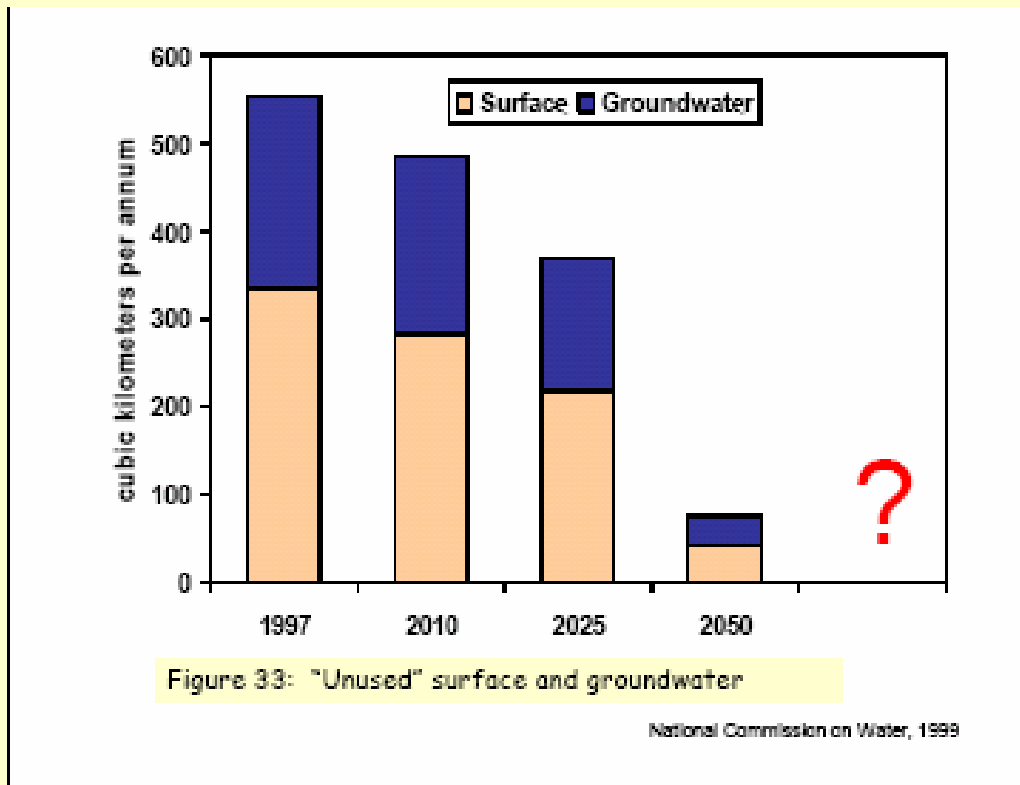
**Bharat R Sharma  
Asia Regional Office,  
New Delhi  
b.sharma@cgiar.org**

# Rice : Cited as Culprit.....?

- **Rice is generally cited as the main culprit for declining groundwater tables in the Indo-Gangetic and Yellow river basins.**
- **Rice is obvious target for conservation: it is grown on more than 30% of irrigated land and accounts for 50% of irrigation water.**
- **A reduction of 10% in water used in irrigated rice would free 150,000 M m<sup>3</sup> of water, corresponding to about 25% of the total fresh water used globally for non-agricultural purposes.**

# Water Scarcity in Rice Growing Areas

- **Overlay of IWMI water-scarcity atlas with IRRI rice area maps, shows that wet-season irrigated rice area in North China (2.5 M ha) and Indo-Gangetic basin (10.5 M ha) will experience 'physical water scarcity' by 2025 or earlier.**
- **Groundwater tables have declined by 1-3 m/annum in North China plains and by 0.5- 1.0 m/ annum in the Indian and Pakistani states of Indus basin.**
- **Yellow river has been running dry in the lower reaches (final 600 km) every year since 1972. Irrigated rice area in China was reduced by 4 M ha during last three decades.**



Running out of groundwater

## Rice Water Requirements and Productivity

Typical ET rates of rice in the Asian region range from 4-7 mm/day. For a normal high yielding medium duration (100 days) paddy crop, the total water input may vary from 1000-2000 mm .

Particulars	Clay loam	Loam	Sandy loam
Irrigation	1125	1500	1775
Runoff	207	193	161
Percolation	893	1187	1515
ET	690	808	745

Average annual rainfall: 650 mm

# Irrigation Requirement of Rice

Region	Seasonal rainfall, mm	Irrigation requirement, mm
<b>Eastern Gangetic</b>	<b>600</b>	<b>1070</b>
<b>Western Indus</b>	<b>200</b>	<b>2030</b>

# Intermittent Submergence

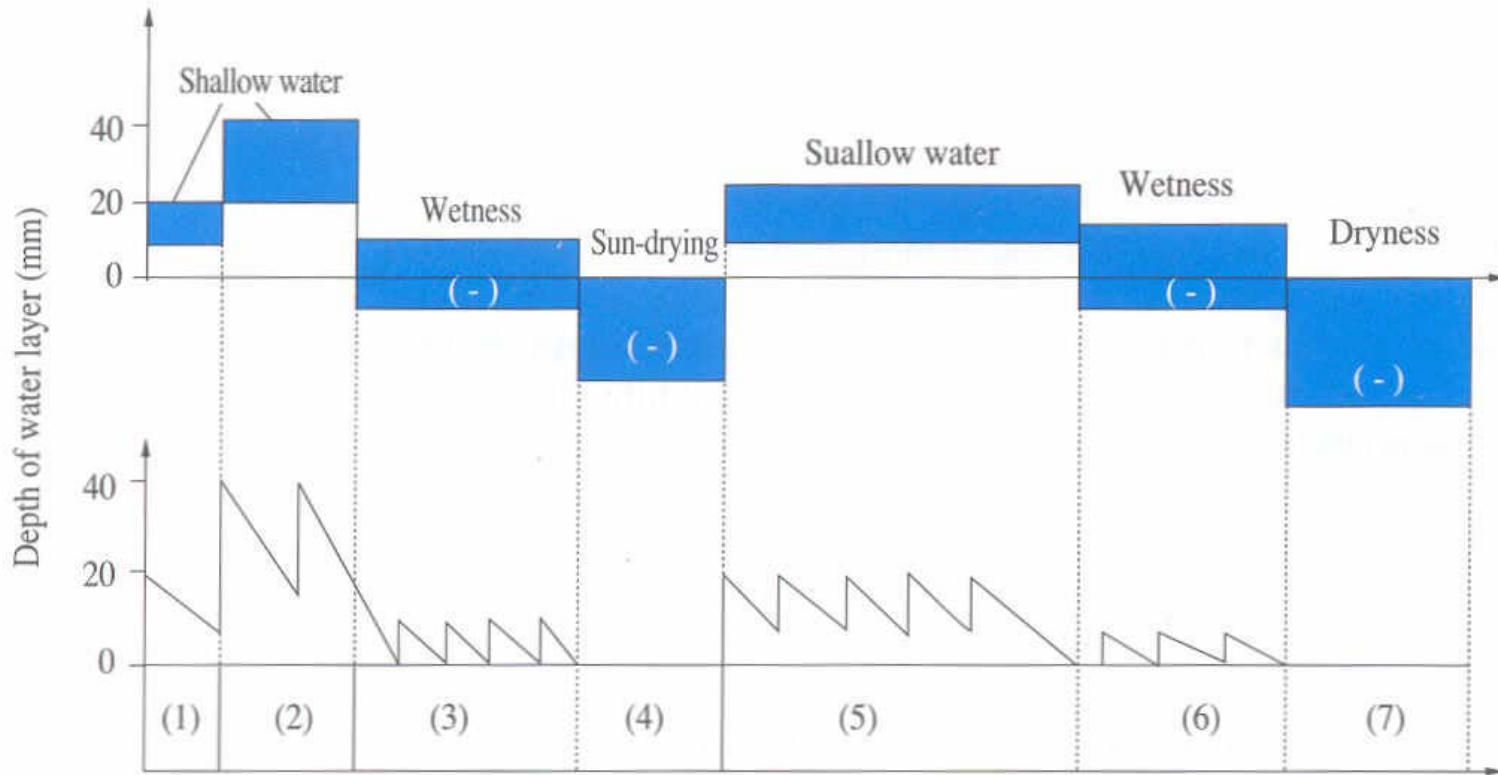
Location	Conti. submergence	Irri. after 1-day drainage	Irri. after 3-day drainage	Savings in irrigation water, %
Pusa, Bihar	3.6 (810)	3.47 (600)	3.25 (460)	43
Ludhiana Punjab	5.52 (1900)	5.44 (1450)	5.12 (1130)	40

# Guangxi Model, China

- “Shallow, Wet and Drying” Water Saving Irrigation Method was developed and widely popularized in Guangxi Autonomous Region.
- This new method of irrigation not only saves a large amount of water but also leads to high yields of rice.

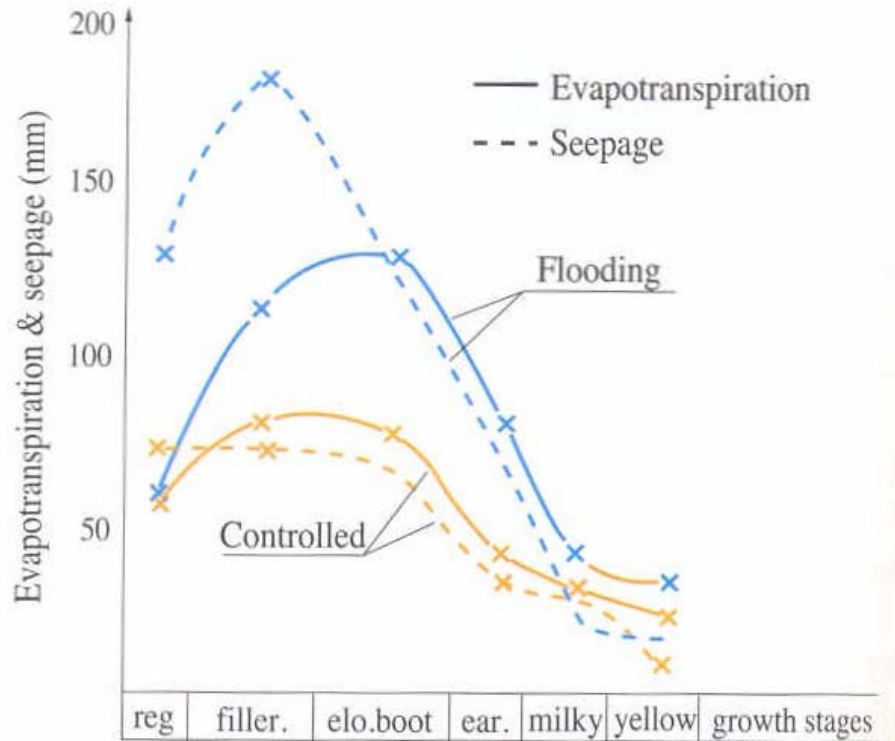
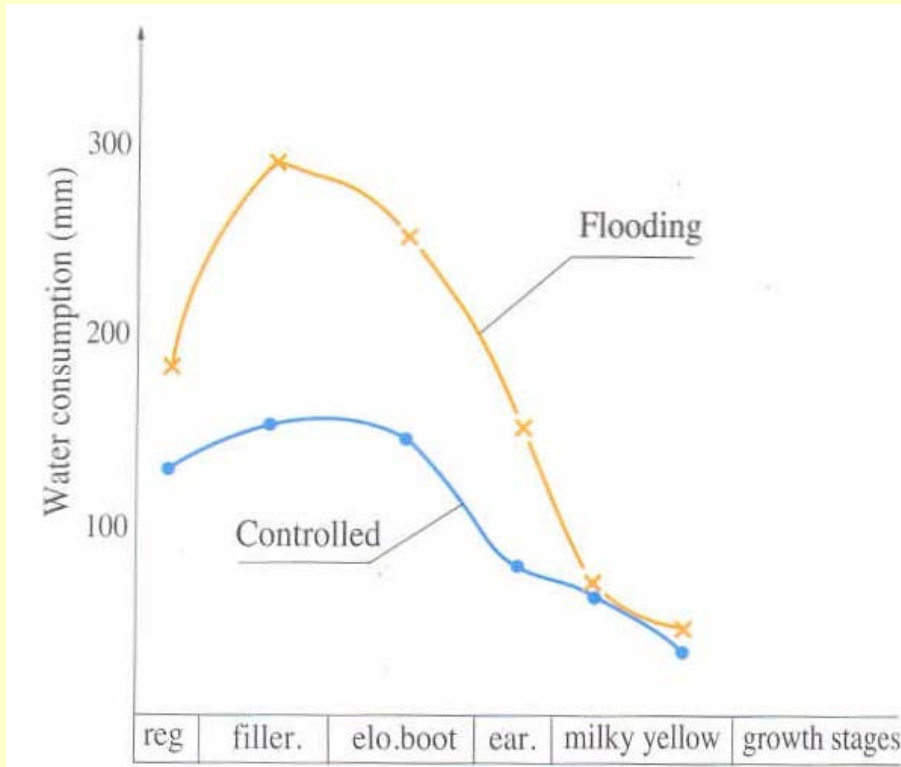
<b>Method</b>	<b>Irri. requirement, m<sup>3</sup>/ha</b>	<b>Rice yield, t/ha</b>
<b>New Method</b>	<b>8918</b>	<b>10.6</b>
<b>Deep Submergence</b>	<b>12,612</b>	<b>7.8</b>

# Varying depths of water under “New Method”



(1) Transplanting, (2) Turning green, (3) (4) Tillering,

(5) Ear formation & flowering, (6) Milky ripening, (7) Yellow ripening



## Comparison in total water consumption, ET and Seepage Losses

# Effect of Date of Transplanting

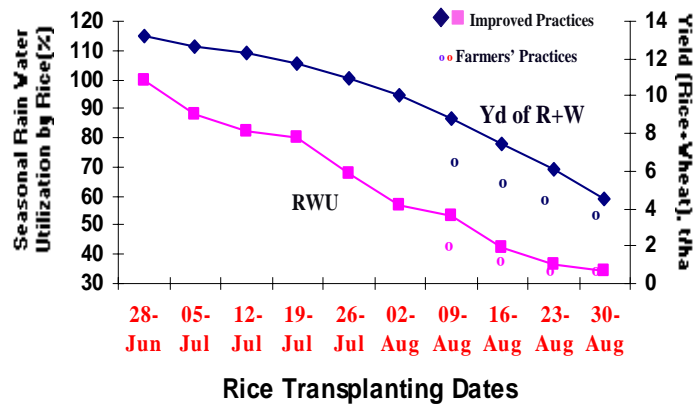
Irrigation Regime	16 May	31 May	16 June
Continuous submergence	7.14* (3100)**	7.71 (2700)	7.08 (2720)
CS (2wks)+ 1-day drainage	6.88 (2140)	7.30 (1890)	6.79 (1910)

\* Yield = t/ha, \*\* Irrigation water = mm

# Improving WP

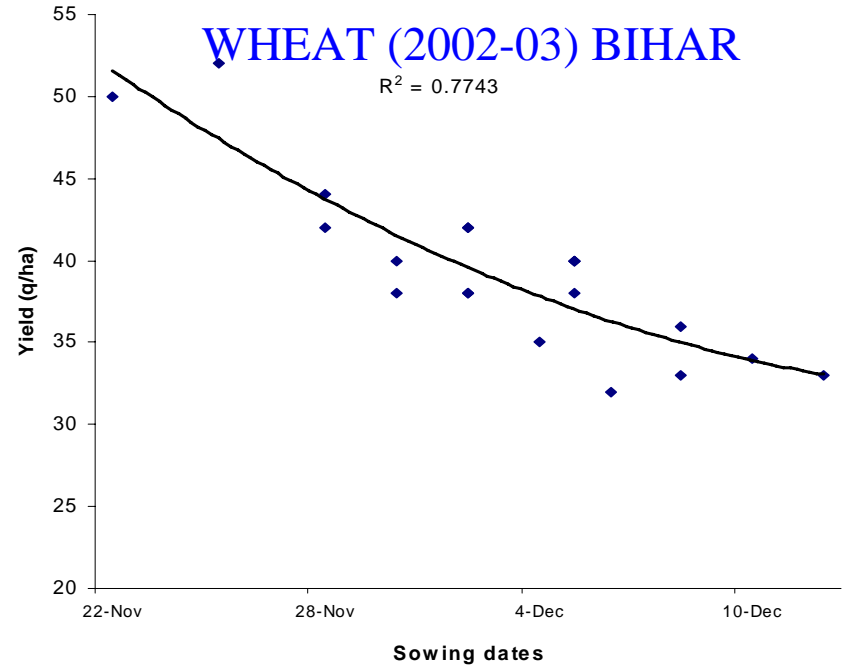
## 1. Timely Operations

Improving Productivity in eastern IGP : Advance Rice Transplanting

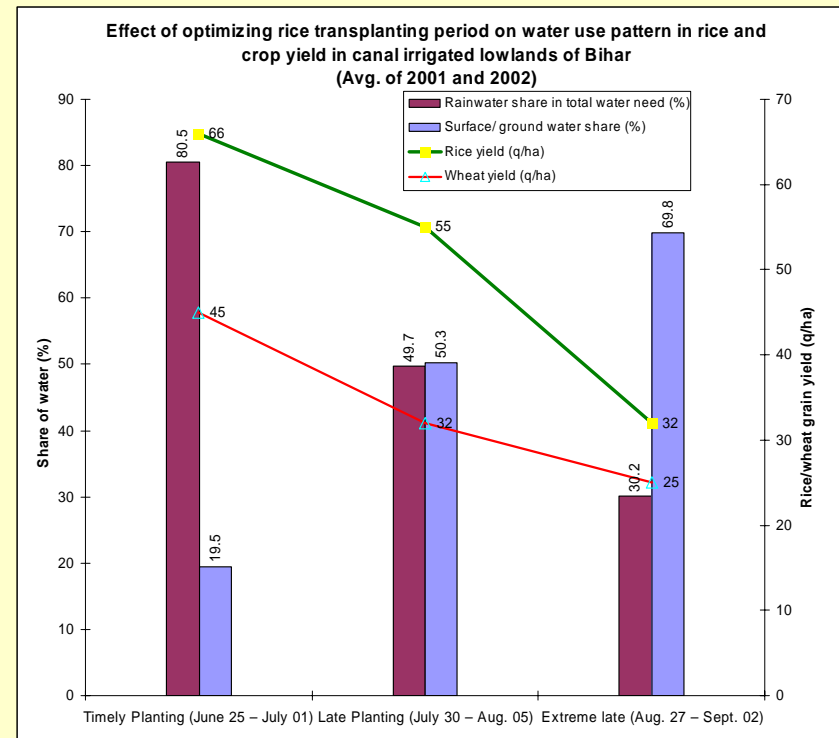


Source: Adapted from SR Singh, 2000, DWMR,

WHEAT (2002-03) BIHAR



- Enhanced effective use of rainwater
- Enhanced rice yield (upto 52%)
- Saved 2-3 irrigations required by late transplanted rice during reproductive phase
- Vacation of field for timely sowing of rabi (winter) crops
- Improved wheat yield upto (50%)
- Energy saving in GW (38 hrs) for diesel pump

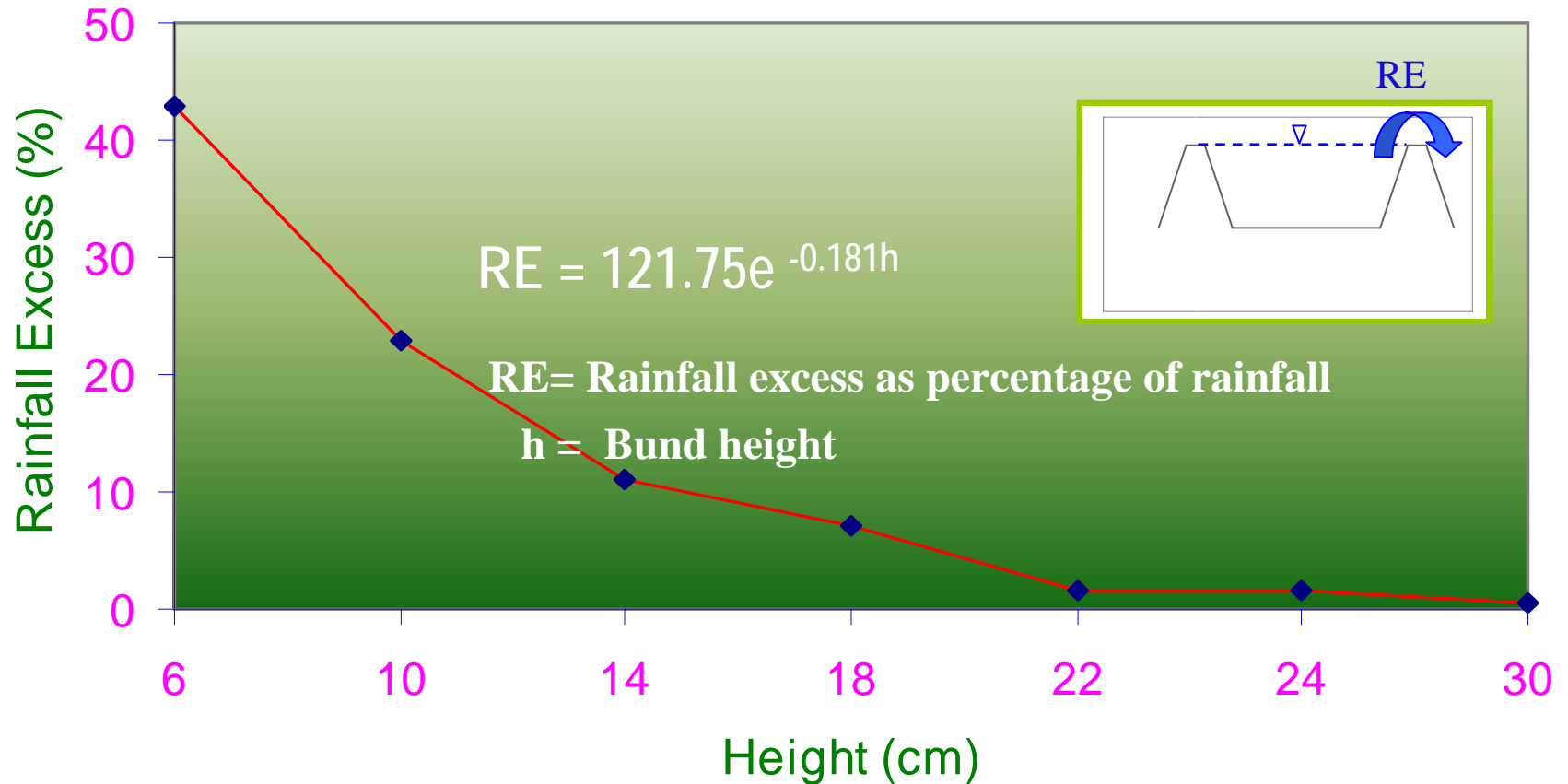


# Conservation Dikes

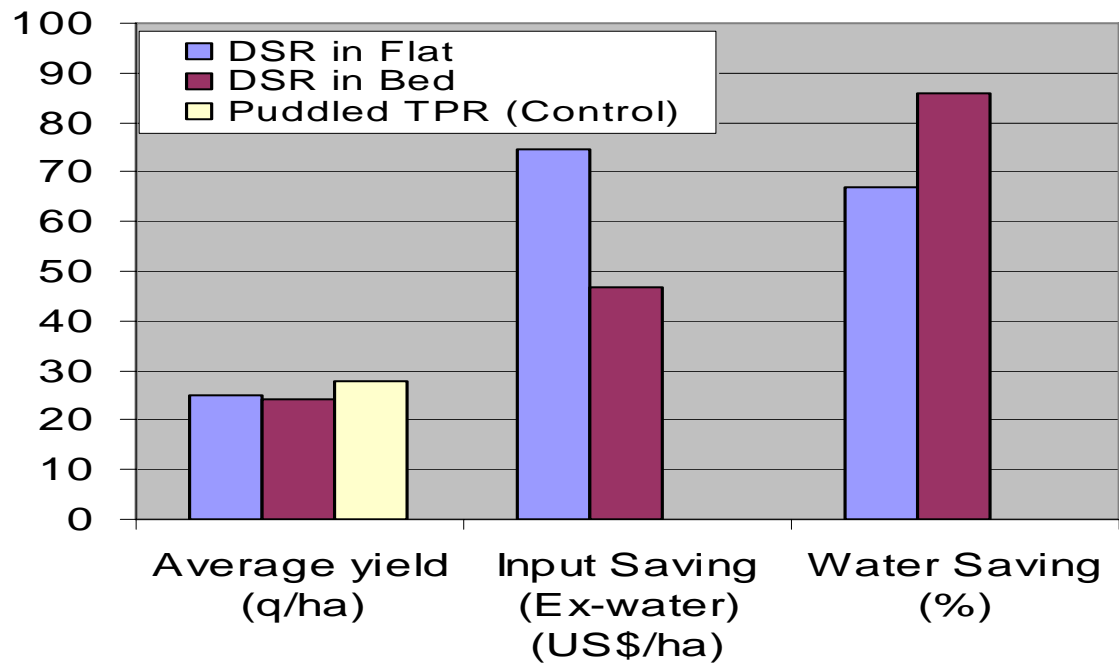
- **Paddy fields also provide a great potential for storage of rainfall.**
- **Optimum dike heights have worked out for ensuring maximum storage of water during the season. Optimum dike heights for light, medium and heavy soils were recommended as 15.0, 17.5 and 20.0 cm, respectively.**
- **Similar studies in Orissa showed that dike heights of 22.5 cm around paddy fields were able to retain about 97% of rainwater.**

# Increased Rainwater Storage

## Rainwater Management: Storage Bunding



### Saving of input and water and grain yield of rice under different planting method in Bihar



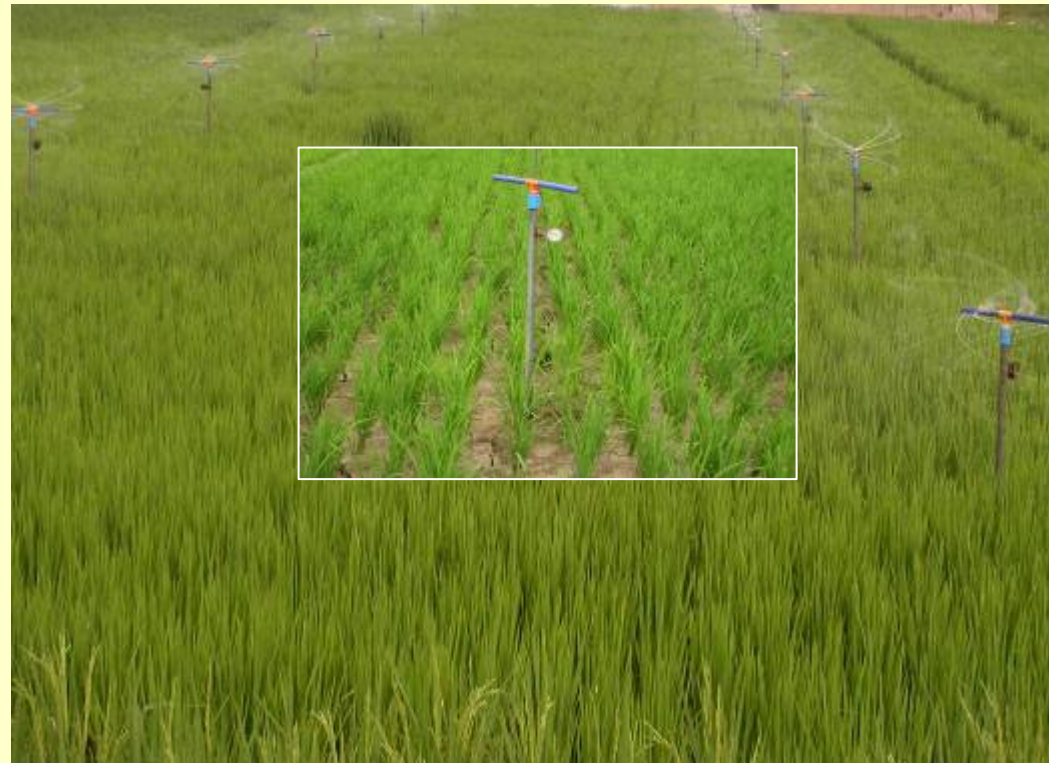
# Aerobic Rice

## Water saving irrigation methods

### LEWA (Low Energy Water

### Application) Device

- Recommended operating pressure – 0.4-0.6 Kg/cm<sup>2</sup>,
- Throw diameter – 6-8 m,
- Application rate – 2.6–3.1 cm/hr
- Riser Height – 1m
- Surface Uniformity > 70 % when operated at an operating pressure of 0.5 Kg/cm<sup>2</sup> or above,
- Sub – Surface Uniformity > 80%
- Higher discharge than the infiltration rate unlike sprinklers just to keep soil surface wet,
- With flexible flat hose pipes a LEWA unit for 1000m<sup>2</sup> costs approximately US\$ 180 whereas a sprinkler system costs \$ 510 (excluding pump).



LEWA System installed in rice field

# System of Rice Intensification (SRI)

- *SRI is a methodology for increasing the productivity of irrigated rice by changing the management of plants, soil, water and nutrients. SRI concepts and practices have also been successfully adopted to upland rice.*
- *SRI does require skillful management of the factors of production and at least initially, additional labour input- between 25 and 50%, particularly for careful transplanting and for weeding. But since yield increases are 50 to 100%, returns to labor are very great since no purchased inputs are needed and profitability of rice production is increased. With SRI there can be water saving of around 50% (?).*
- *Additional information on this can be found at <http://cifad.cornell.edu/sri/>*

# Challenges in Adoption of Water Saving Practices

- Water is generally considered a low value input.
- Groundwater is an easement and can be pumped to the hilt.
- Energy and procurement policies.
- Farmers more readily accept policies that improve productivity and income.

# CHALLENGES IN SAVING WATER & INCREASING WATER PRODUCTIVITY WITH RESOURCE CONSERVATION TECHNOLOGIES

(Mobin-ud-Din, et al. 2006)

