

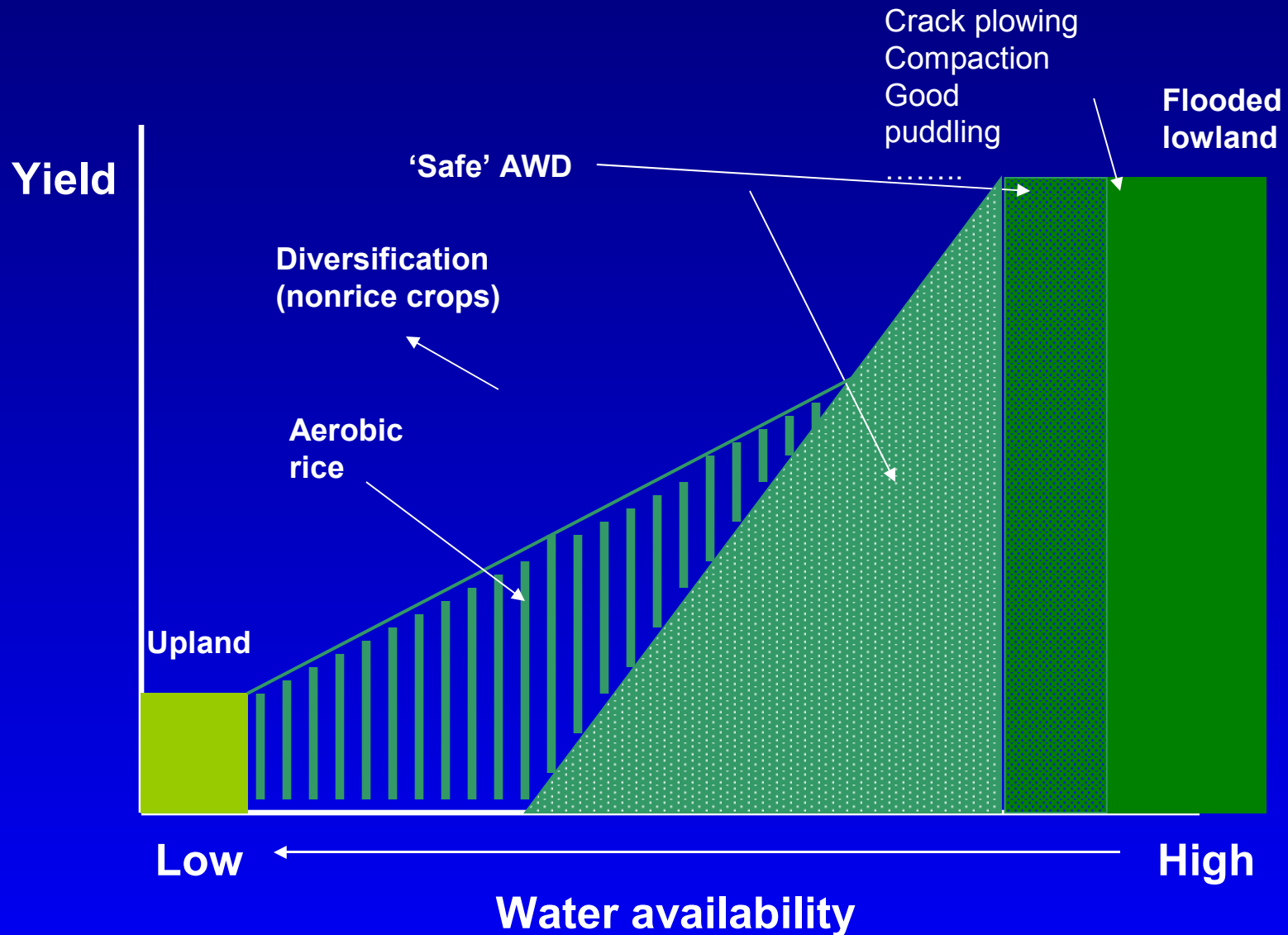
What technology where?

**Crop and Environmental Sciences Division
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Boundary conditions and settings

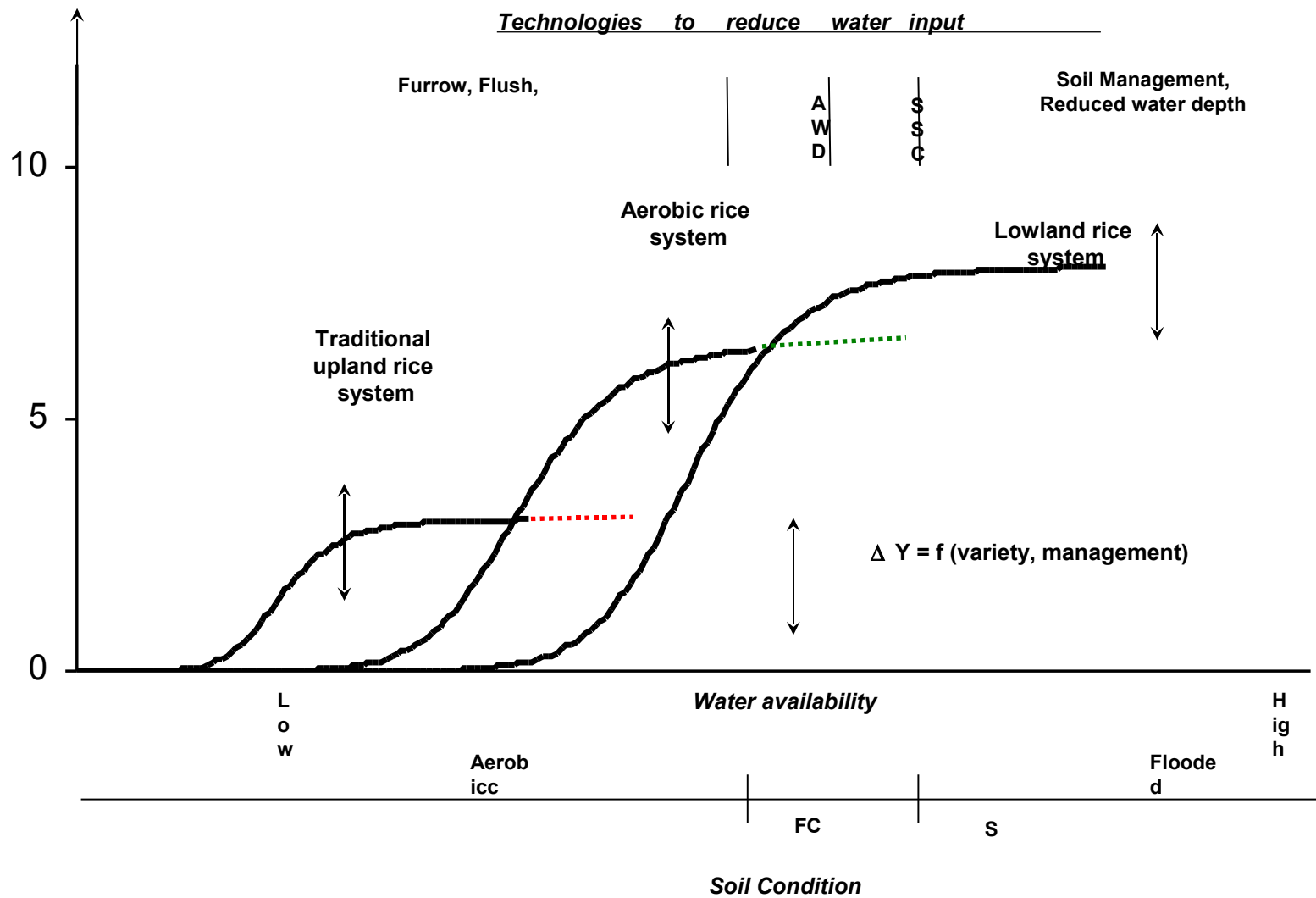
- **Nature of water scarcity (“imposed”, natural, physical, economical)**
- **Socio-economic setting (price of rice, price of water, water market, water rights, labor availability, gender issues)**
- **Technical infrastructure (water control, irrigation system)**
- **Organizational infrastructure (water user groups, irrigation association)**
- **Policy (water pricing)**

Response options to level of water scarcity

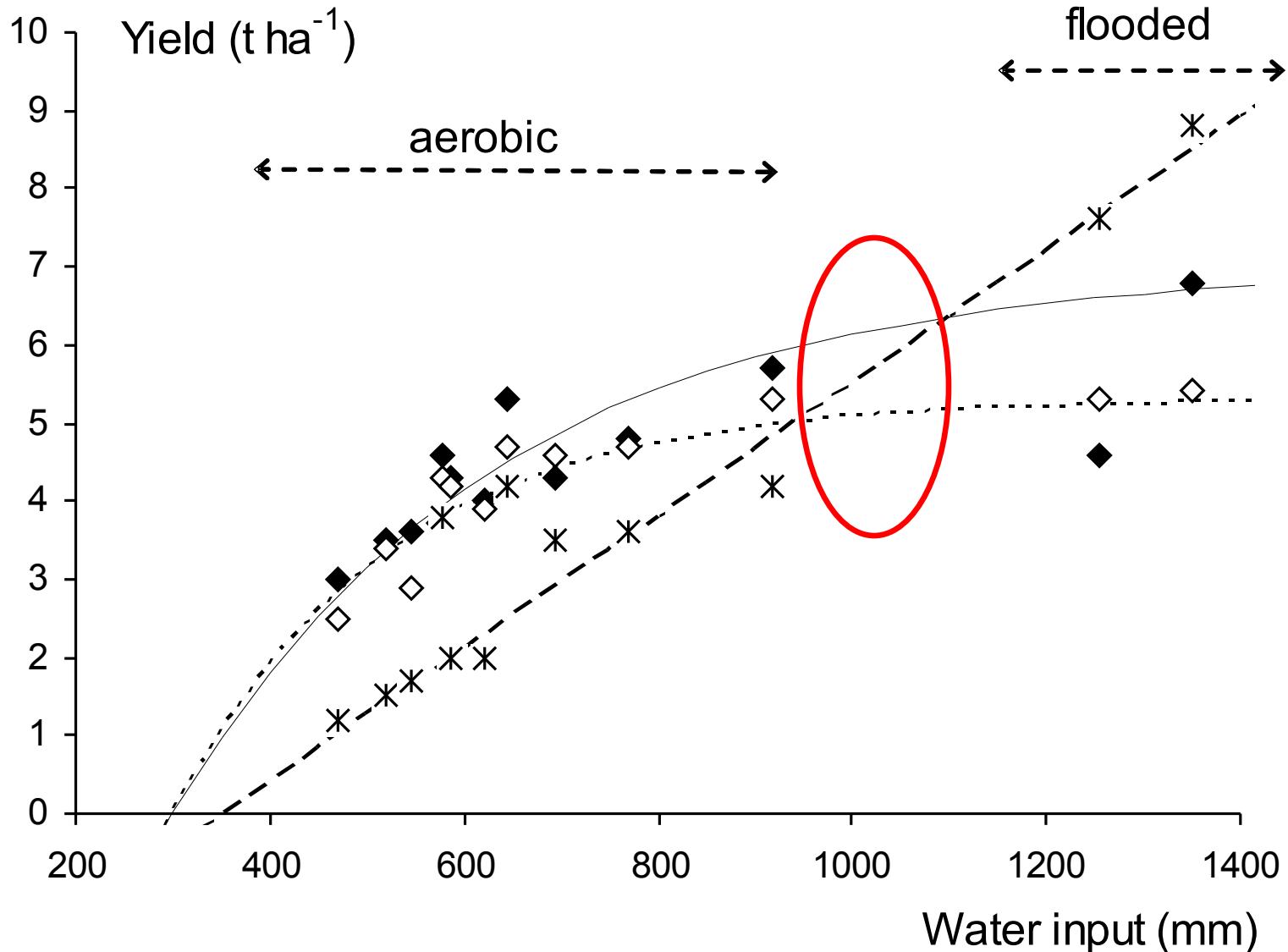


Yield (t ha⁻¹)

Technologies to reduce water input



Cross-over point flooded - aerobic

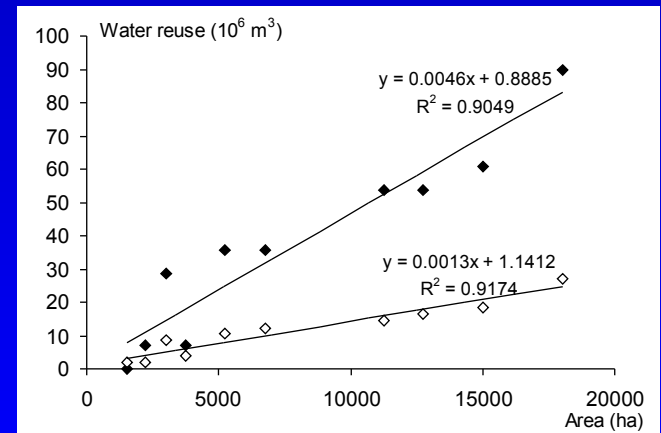
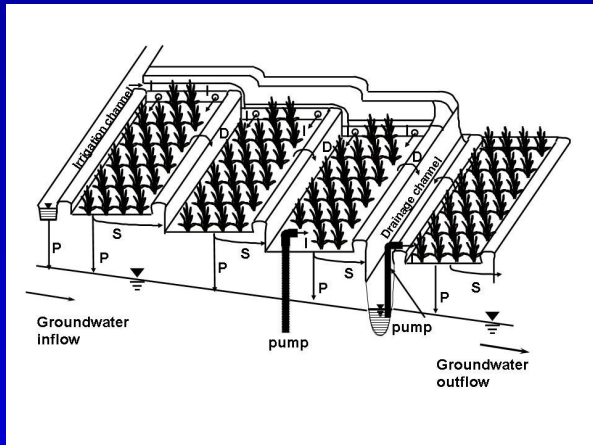


Scale considerations

| Scale level | User | Objective |
|--------------------------------|---|---|
| Field | Farmer | Yield, income |
| Small landscape | Competing farmers Governor, mayor,.. | Competing income Votes, regional production |
| Irrigation system | Competing farmers Managers Hydropower, industry, city Recreation | Competing income Equity, production, \$\$ \$\$ \$\$ |
| Region, province, catchment | Competing farmers Governor, mayors,.. Hydropower, industry, city Recreation Nature | Competing income Votes, production, \$\$ \$\$, \$\$, \$\$ \$\$ Various services |
| Country | All the above, competing | All the above, competing |

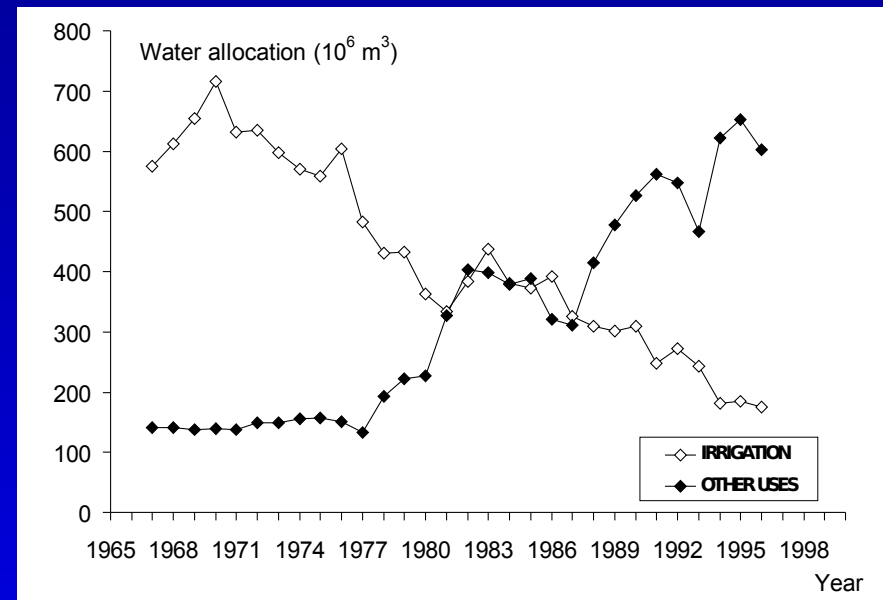
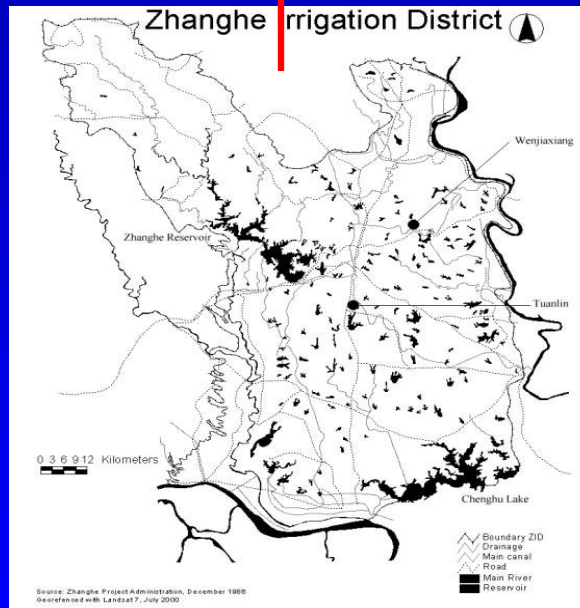
Scale considerations

Loss from field is not always loss from system
Increasing options for water reuse with increasing scale



Integrated approach

Zanghe Irrigation System. 160,000 ha mainly rice

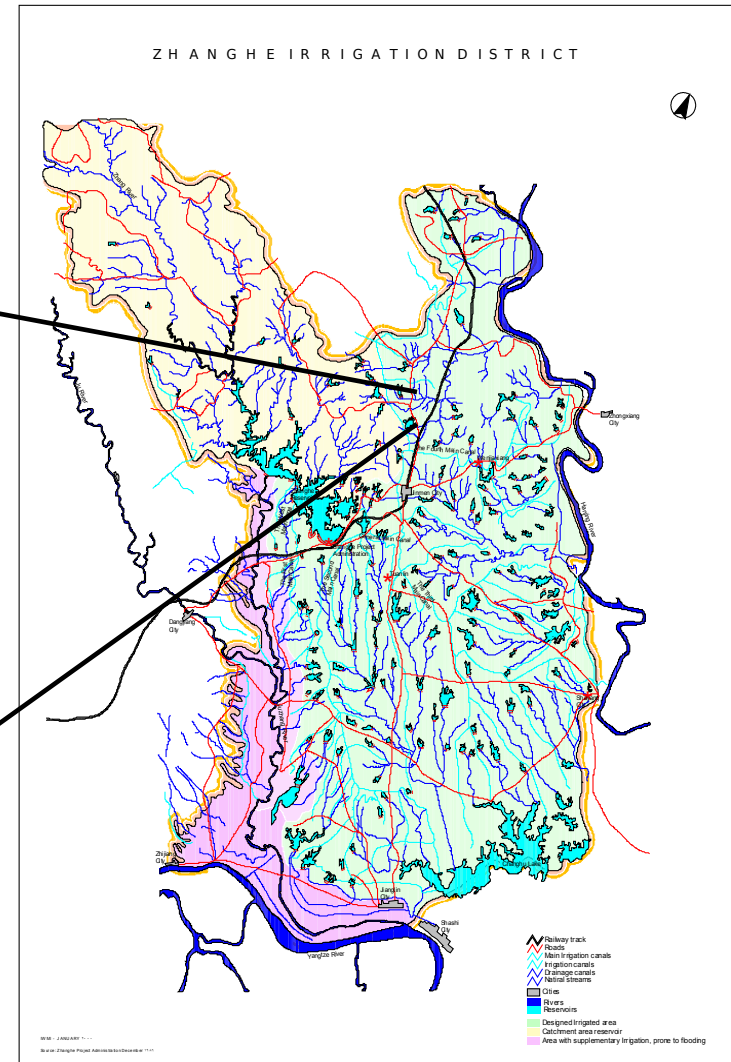
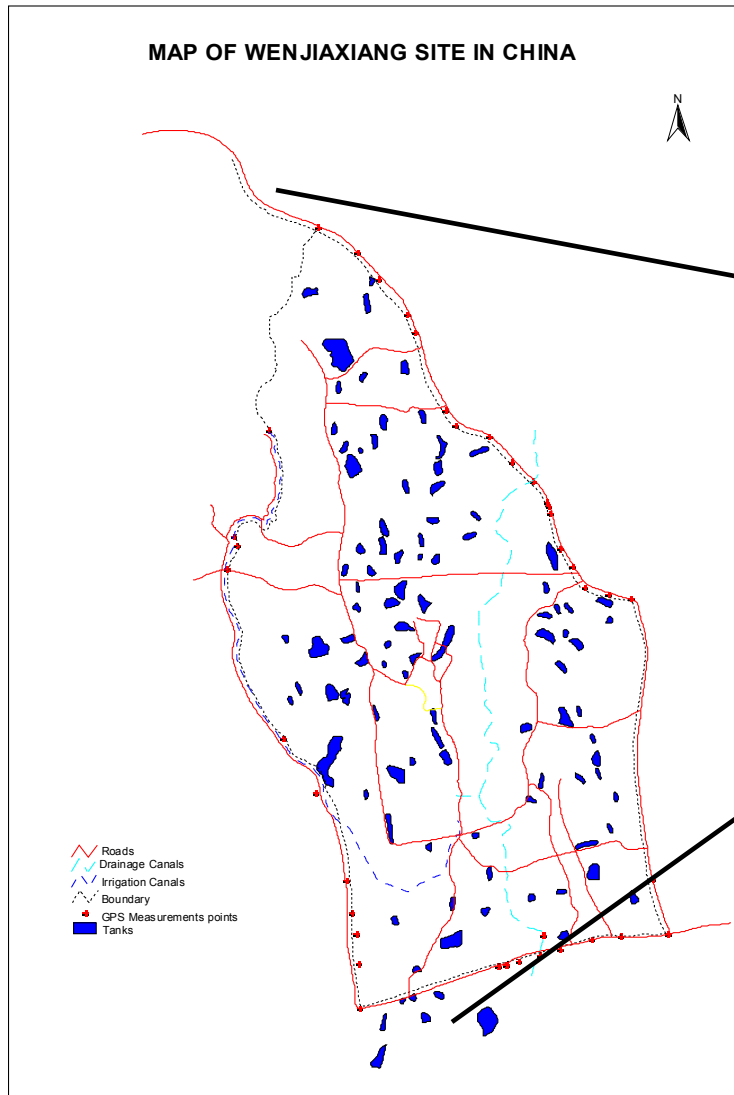


Other users:
Hydropower, city, industry

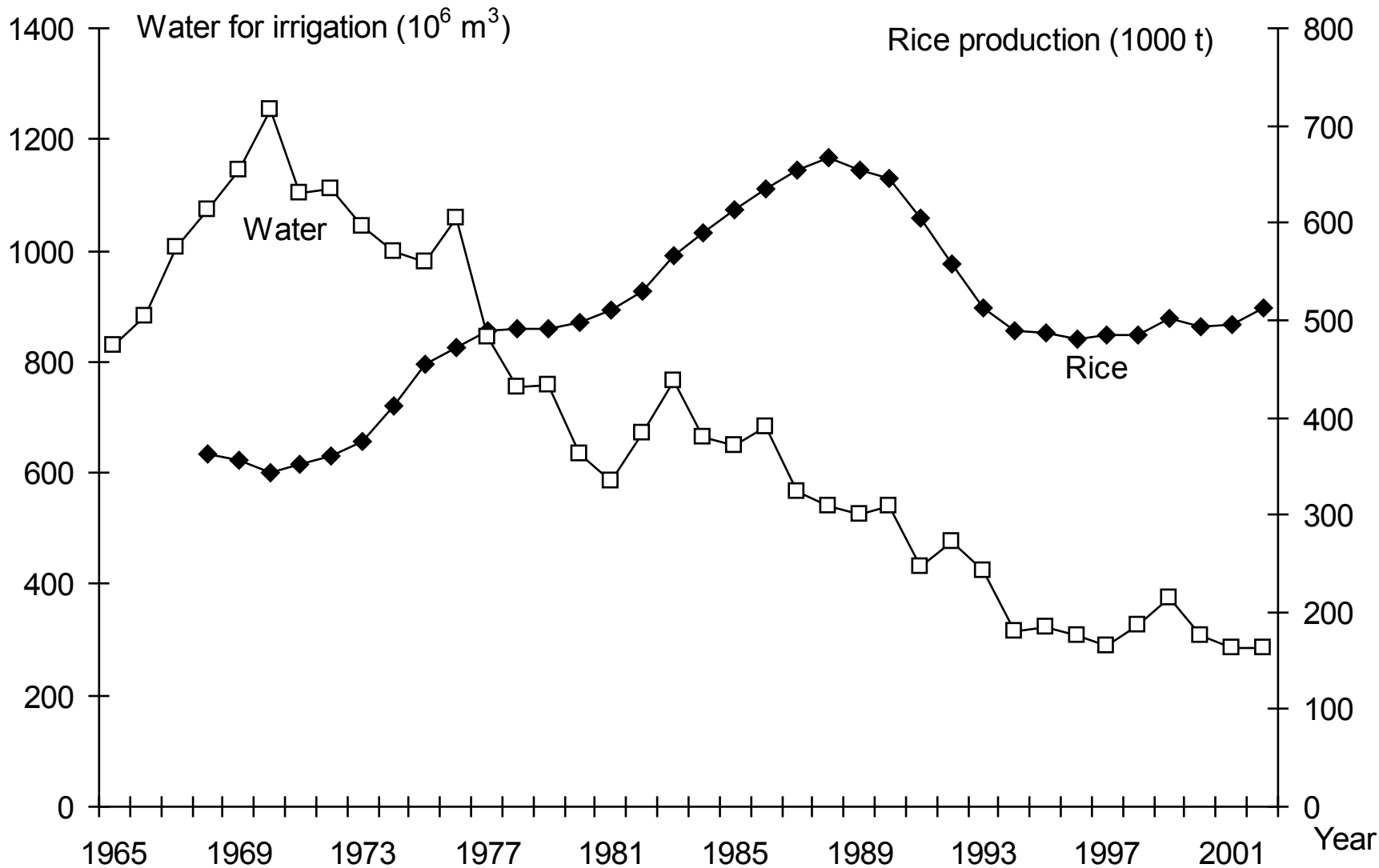
Responses

- **Double rice => single rice (same total yield, less water)**
- **Active promotion AWD**
- **Farmer organization in water user groups**
- **Volumetric water pricing**
- **System modernization (water control, canal lining, water measurement)**
- **Thousands of ponds for water reuse**

Water re-use through reservoirs and on-farm ponds



More rice using less water!



When water is scarcer than land, maybe maximize water productivity instead of land productivity (= yield)

Suppose:

- Irrigation command area of 10,000 ha**
- Reservoir with $69 \cdot 10^6 \text{ m}^3$ capacity**
- Water shortage: only $56 \cdot 10^6 \text{ m}^3$ available**

| Rice | Yield (t ha⁻¹) | Water (mm) | WP_{IR} |
|----------------|----------------------------------|-------------------|------------------------|
| Flooded | 7.4 | 0.69 | 1.06 |
| AWD | 6.7 | 0.37 | 1.81 |

Two “response options”

| Conventional (less area) | Area (ha) | Water used (10⁶ m³) | Production (10³ t) |
|-------------------------------------|----------------------|--|--|
| Flooded rice | 8,000 | 56 | 59.2 |
| Fallow | 2,000 | - | - |
| AWD | - | - | - |
| Total | 10,000 | 56 | 59.2 |

| Alternative | Area (ha) | Water used (10⁶ m³) | Production (10³ t) |
|---------------------|----------------------|--|--|
| Flooded rice | 5,680 | 40 | 42.0 |
| Fallow | - | - | - |
| AWD | 4,326 | 16 | 29.0 |
| Total | 10,000 | 56 | 71.0 |

Maximized water productivity

- **Higher total production**
- **Increased equity among farmers**
- **No land abandonment**