Cornell University
Cornell International Institute for Food, Agriculture and Development

"MORE CROP PER DROP- SYSTEM OF RICE INTENSIFICATION" Pratyaya Jagannath

SRI-RICE
SRI INTERNATIONAL NETWORK AND RESOURCES CENTER

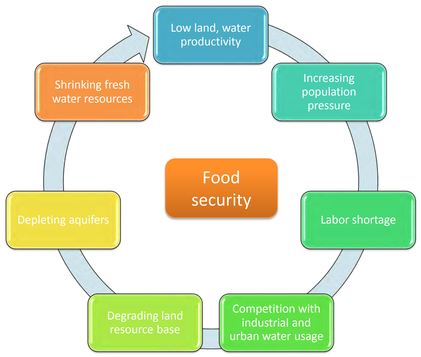
Water scarcity

- Fresh water resources are only about **3%** of the world's **available water**.
- The world **population** is expected to increase to **9.1 billion** by **2050** (up from current 7 billion).

Table 1 | Total Water Withdrawal by Sector (km3/per year)

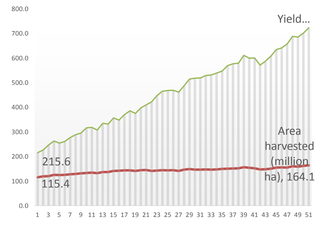
Region	Municipal	Industrial	Agricultural
World	429	723	2,710
Africa	21	9	184
Americas	126	280	385
Asia	217	227	2,012
Europe	61	204	109
Oceania	5	3	19

Water usage globally has been **growing** more than twice the rate of increase in population during the last century.



Rice, food security, and water usage

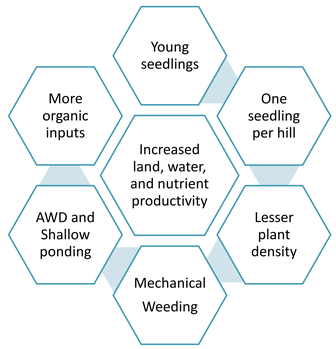
- **Rice** (Oryza spp.) is the **staple food** for about **50%** of the world's **population**.
- Rice **production** needs to be **increased** by **60%** from the current level to meet the food demand in 2025.
- The **annual yield** of **rice** is about **723 million tons** in an **area** of **164.1 million hectares**.



- The **area** under rice production has **increased** by about **42%** only, compared to an overwhelming **increase** of **235**% in the **yield** of rice.
- About **1,900 to 5,000 liters of water** is required to **produce 1 kg of rice.**
- Rice uses of about **34 – 43%** of the **world's** total **irrigation water** (about **24– 30%** of the world's developed **freshwater** resources).
- By **2025** about **10% land** under rice production will face **water scarcity**.
- There is a **need** to **produce** both more **food** and at the same time to **save fresh water**.

The System of Rice Intensification (SRI)

The System of Rice Intensification (SRI) is a climate-smart, agroecological methodology for increasing the productivity of rice and other crops by changing the management and increasing the productivity of seeds, soil, water and nutrients. (See http://sririce.org).



Difference in agronomic practices

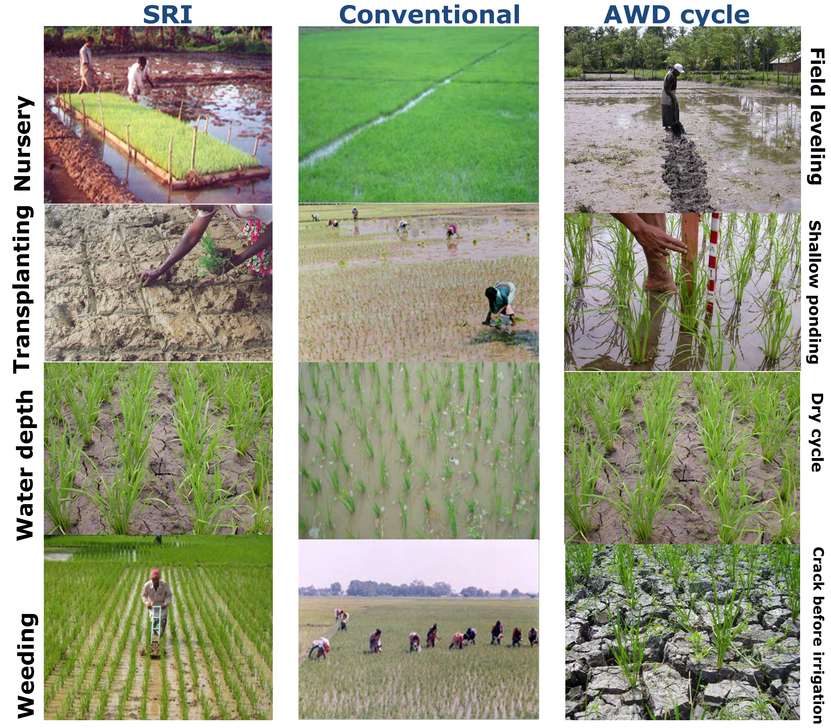
Practices	System of Rice Intensification	Conventional methods
Seed (kg/ha)	5-10	80-120 or more
Age of seedlings (days)	8-15	25-45 or more
Number of seedlings / hill	1, possibly 2	3-6 or more
Spacing between hills (cm)	20 x 20 to 35 x 35	Different practices, rows, lines, furrows, hills at random
Number of transplants / m²	9-25, maximum 30-35	75-200
Water management	Maintain moist or saturated soil; or alternate wetting and drying (AWD)	Continuous flooding of paddies
Manure management	Compost/manures; mineral fertilizers as a supplement if needed and available	Basal mineral fertilizers + N topdressing
Weed management	3-4 times with rotary hoe / cono-weeder	Manual +Herbicide

Difference in water management during different stages of crop growth

Growth Stages	Planting	Rooting	Tillering	Forming young head	Booting	Heading, flowering	Milky stage	Dough stage	Yellow stage	Full ripe
Conventional practice	Shallow ponding	Deep ponding	Shallow ponding	Deep ponding			Shallow	ponding		Water release
SRI	Saturated	AWD	AWD	Maintain shallow ponding or AWD as plant roots have grown deeper						Water release

Advantages and disadvantages of flooding and AWD practices

	Continuous flooding		AWD	
	Advantages	Disadvantages	Advantages	Disadvantages
Soil properties	Neutralises the soil, softer till	Accumulation: Organic acids of Fe (Iron) + emissions: CH_4, CO_2, and H_2S gases Root zone: hypoxia, rot, & stagnation	Aeration: Soil biota and root systems Nullifying: oxidation of minerals like iron - emission: Maintain temperature	Non-neutralization of soil pH.
Nutrients	+ availability of: N, P, K, Si, Mb, Ca, Nitrogen fixation Mineralization of organic N	De-nitrification: Leaching and nutrient loss - concentration of : water soluble of Zn and Cu	Faster and increased N fixation and assimilation	Lower P,K, and Si availability in poor and acidic soil conditions
Weed	Effective control of grass and weeds	Broad leaf weed growth	If regulated properly weed growth can be controlled	Need of frequent weeding

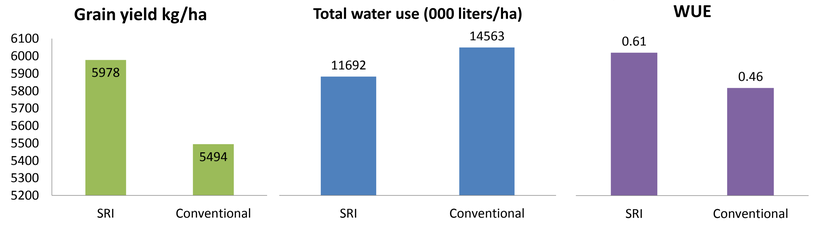


Comparing yield, water usage and water productivity

(comparing 32 scientific researches across the world on water use comparing SRI and conventional methods)

Significant advantages of SRI over conventional methods recorded by researchers in %					
Grain yield		Water usage		WUE	
81	Avasthe, R.K., 2012	52	Adusumulli,R. 2011	175	Radha, Y. ,2013
74	Hasan, M., 2007	44	Ceesay, M. 2006	149	Adusumulli,R. 2011

***WUE**= Grain yield (kg/ha) / total water consumed in liters per hectare), the higher the better for enhancing water productivity



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- Photographs courtesy- SRI Rice, CIIFAD and the authors of the papers
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