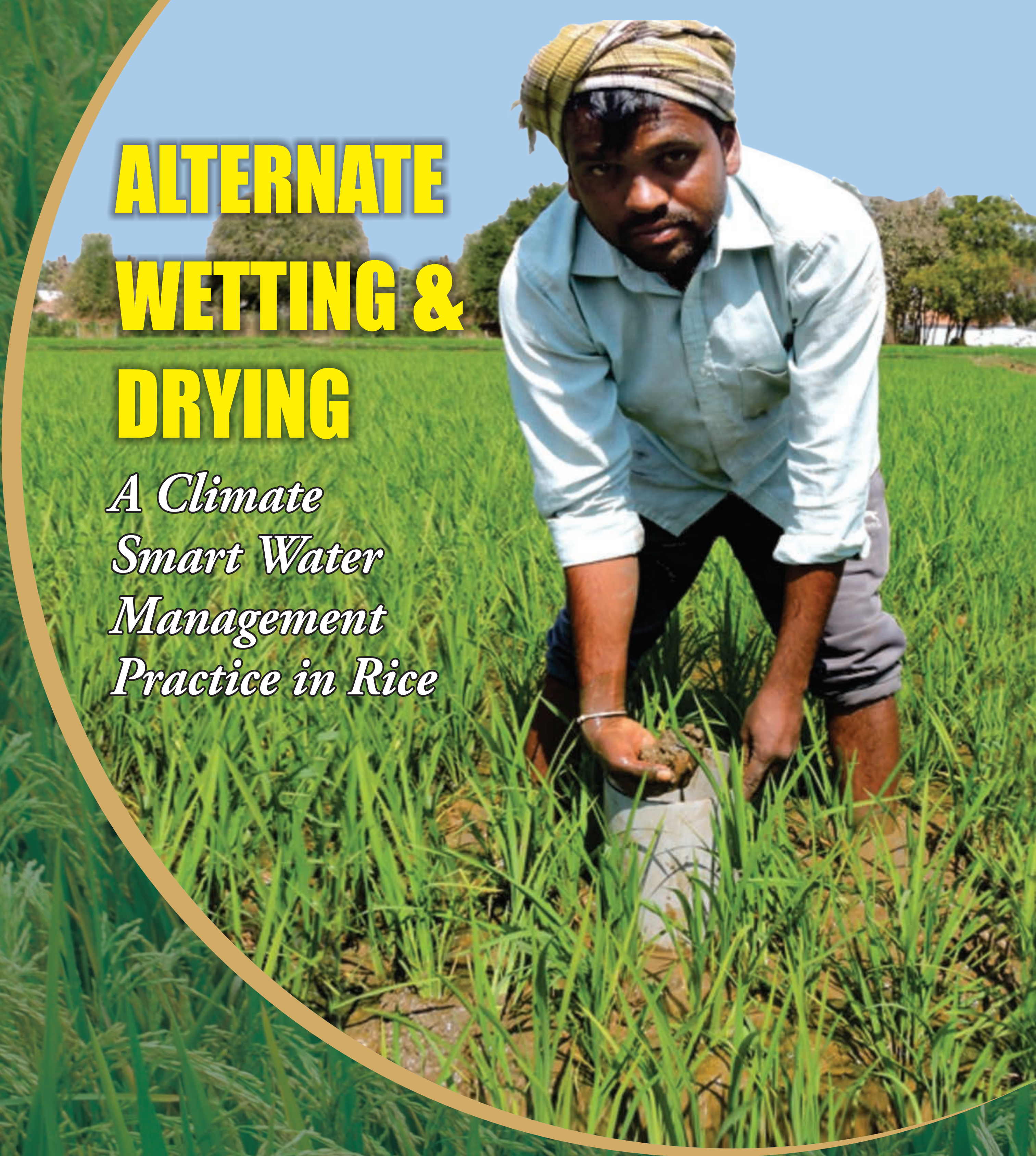
ALTERNATE WETTING & DRYING

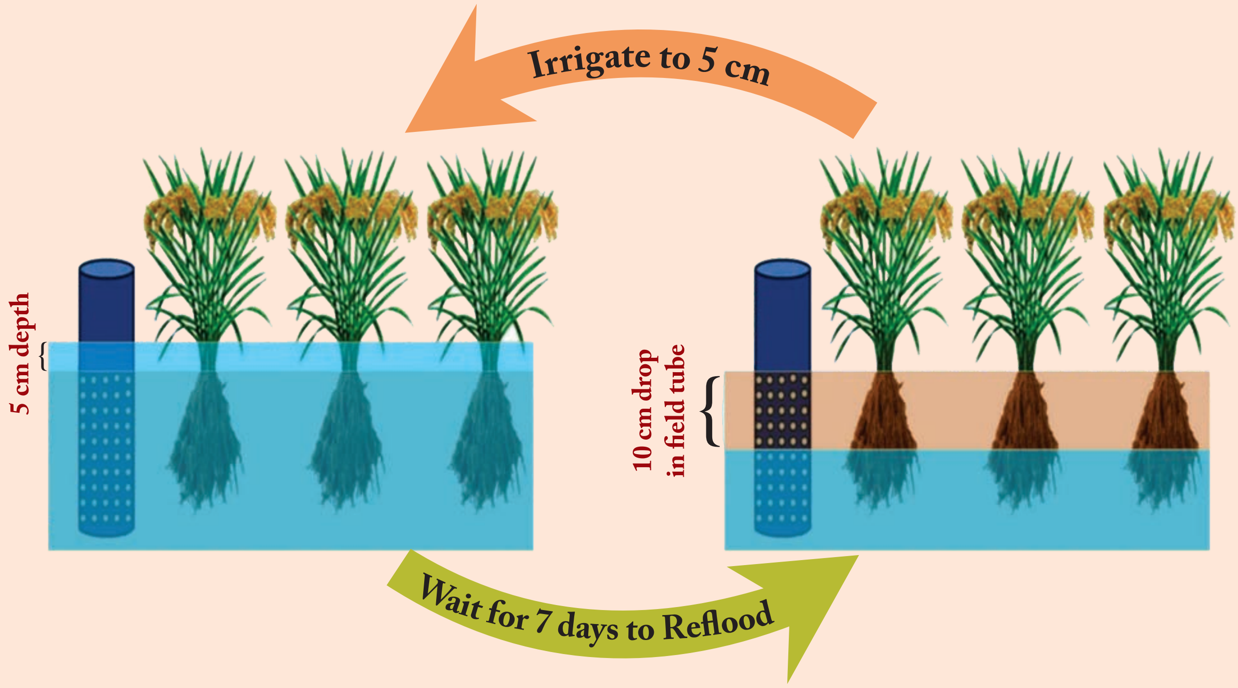
A Climate Smart Water Management Practice in Rice



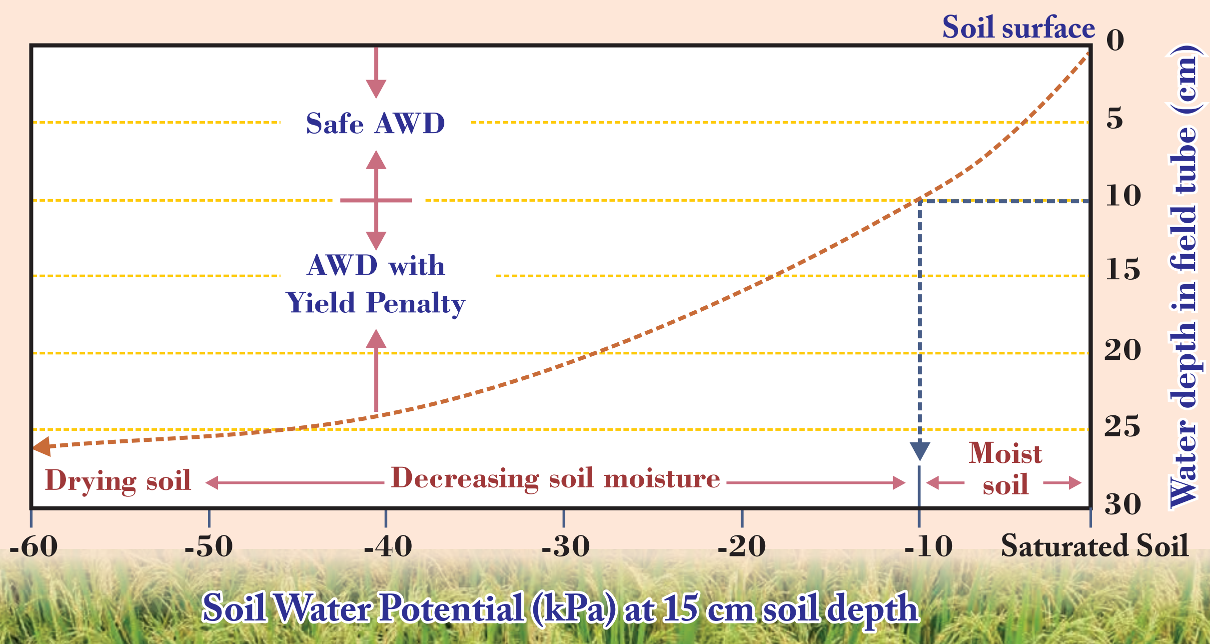
Rice is the dominant staple crop in much of the world and is critically important for global food security, yet rice cultivation is a profligate user of water and a significant source of CH_4 emissions, accounting for 9–11% of GHG emissions from agriculture. Furthermore, increases in rice production over the last half-century relied heavily on irrigated rice production, which is increasingly constrained by water scarcity. Given the growing shortage of water for irrigation of crops and environmental concern, the Professor Jayashankar Telangana State Agricultural University, developed water conserving technologies. One of these technologies is Alternate Wetting and Drying irrigation practice (AWD) in rice.

What is AWD?

- AWD of rice is a water management practice that could reduce water use and curtail greenhouse gases (GHG) emissions in irrigated lowland rice fields.



- In AWD, irrigation water is applied to flood the rice field a certain number of days after the disappearance of ponded water.
- Hence, the field is subjected to periodic drying and reflooding reducing water use and curtailing GHG emissions, while increasing grain yields over conventional farmers practice of continuous flooded (5 – 10 cm) rice crop.
- At about two weeks after transplanting of rice (or with a 10-cm tall crop in direct seeding), the rice field soils are left to dry out until the ponded water level in the perforated field water tube reaches 10 cm below the soil surface. Then, the field is flooded again to a water depth of 5.0 cm before allowing to water level drop again to 10 cm below the soil surface in the field water tube while meeting the crop water needs.
- This irrigation scheme of periodic drop in ponded water level and reflooding is repeated during the rice life-cycle.
- The number of days of drying period without standing water in rice field in AWD irrigation practice before reflooding varies from 1 to 7 days depending on the soil type, weather conditions and crop growth stage.



Why is AWD Important?

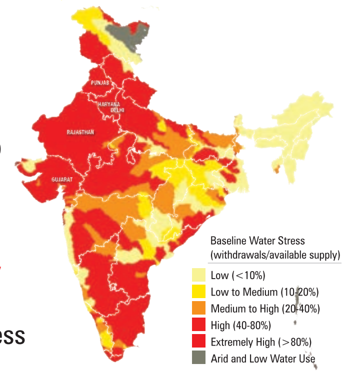
Rice Cultivation Requires Large Amounts Of Water

Approximately **3250** Litres Of Water *to produce* **1 KILO** OF RICE

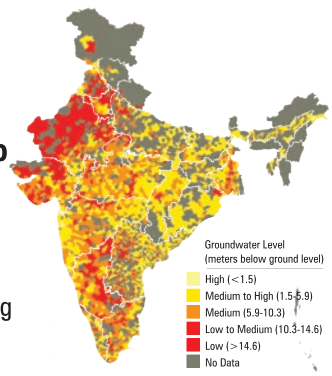
Water for Agriculture is becoming increasingly scarce Worldwide.

By 2025 **20 Million** Hectares of Irrigated rice fields may suffer from water scarcity

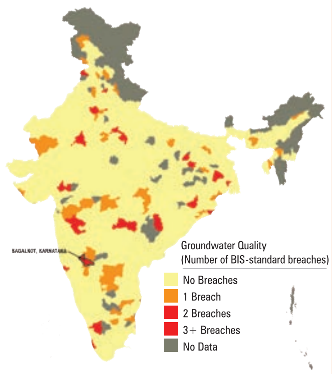
54% of India Faces **High** to **Extremely High** Water Stress



54% of India's Ground-water in Wells are Decreasing

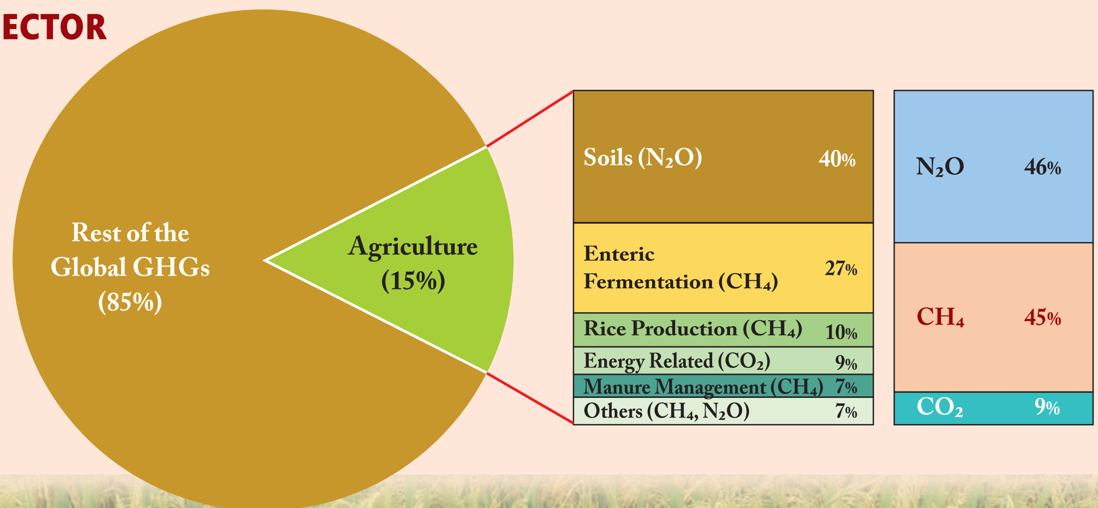


More than **100 Million** People Live in Areas of Poor Water Quality

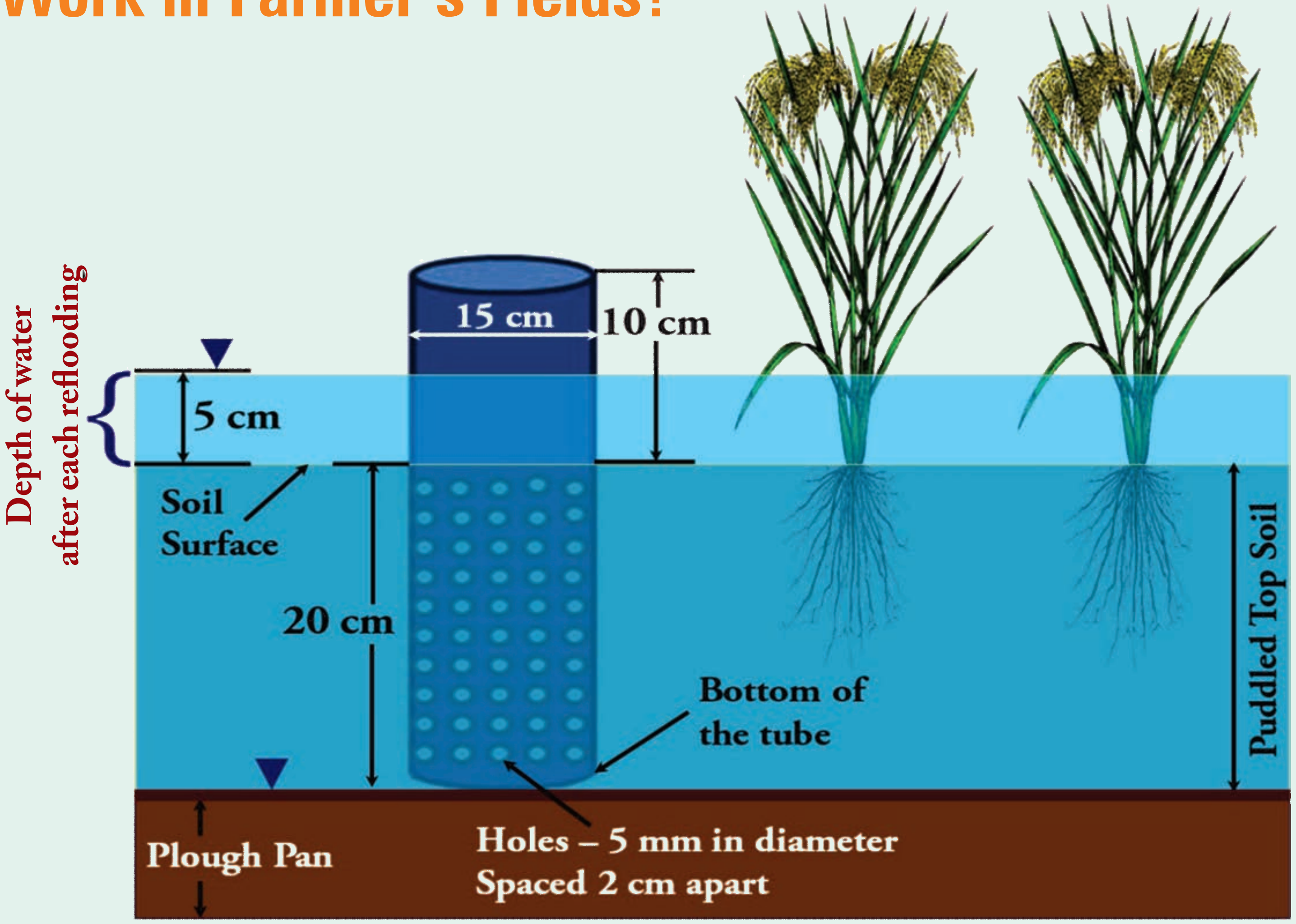


Globally, 15% of Anthropogenic GHG Emissions come from The Agriculture Sector

Flooded rice production systems comprising irrigated lowland, rainfed, direct seeded converted to wet, deep water rice emit significant amounts of methane (CH_4), a potent GHG that contributes to global warming



How Does AWD Work in Farmer's Fields?

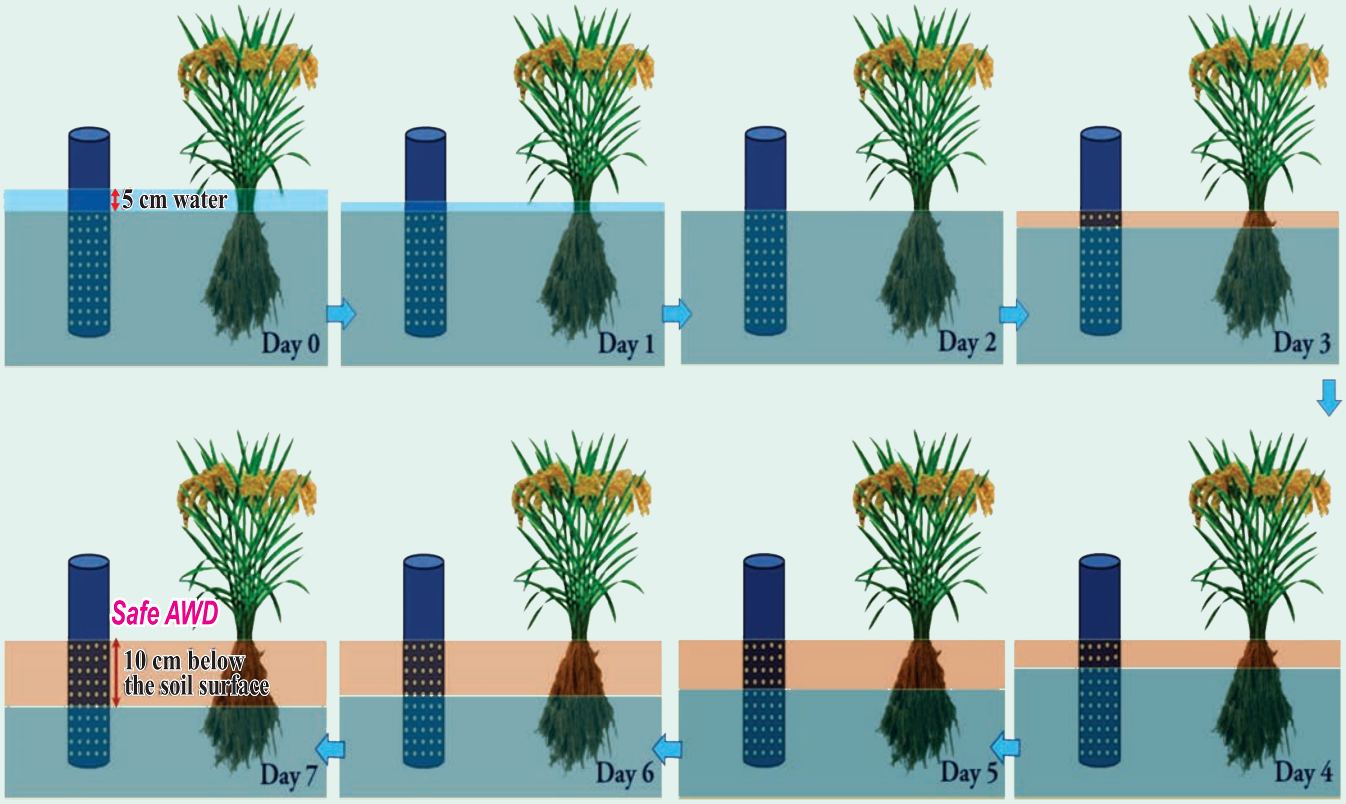


A practical way to implement the AWD is to monitor the depth of ponded water in rice fields using a field water tube. A field water tube can be made of 30 cm long PVC pipe having 15 cm diameter so that the water table is easily visible. Perforate 20 cm of field water tube on all sides by drilling holes of 5mm diameter spaced 2 cm apart. Bury the perforated side of the tube in the soil so that 10 cm protrudes above the soil surface. Remove the soil from inside the tube until the bottom of the tube is visible.

Locate the field water tube in a well levelled representative spot to ensure that the water level maintained is similar both inside and outside the field water tube and easy monitoring. This field water tube has been effective in assuring farmers that the rice plant is accessing water even when there is no standing water in the field.

Once AWD has become established, the tube is often dispensed with and farmers base the decision to irrigate on soil monitoring. Proper levelling of rice fields is necessary to ensure that no areas are excessively dry or wet, which could adversely affect grain yields. Laser land-levelling may be appropriate in some farming situations. Weed control is important, as periods of no standing water in rice fields encourage weed growth.

Safe AWD



Where AWD can be Practiced?

In groundwater irrigated areas where farmers have access to reliable water supplies to reflood once the field is dried out to “Safe AWD” status. AWD is not applicable in high rainfall areas since the rainfall exceeds crop water needs and the field will not be able to drain out the excess water during the growing period. AWD is not recommended in rainfed rice and tail-end canal commands due to uncertain water availability when fields have to be re-flooded.


LESS
MORE
AWD

Benefits of AWD

Based on field studies, AWD is the most promising climate smart water management practice for reducing water use and decreasing CH_4 emissions.

Reduced water application

Conventionally rice crop is raised by impounding water in the field to a depth of 5 to 10 cm. In AWD irrigation since no continuous standing water is maintained in the field during crop growing season the number of irrigation events is reduced. This results in a net water saving of 35% when compared to continuously flooded rice crop. AWD can save up to 660 liters of water per kilogram of paddy. It is also considered as climate smart agriculture practice and helps farmers to cope with declining water levels in wells and unforeseen water scarcity situations. Improving water management in rice production generally reduces demand for irrigation water, which can increase fresh water supply for other uses.

Increased net profits for farmers

Safe AWD irrigation practice in rice production under wells increases net profit to farmers by lowering water costs (when priced), lowering electricity (pumping) costs (when power is unsubsidized), raising crop yields by promoting more effective tillering and stronger root growth, and/or reducing labour costs. However, in many other cases, additional incentives will be necessary in order to make improved water management practices cost effective for farmers.

Tolerance to lodging

Decreased water use also reduced the occurrence of 'lodging' (when rice plants keel over due to heavy rain) and helps the plant grow better tillers (the 'branches' that eventually carry grain) and stronger roots. The resulting improved field conditions (soil stability) helps reduced harvesting costs (Rs. 200 – 400/acre), as mechanical harvesting becomes feasible.

GHG mitigation potential

The growing of rice in flooded fields produces methane because the standing water blocks oxygen from penetrating the soil, creating conditions conducive for methane-producing bacteria. Shorter flooding intervals and more frequent interruptions of flooding in rice fields reduces the emissions of methane—a potent greenhouse gas—by reducing the populations of methane-producing bacteria and stimulating the break down of methane by other bacteria. Rice cultivation under flooded conditions is responsible for 10 - 16% of GHG emissions from agriculture in different countries. Water saving technologies such as AWD irrigation practice reduces the amount of time rice fields are flooded and is assumed to reduce the production of methane by about 30 – 50%. Combining AWD with nitrogen-use efficiency and management of organic inputs can further reduce greenhouse gas emissions. Intensive research by scientists from IRRI and its partners have helped AWD irrigation practice to become a key component for GHG mitigation in many Asian countries including India in the Agriculture sector. Other benefits expressed by farmers in Telangana included early maturity (5 – 7 days), less incidence of BPH, reduced plant protection costs (Rs. 400 – 900/acre), no lodging etc.

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