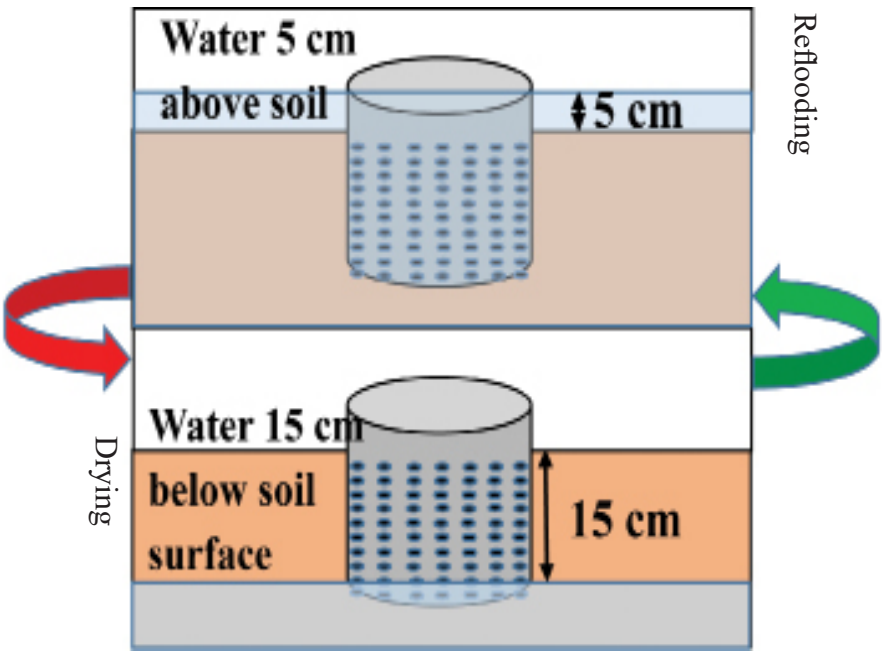
Grow More with Less: A Farmer's Guide to Alternate Wetting and Drying

Anjani Kumar, Sangita Mohanty, Abhishek Kumar Sahu,
R P Sah and Arvind Yadav



INTRODUCTION

Alternate Wetting and Drying (AWD) is a controlled and intermittent irrigation method designed to enhance water use efficiency in rice cultivation. This water-saving technology can reduce water consumption by 15-40% while maintaining yield levels. The technique involves applying irrigation water only when the ponded water on the soil surface has completely disappeared. To ensure precise monitoring, farmers use a field water tube or pani pipe (40 cm in length and 7-10 cm in diameter) to track water depth in the field. For optimal results, re-irrigation should occur when the water level in the field water tube drops below 15 cm from the soil surface. However, during sensitive growth stages like flowering, a thin water layer of about 2 cm should be maintained to prevent stress. AWD not only enhances water-use efficiency but also significantly reduces greenhouse gas emissions by 30-50%, making it an environmentally sustainable approach to rice cultivation.

KEY NOTE

AWD cuts methane emissions by 48% while maintaining yield.

Incentives for AWD adoption are stronger when farmers bear pump irrigation costs, as water savings translate to direct financial benefits.

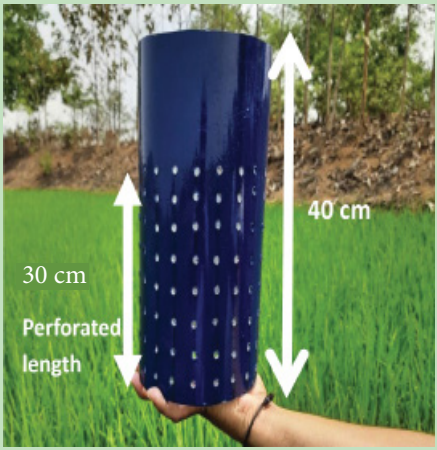
Benefits of Alternate Wetting and Drying

AWD offers significant benefits, including water savings of 15-40% without yield loss. It enhances root anchorage, reducing plant lodging issues. For farmers using pump irrigation, AWD lowers fuel costs and pumping expenses, leading to an increased income of Rs. 6000-8000/- per hectare. Additionally, AWD reduces methane emissions by 30-50%, depending on water management and rice stubble handling. Periodic soil aeration under AWD also increases zinc availability in both soil and grains, improving crop nutrition. As a sustainable water-saving technology, AWD is well-suited for lowland paddy rice production under irrigation.

Implementing Alternate Wetting and Drying (AWD)

1. Pani Pipe based AWD:

Making the Pani Pipe (Field Water Tube): To implement AWD in rice fields, a field water tube is essential for monitoring water levels. The tube, made from either plastic pipe or bamboo, should be 40 cm long and 7-10 cm in diameter to ensure visibility of the water inside. The bottom 30 cm of the tube should be perforated with 0.5 cm holes, spaced 2 cm apart, allowing water to flow freely through it.



Placing the Tube: The tube should be installed in an easily accessible location near the bund (at least 1 meter away) in a spot that represents the average water depth of the field. It should be buried 30 cm deep, leaving 10 cm of its length above the surface. The soil inside the tube must be cleared to ensure visibility of the water level, which should align with the field water level.

Practicing Alternate Wetting and Drying (AWD): AWD involves monitoring ponded water depth using the field water tube. After flooding, the water level gradually decreases. Once the water drops 15 cm below the soil surface, the field should be re-irrigated to maintain 5 cm of ponded water—a practice known as Safe AWD. AWD can begin a few days after transplanting (or when crops reach 10 cm height in direct seeding). In fields with heavy weed infestation, AWD may be delayed for two to three weeks until weeds are suppressed by ponded water.

During the flowering stage, a 5 cm water layer must always be maintained to prevent water stress and avoid significant yield loss. After flowering, during grain filling and ripening, the field can again be allowed to dry down to 15 cm below the surface before re-flooding. Safe AWD can reduce water usage by 15-25% without compromising yield. In some cases, the water depth can be allowed to drop further—20 to 25 cm below the surface—to optimize water savings.

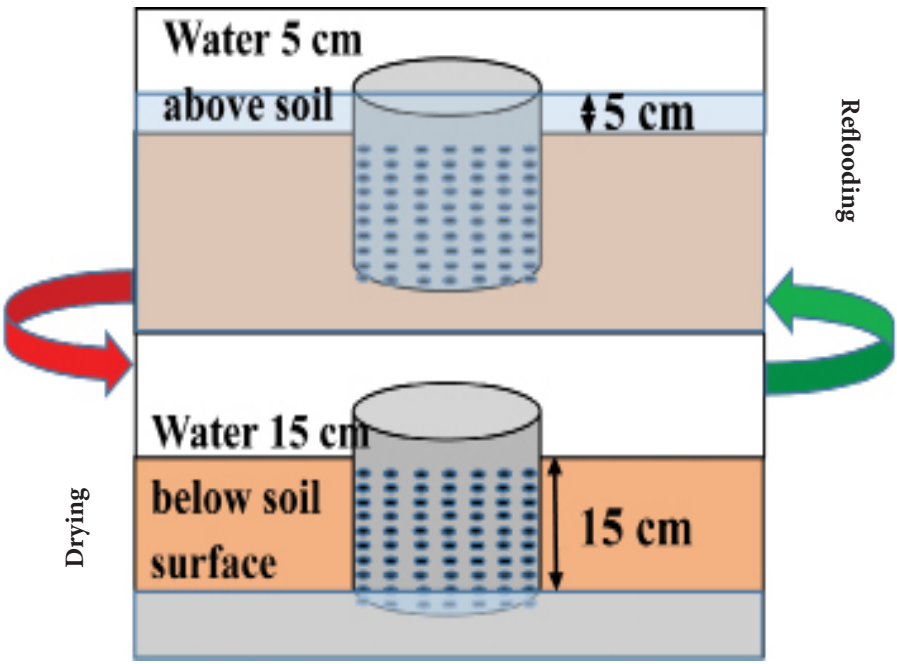
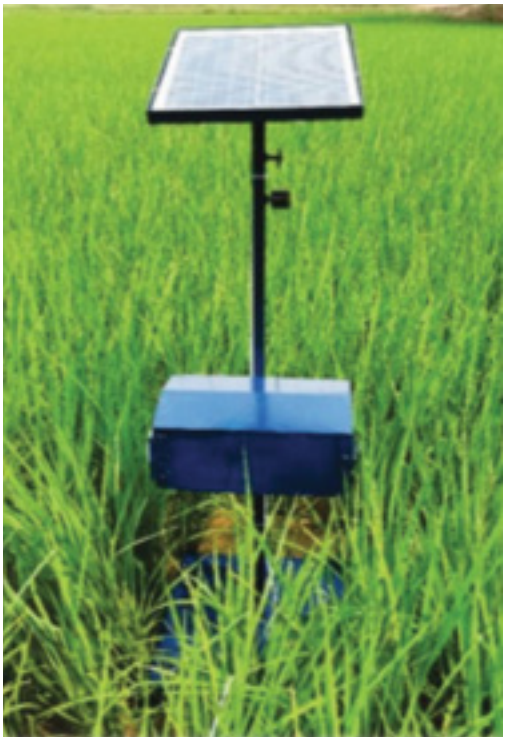


Illustration of AWD operation technique based on Pani Pipe

Eco-friendly Irrigation Alert System (e-IAS) based AWD

Monitoring the water level in the pipe on regular basis in the distant fields is a difficult task for the farmers, very often, the monitoring is not done properly, which results in late irrigation, and ultimately the adverse effect is reflected in the crop performance. For overcoming the manual monitoring, ICAR – CRRI has developed Eco-friendly Irrigation Alert System (e-IAS). In this system, a sensor is attached with the perforated pipe installed in the rice field at desired depth. The sensor is connected to a microcontroller and relay module. The whole system is powered by a 12V battery and the battery is charged by a solar panel installed at the top of the structure. As soon as the water level in the rice field goes down below the desired level, the sensor communicates the signal to the microcontroller, which switches on the red bulb and alarm. The glow of red bulb and alarm sound aware the farmer for the irrigation event. Moreover, on reaching the threshold level, the microcontroller and GSM modem also sends an alert message to the farmers' mobile number registered with the system.

This innovation bridges traditional practices with smart technology, enhancing water-use efficiency while safeguarding crop yields.



Key Advantages of e-IAS

- Eliminates manual monitoring errors
- Solar-powered, sustainable operation
- Instant visual (LED) + audio (alarm) alerts
- Remote SMS notifications for distant fields

Customized Color Coded Tensiometer (CCCT) based AWD

It is a simplified and farmer friendly version of tensiometer tube for real time soil water potential based irrigation management in rice fields. In this tensiometer, the usual measuring gauge has been replaced by the stripes of light blue, deep blue, orange and brown color. While the water level in tensiometer tube at light blue stripe signifies no need for irrigation, there is need to irrigate when the water level enters the deep blue stripe. The entry into the orange and brown stripe may adversely affect the crop yield and hence should be avoided

Before installation, fill the tensiometer tube with air-free water and seal it with the cap. Then submerge the entire unit in clean water overnight, making sure the porous ceramic cup is completely covered to ensure proper saturation and to check for any leaks.

To prevent the ceramic cup from drying out during transport, keep it wrapped in wet paper towels or covered with a plastic bag until installation.

To install the tensiometer, first drill a hole to the desired depth (e.g., 20 cm) using a soil auger. After removing the auger, place a handful of loose, friable soil into the hole. Carefully remove the protective covering from the ceramic cup and insert the tensiometer with a firm, twisting motion to ensure good soil contact while avoiding excessive force that could damage the cup. Finally, backfill the hole with soil slurry to securely hold the instrument in place.

After installation, check the tensiometer for any air bubbles that may have formed beneath the cap. If present, carefully remove the cap and refill the tube with de-aerated water to ensure accurate measurements. Allow the instrument to stabilize in the soil for approximately 24 hours before recording any readings, as this equilibration period is critical for obtaining reliable data.

PRECAUTION

When using customized color-coded tensiometers for irrigation scheduling, ensure proper installation at the correct root zone depth with good soil-cup contact to prevent air gaps. Regularly check for and remove air bubbles by refilling with de-aerated water, and handle the ceramic cup carefully to avoid cracks. Protect the instrument from direct sunlight and physical damage, while following the manufacturer's color codes to interpret moisture levels accurately. Maintain the tensiometer by keeping the cup saturated when not in use, cleaning it periodically, and allowing 24 hours after installation for stabilization before taking readings. Replace the unit if the ceramic cup becomes damaged or unresponsive for reliable irrigation scheduling.

NRRI-ARM SENSOR based AWD

This innovative device assists rice farmers in determining optimal irrigation timing, enabling significant water conservation while improving water-use efficiency in rice cultivation. The NRRI-ARM Sensor helps optimize rice irrigation by monitoring soil moisture at 25-30 cm depth. Its rods measure soil conductance, triggering color-coded LED indicators to glow. This precision tool enhances water productivity by guiding farmers to irrigate only when needed, saving 30-40% water.

Interpretation of Soil Moisture by NRRI-ARM sensor

Color of bulb	Soil moisture status	Interpretation
Blue	Sufficient moisture	Irrigation not needed
Yellow	Low moisture	Irrigation advisable
Red	Very Low moisture	Immediate need of irrigation

BENEFITS

- Portable, easy to install and handle
- Save irrigation water upto 40%
- Instant indication of the real time soil moisture

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Phone: +91-671-2367757; PABX: +91-671-2367768-783; Fax: +91-671-2367663;
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