# Using Alternate Wetting & Drying (AWD) Rice Flood Management

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## What is Alternate Wetting & Drying?

Alternate wetting and drying (AWD) is also known as intermittent flooding. AWD is the practice of flood initiation and recession. It was first developed at the International Rice Research Institute (IRRI). As a rice flood management practice, AWD is used to maximize rainfall capture and reduce irrigation pumping while maintaining grain quality and yield.

AWD consists of flooding a field to a reasonable depth and allowing the flood to naturally subside to the soil surface via infiltration and evapotranspiration. This subsidence can be a mud (or drier) consistency at the soil surface before reflooding depending on field specifics including soil texture and irrigation capacity.

The timing, frequency, and extent of the wetting and drying cycles depend on rice growth stage, prevailing weather and field conditions, and grower comfort level with the practice. After holding the initial flood for three weeks, it is common to refrain from applying a flood for five or more days between wet-dry cycles when using AWD. A full flood is maintained at panicle initiation (green ring) and at flowering, when rice is most sensitive to water stress.

## Potential benefits

Mid-South producers have shown that when properly managed AWD can reduce irrigation use while having no negative impact on grain yield. As much as one gallon of diesel fuel may be saved for every acre-inch of groundwater that is not pumped or is offset by the capture of rainfall. Edge-of-field runoff is also reduced. Lastly, both methane gas emissions and arsenic levels in grain are reduced when AWD flooding is practiced where the soil becomes aerobic for a short period of time.

## Potential risks

Reduced grain yield and/or quality may result from water stress and/or reduced control of pests, particularly grasses and diseases. Water stress will occur if the field is allowed to dry too much and/or if the flood is not re-established in a timely manner, as can occur with undersized wells, irrigation system failure, and/or human error. Late-planted rice (late May and June) is susceptible to disease and should not be managed using AWD flooding.

## Getting Started

First, determine if AWD flood management works with your conditions and management style. Determine this on a small field, using a single dry-down period similar to that used for straighthead control.

Only use AWD on fields that meet the following criteria:

- Weed, disease, and/or insect issues should be well known and low risk for AWD candidate fields. Selected fields should be low risk for difficult to control weed pressures.

- Fields should not have a history of blast incidence.
- AWD should not be attempted on lighter-textured soils – only on silt loam and clay textured soils.
- AWD fields must use Multiple Inlet Rice Irrigation (MIRI) or zero-grade rice irrigation systems. A field irrigated using only levee-gate (cascade) flood distribution is not suitable for AWD. Use of MIRI ensures that flooding can be done in the least amount of time. MIRI plans can be developed by the University of Arkansas "Rice Irrigation" mobile app or the web-program "Pipe Planner™" offered by Delta Plastic.
- The field should have the irrigation capacity to establish an initial flood in a short period of time (~3 days) using MIRI. Irrigation source should meet recommended capacity of 15-20 gallons per minute per acre for silt loam and clay soils. A reliable irrigation source is critical, so that reflooding can be accomplished within 24 hours. Additionally, fields that can be serviced by more than one pumping plant provide assurance of this capacity. Divide fields into smaller sets to meet flood time criteria.
- Hybrid rice offers additional protection against disease5, particularly blast, and should be considered when evaluating and learning AWD until one is comfortable with the practice before attempting it with cultivars more susceptible to disease.
- Levee gates should be raised 1-2 inches to create freeboard between the full flood level and top of the gate; this greatly improves capacity to capture rain and reduce pumping.
- Flood depth gauges aid in AWD flood management and are highly recommended.

**Fig. 1.** Multiple inlet irrigation is required when implementing AWD.

**Fig. 2.** Cascade (levee-gate) flood irrigation is not suitable for AWD.

- Thorough training and oversight of field personnel new to AWD flood management is highly recommended.

## Pest Control in AWD

While more AWD-specific research is needed, experience suggests that pest control programs that are effective under a continuous flood also work under AWD. Follow university recommendations.

**Weeds:** With the effective herbicide programs now available, continuous flooding for weed suppression is not necessary in most cases. For example, barnyardgrass control remains as effective using AWD as with continuous flooding.

**Insects:** Follow university recommendations.

**Diseases:** Use of crop rotation, disease resistant rice hybrids and varieties, and preventative fungicide applications when needed are recommended.

## Fertility Management

Properly managed AWD should not influence nutrient management in regards to rates and timings of fertilizer application. By following the above university guidelines for AWD, no changes are needed to nitrogen (N) fertility management. A single preflood N fertilizer application simplifies water management through the season. A continuous flood should maintain well saturated soils for a full three weeks following preflood N application to ensure efficient N uptake by rice plants. If a two-way split N management plan is used for conventional cultivars the midseason N application should be applied into the floodwater, which is maintained for at least five days following application.

**Table 1.** Alternate Wetting & Drying (AWD) rice flood management practices for delayed flood, drill-seeded rice production in the Mid-South.

| Rice Growth Stage | Flood Status | Agronomic Activity | Comments |
|---|---|---|---|
| **Planting to four-leaf.** | None. | Weed control: Pre-emergence plus early post-emergence herbicide program featuring residual herbicides.<br>Disease: Seed treatment using broadspectrum fungicide(s).<br>Insects: Insecticide seed treatment for rice water weevil and grape colaspis control. | Follow standard university cooperative extension pest control recommendations. |
| **First tiller (4-5 leaf rice).** | Initiate and maintain flood as normal. | Apply herbicide(s) and fertilizer as normal prior to initial flood. | Hold flood for three weeks to stabilize nitrogen and to allow canopy closure to aid in weed suppression. |
| **Three weeks after initial flood.** | AWD flood. | Begin AWD flood by halting irrigation and allow flood to subside naturally. Reestablish flood when mud appears in top third of paddy, do not allow soil to form cracks. Repeat cycle. Apply postemergence weed control as needed, per university recommendations. | If new to AWD, begin with single dry down as recommended for straighthead control. The ultimate number of wet-dry cycles is a function of weather, field, soil conditions, and producer comfort with AWD. |
| **Panicle initiation (Green ring).** | Full flood. | Establish and maintain flood 5 daysbefore and 7 days after panicle initiation (green ring). | Rice is sensitive to water stress during this growth stage. Do not allow flood to dry. |
| **Optional: Midseason N application.** | Shallow flood. | Apply mid-season N fertilizer to a shallow flood, if needed after panicle initiation AND 3 weeks after preflood N incorporation. Maintain stable flood condition for 5 days. | Resume AWD flood management after nitrogen applied. |
| **Early to late boot.** | AWD flood. | Apply broad-spectrum fungicides for disease prevention, per university recommendations. | Re-flood whenever mud appears in top third of paddy, do not allow soil to form cracks. |
| **Heading and Grain Fill** | Full Flood | | Establish and maintain a full and permanent flood from 3 days prior to 50% heading until 25 days after 50% heading for long-grain cultivars (35 days for medium grain cultivars) |

## Resources

Arkansas Rice Production Handbook, MP192. (J. Hardke, ed.) University of Arkansas Division of Agriculture. (208 pages). Available at: http://www.uaex.uada.edu/publications/pdf/mp192/mp192.pdf.

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