AGRONOMY

ON-FARM VERIFICATION OF INTERMITTENT FLOOD TECHNIQUES IN THE MISSISSIPPI DELTA

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"DATA SUGGESTS THAT RICE GROWN USING ALTERNATE WETTING AND DRYING IRRIGATION CAN IMPROVE WATER-USE EFFICIENCIES COMPARED TO USING CONTINUOUS FLOODED RICE, REDUCE IRRIGATION PUMPING AMOUNTS, AND IMPROVE OVERALL FARM PROFITABILITY."

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The alluvial aquifer serves as the major source of irrigation water for rice production in Mississippi; however, it is declining at a rate of 300,000 acre feet per year and has done so for approximately 25 years. On average, rice uses approximately 3.0 acre feet per year, which based on average acreage equates to approximately 600,000 acre feet per year. MS Agricultural and Forestry Experiment Station research has shown that rice can be produced with up to 50% less water than the regional average using multiple-side inlet, alternate wetting and drying (AWD) flooding strategies in Mississippi. The objective of this research is to develop safe and efficient intermittent flood strategies while maintaining yield and improving overall farm profitability and to establish best management practices (BMPs) for Mississippi rice growers, state and federal agencies (including county extension agents), and private industry (field reps/consultants) for an AWD irrigation production system including: cultivar selection, N management, weed control, disease, and physiological disorder control.

An experiment was conducted on 18 grower fields throughout the Delta region of Mississippi from 2014-2016 to evaluate yield response of rice grown using multiple side-inlet (MSI) irrigation, and MSI coupled with AWD irrigation as compared to rice grown using conventional continuous water management. Three adjacent fields were chosen on each

Table 1. *Yield, water use, water use efficiency (WUI), and profitability for conventional rice irrigation, multiple side inlet, and multiple side inlet + alternate wetting/drying (AWD) for grower field experiments from 2014 – 2016.*

	Yield --- bu/ac---	Water Use --- ac-in ---	WUI --- bu/ac-in ---	Profitability --- $/acre ---
Conventional	165 a*	34.3 a	4.8 a	604 b
MSI**	168 a	28.7 b	5.8 a	629 a
MSI + AWD	166 a	23.4 c	7.1 b	633 a

* Means followed by the same letter are not significantly different at P ≤ 0.05.
** MSI- Multiple side inlet

farm, one for each irrigation treatment. Continuously flooded rice was managed by the grower, while MSI and MSI + AWD was managed by MSU. A custom pipe made from 6" PVC was installed in AWD fields to monitor water level below the soil surface. Irrigation of AWD treatments was initiated when water level reached 4″ below the soil surface. Rice water use was determined using a flow meter in each treatment, and yield was recorded at harvest.

Results from grower fields from 2014-2016 suggest that rice grown using AWD irrigation reduced water use by 27% compared to conventional irrigation. Rice grain yield was maintained in AWD irrigation compared to MSI and continuous irrigation. Water use efficiency (WUI, bushels per acre-inch) increased 29% for AWD irrigation compared to continuous flood irrigation. Averaged over 18 sites, 45% of growers exceeded the permitted 36 acre-inch for a conventional continuous flood, 26% over using MSI, and 6% exceeded the permit using AWD. Economic analysis results indicate that profitability from rice grown using AWD and MSI averaged $29 and $25 per acre more than continuous flood irrigation, respectively. Rice growers that currently practice intensive water management (n=8) exceeded the permit 5% of time for conventional rice irrigation, however did not exceed the permit using MSI or AWD. On-farm locations that are not currently practicing intensive water management (n=10) exceeded irrigation pumping permitted values 86%, 46%, and 16% of the time with conventional, MSI, and AWD irrigation, respectively. Compared to continuously flooded rice, MSI alone increased farm profitability $56 per acre, and MSI with AWD averaged $74 per acre greater than continuous flooded irrigation practice. Irrigation water applied was reduced by 11 ac-inches, on average using AWD irrigation compared to conventional irrigation, and maintained equivalent grain yield. These data suggest that rice grown using AWD irrigation can improve WUI compared to using continuous flooded rice, reduce irrigation pumping amounts and improve overall farm profitability for Mississippi rice producers.

Figure 1. *Example of water level measurement below the soil surface using a modified "pani-pipe."*