RICE CULTURE

Rice Irrigation-Water Management for Water, Labor, and Cost Savings

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ABSTRACT

Field demonstrations of Multiple Inlet Rice Irrigation (MIRI) were conducted in 12 counties with 23 producers on 38 different fields. Additional MIRI work was coordinated through county agents in 9 counties and involved 27 other producers. Three county field tours included MIRI fields. Two field studies comparing MIRI to conventional rice irrigation on flat clay soil showed water savings of 42% and 44% on the MIRI fields. Early season data collection problems were encountered on another comparison between two clay soil fields, but MIRI still resulted in 2% water savings after mid-season even though timely rains were being received. A field comparison on two sandy loam fields recorded a 9% water savings on the MIRI field. Water savings of 26% with MIRI were measured on a comparison between two silt loam fields. Another silt loam field comparison resulted in 17% water savings after 10 July on the MIRI field. One cooperator found that his well was only delivering 750 gallons per minute (gpm). He contacted a well driller who lowered the pump setting and blasted the well screen and the well yield increased to 1500 gpm. A survey of growers using MIRI indicates most feel it is providing water-management advantages that will result in them using it on more fields.

INTRODUCTION

Multiple inlet rice irrigation offers several potential advantages over the conventional irrigation method: (1) reduced cold-water rice, labor, runoff, and pumping cost, (2) water conservation, and (3) improved water management and fertilizer efficiency. The mechanics of this system need to be introduced to growers and adequately evalu-
ated on production size fields with varying soil, water, and topographical conditions. This can be best done through on-farm demonstrations in various rice-producing areas of the state.

Many growers operate several pumping units that are often spread over a large area with several miles separating them. Managing these units becomes time- and labor-intensive. This can result in some units running longer than necessary. This occurs when no one is available to check on turning them off because of other time demands on the farm. The result is increased water use and pumping cost. Automatic timers and pump unit shut-off systems could be used to address this problem. There are various automatic shut-off methods available that need to be evaluated on-farm for practicality, dependability, and affordability.

An accurate measurement of pump flow is critical to effective water management. Few growers know the actual flow delivered by their pump units or how to determine it. The plumb-bob method and/or a flow meter are two practical approaches for measuring pump flow. On-farm demonstrations offer the opportunity to instruct growers on how to use the two methods. If the measured flow is substantially less than expected, then a pumping-plant performance evaluation can be conducted. The evaluation helps determine what to do to improve the situation. This provides very useful information to the grower involved. It also updates field data that are used to advise many other growers on factors that determine pumping plant performance.

On-farm demonstrations cannot be conducted on every farm. However, experience and information gained on one farm is often applicable to other farms in the same area. The extension staff involved in on-farm demonstrations will become better able to advise growers on rice irrigation-water management. In time, demonstrations can be conducted in all rice-producing areas to address specific water-management problems and concerns.

**PROCEDURES**

On-farm irrigation demonstrations will be coordinated with interested county extension agents and growers. When possible, the initial focus will be in designated and pending critical groundwater-usage areas. Priority will also be given to opportunities that allow for comparison of a conventional irrigated field to a field that is irrigated with multiple inlets.

Measurements will be taken of water savings, cost savings and other impacts of different irrigation-water management efforts including multiple inlet rice irrigation, automatic pump unit off, pump flow measurement, and pumping-plant performance evaluation.

Information and experience gained from on-farm irrigation demonstrations will be distributed through field tours, meetings, presentations, and publications.
RESULTS AND DISCUSSION

Project investigators and county extension agents worked directly with 23 producers in 12 counties on 38 different field demonstrations of MIRI (Table 1). Assistance with MIRI was indirectly provided to 27 additional growers in 9 other counties by phone or through county extension agents. Nine of the 21 counties are either designated or pending designation as critical groundwater-usage areas. Three of the counties conducted field tours of MIRI fields.

Six field comparisons of MIRI to conventional rice irrigation were conducted in Crittenden, Desha, and Poinsett counties. The Crittenden County MIRI clay field only showed 2% water savings, but this was after mid-season when timely rains were occurring (Table 2). Early season data collection problems caused inaccurate irrigation readings before mid-season. A comparison of two Crittenden County sandy loam fields recorded 9% water savings on the MIRI field. The Desha County comparison between two silt loam fields resulted in 26% less water being pumped on the MIRI field. A comparison of two Poinsett County silt loam fields found 17% water savings on the MIRI field after 10 July. Equipment problems resulted in the readings before 10 July not being usable. Another Poinsett County comparison, involving two MIRI fields and one conventionally irrigated field on clay soil, showed water savings of 42% and 44% on the two MIRI fields.

Forty-three growers returned a survey concerning their use of MIRI for the first time. Thirty-five percent (35%) of the total rice acreage farmed by those completing the survey was irrigated with MIRI. When asked how much time MIRI took to establish the initial flood, 92% indicated it was at least 10% less time than conventional flooding, two growers reported the same, and another stated it was 10 to 20% more. Ninety-five percent (95%) estimated that MIRI required at least 10% less irrigation water than conventional irrigation and two growers said it was the same. When asked how much time was required to check the MIRI field and maintain the flood, 80% responded that it was less, six growers indicated it was the same, and two indicated it was more. Eighty-eight percent (88%) also indicated that the cold-water effect was less in the MIRI fields. The survey indicated that the average time required to install and set up the MIRI system in a field was 3.75 man hours. When asked what material costs were involved with MIRI, 89% indicated it was $7 per acre or less. Sixty-three percent (63%) indicated they would do more MIRI next year and 33% said they would do the same amount.

A MIRI demonstration in Craighead County benefitted the cooperator by helping him determine that he had well problems. By discovering this early he had time to get the problems corrected so he could use MIRI to help him successfully irrigate a difficult-to-water 85-acre sandy loam field. The well yield was improved from only 750 gpm initially to 1500 gpm by lowering the pump setting 20 feet and blasting the well screen. The MIRI demonstration cooperator in Crittenden County indicated that he had problems with levees washing out on his conventional field but never had the problem in the MIRI field. He indicated that not having to repair levees in the MIRI field made it well worth the initial effort of installing the tubing that is required for the MIRI approach. A Woodruff County producer participated in a MIRI demonstration in an
effort to deal with the problem he was having with scum and algae blocking flow-
through levee spills, making it difficult to get water to the bottom part of the field. He
was pleased that the MIRI approach allowed him to successfully address the problem
with a lot less labor expense. A Lincoln County demonstration cooperator made the
following statements: “My cold-water rice was significantly less and my water man was
real skeptical at first but really liked it once he got into the season,” “Not sure on water
savings, but my scout on one field said we got a flood on quicker than it had ever been
done before.” Following is a statement from a demonstration cooperator in St. Francis
County: “This has changed my 40 years of experience in irrigating rice.” A demonstra-
tion cooperator in Arkansas County stated: “I have grown 54 rice crops and this is 10
bu/acre more than I have ever made on the 80-acre field that I put the tubing in.”

Flow measurements were conducted on several wells used for MIRI demonstra-
tions. The producers appreciated having this information, but most were disappointed
to find that their wells were pumping less than they thought. Efforts were made to find
a practical and affordable automatic pump shut-off for power units. Although the
equipment required to accomplish this is available, it is not considered to be practical
or affordable at this time.

Experience from this year’s efforts indicate that there is a lot of potential for other
growers to implement MIRI if demonstrations can continue to be conducted. There are
still certain areas and counties in the state that have not yet adopted MIRI.

SIGNIFICANCE OF FINDINGS

Many Arkansas rice growers are experiencing increasing difficulty in effectively
managing their irrigation water. Contributing factors are declining water tables, reduced
pumping capacity, increased production acres, lack of skilled/dependable labor, de-
creased irrigation-equipment efficiency, increasing pumping costs, and extended drought
periods. All of these factors can’t be controlled, but there are water-management ef-
forts that many growers could implement to reduce the impact of many of these factors.
On-farm demonstrations are very effective in encouraging growers to implement differ-
ent water-management recommendations that address these factors.

Cooperating growers involved in on-farm demonstrations will learn irrigation
water-management techniques for reducing water use, labor, and pumping cost. Demo-
strations to date show the potential value to the grower is 25% average water use
and pumping cost savings, an average labor reduction of 30%, reduced cold-water rice,
and increased nitrogen fertilizer efficiency. The field experience and information gained
from the demonstrations will be provided to other growers through field tours, meet-
ings, and publications.

ACKNOWLEDGMENTS

This work was partially funded by rice producers’ check off funds administered
by the Arkansas Rice Research and Promotion Board.
Table 1. Multiple Inlet Rice Irrigation (MIRI) field demonstrations – 2002 season.

<table>
<thead>
<tr>
<th>County</th>
<th>Fields</th>
<th>Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas*</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Craighead</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Crittenden</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Cross*</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Desha</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Jefferson*</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Lincoln</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Monroe*</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Poinsett*</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Prairie*</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>St. Francis</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Woodruff*</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>12</strong></td>
<td><strong>38</strong></td>
</tr>
</tbody>
</table>

\( * = \) counties that are designated or pending designation as critical groundwater management areas.

Table 2. Results of MIRI field comparison studies - 2002.

<table>
<thead>
<tr>
<th>County</th>
<th>Location</th>
<th>Type of Soil</th>
<th>Water Savings Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crittenden</td>
<td>Fogleman Farm</td>
<td>Clay fields</td>
<td>2% less water from mid-season(^z)</td>
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<tr>
<td></td>
<td>Marconi Farm</td>
<td>Sandy loam fields</td>
<td>9% less water</td>
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<tr>
<td>Desha</td>
<td>Henry Farm</td>
<td>Silt loam fields</td>
<td>26% less water</td>
</tr>
<tr>
<td>Poinsett</td>
<td>Craig Farm</td>
<td>Clay fields (2)</td>
<td>44% and 42% less water</td>
</tr>
<tr>
<td></td>
<td>Hutchinson Farm</td>
<td>Silt loam fields</td>
<td>17% less water(^y)</td>
</tr>
</tbody>
</table>

\(^z\) Early-season data not available.  
\(^y\) Water savings after July 10.