

Water Conservation Practices for Rice and Soybean Irrigation

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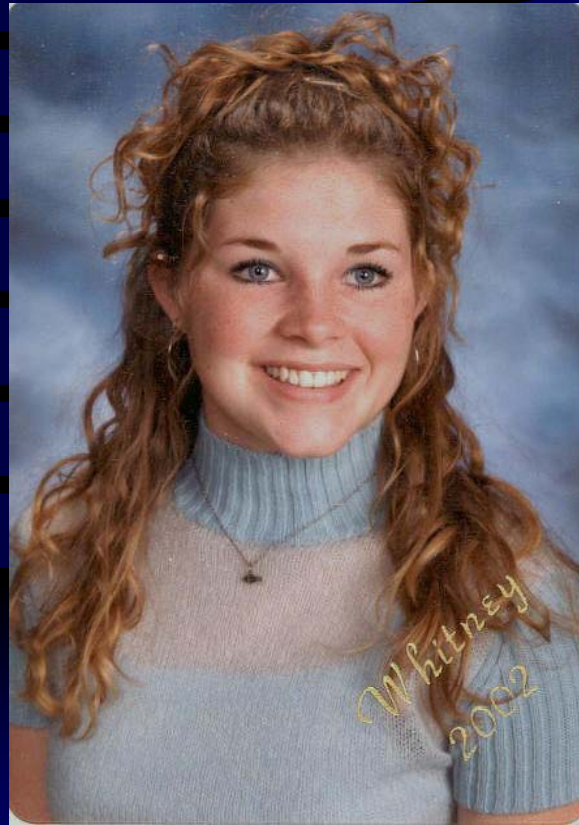
Northeast Research & Extension Center



**I way over-married and am
blessed with two teenage
daughters that are beautiful,
inside and out**



Susan



Whitney



Brooke

Stress Test

There will be a picture of two dolphins...if you see anything other than two dolphins your stress level is critical – you should take a break, get a smoke, eat a snickers etc. but do something relaxing **NOW!!**



We irrigate most of our crops in the Arkansas Delta

- **Rice: 1.5 million acres - all irrigated**
- **Corn: 350,000 acres – 80% irrigated**
- **Cotton: 1 million acres - 75% irrigated**
- **Soybeans: 3 million acres - 62% irrigated**
 - **Milo: 250,000 acres – 50% irrigated**

4.5 million irrigated acres – 74% of total acres

Where do we rank among states?

Arkansas Is Fourth in Irrigated Acreage

Following Nebraska, California & Texas

USDA ARS Proposal

National Irrigation Watershed

Research Lab in Arkansas

Over 90% of the water for irrigation in Arkansas comes from groundwater

- **Also primary source for municipal and industrial**
- **Critical groundwater areas have been identified**
- **Predicted that half of aquifers will be depleted by 2011***

*** Scott et al. (1998)**

Alluvial Aquifer Water Level Changes (1997-2002)

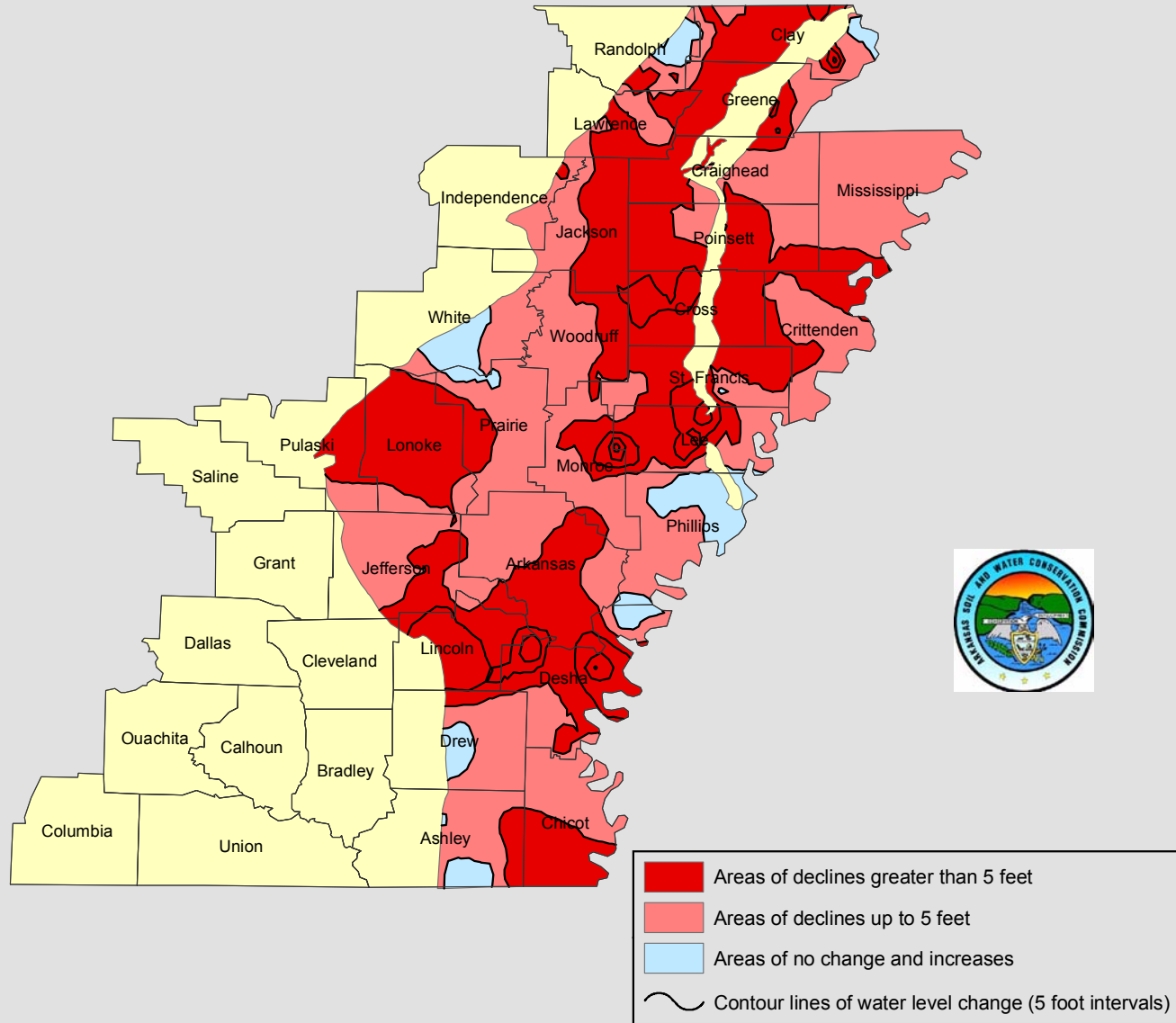
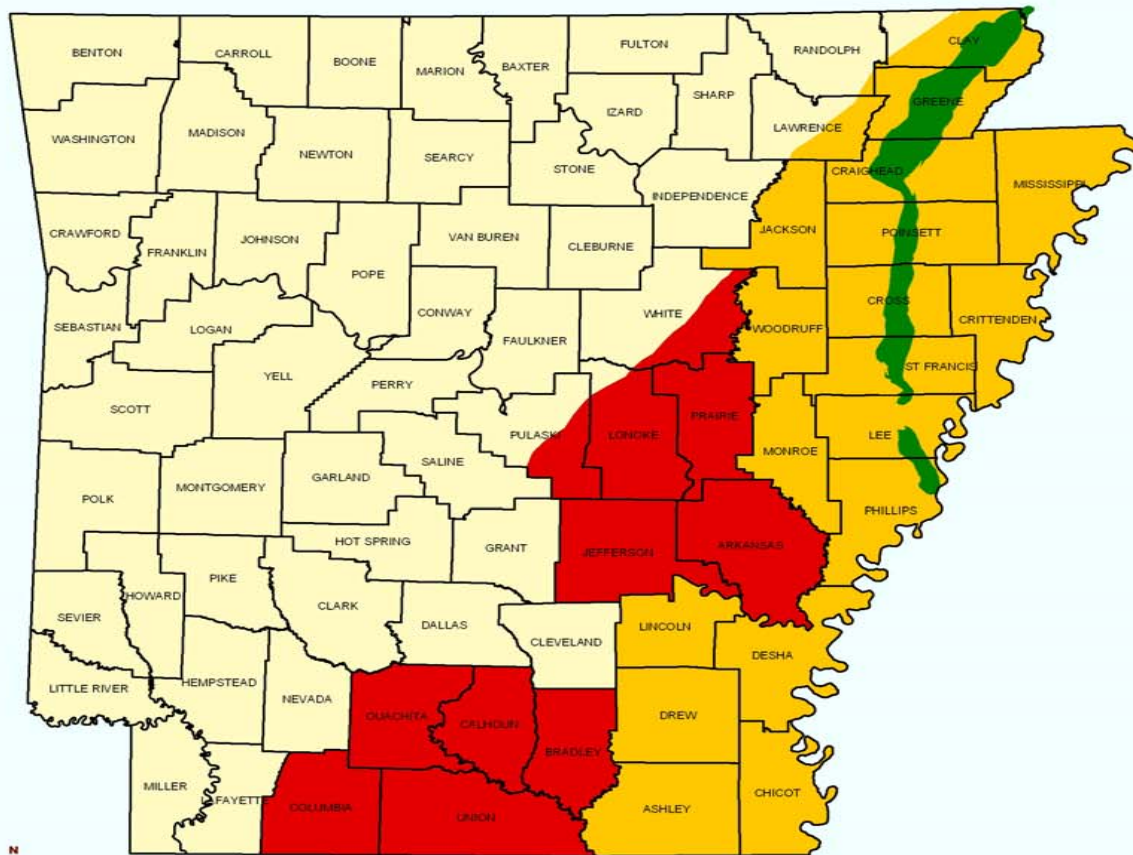


Fig. 2

Critical Ground Water Designations



One well often shared among multiple crops, especially rice and soybean

- Irrigation of soybean usually dependent upon first being able to adequately irrigate rice**
- Soybean often suffers drought stress because unable to stop watering rice long enough to complete soybean irrigation**

Situation

Advantageous to the individual farmer as well as to everyone else in state to reduce irrigation requirement for producing rice.

Conventional Rice Irrigation



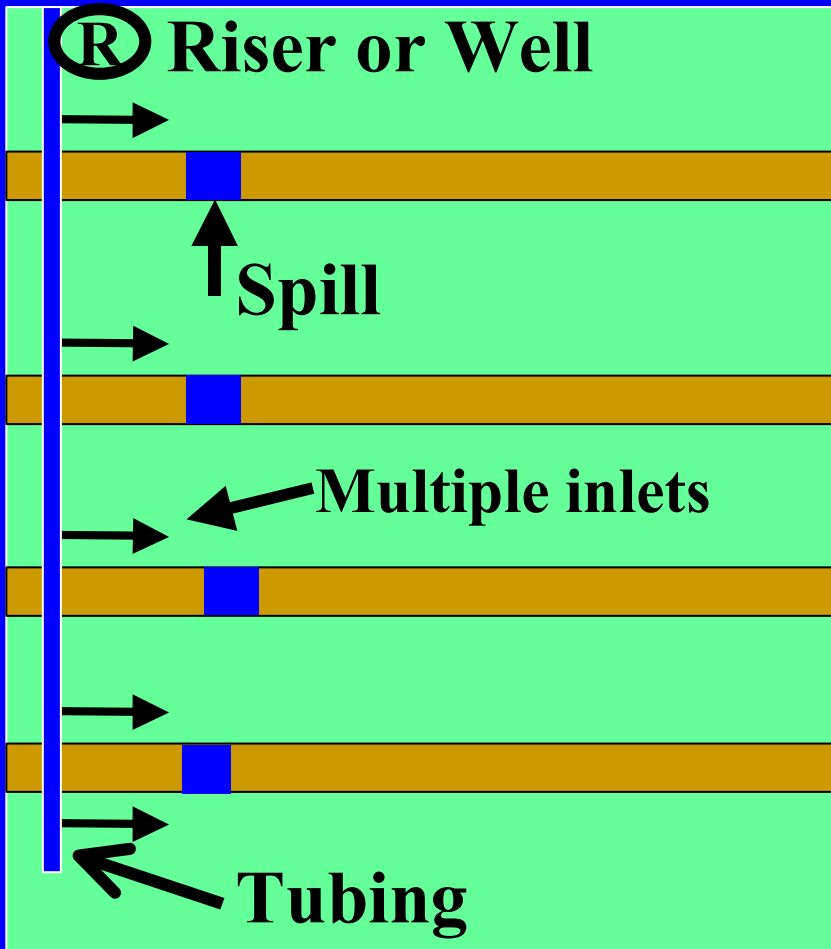
Multiple Inlet Concept

Apply smaller amount of water to each paddy, rather than all to top paddy:

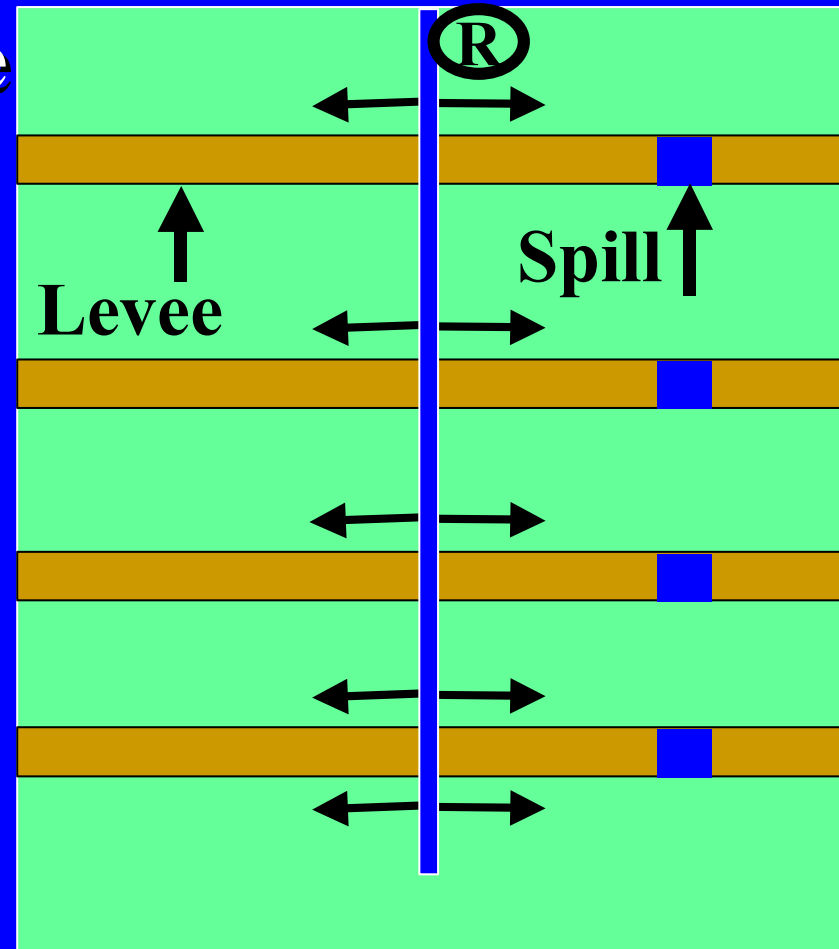
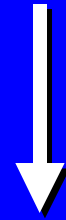
- **Can often operate well at or near full capacity without fear of topping first levee**
- **Don't have to overpump top paddies and guess when have enough water to flood lowest paddies**
- **Can leave some room to catch rainfall**

Multiple Inlet Rice Irrigation

Contour or Straight Levees



Slope



Tubing down side of field

OR

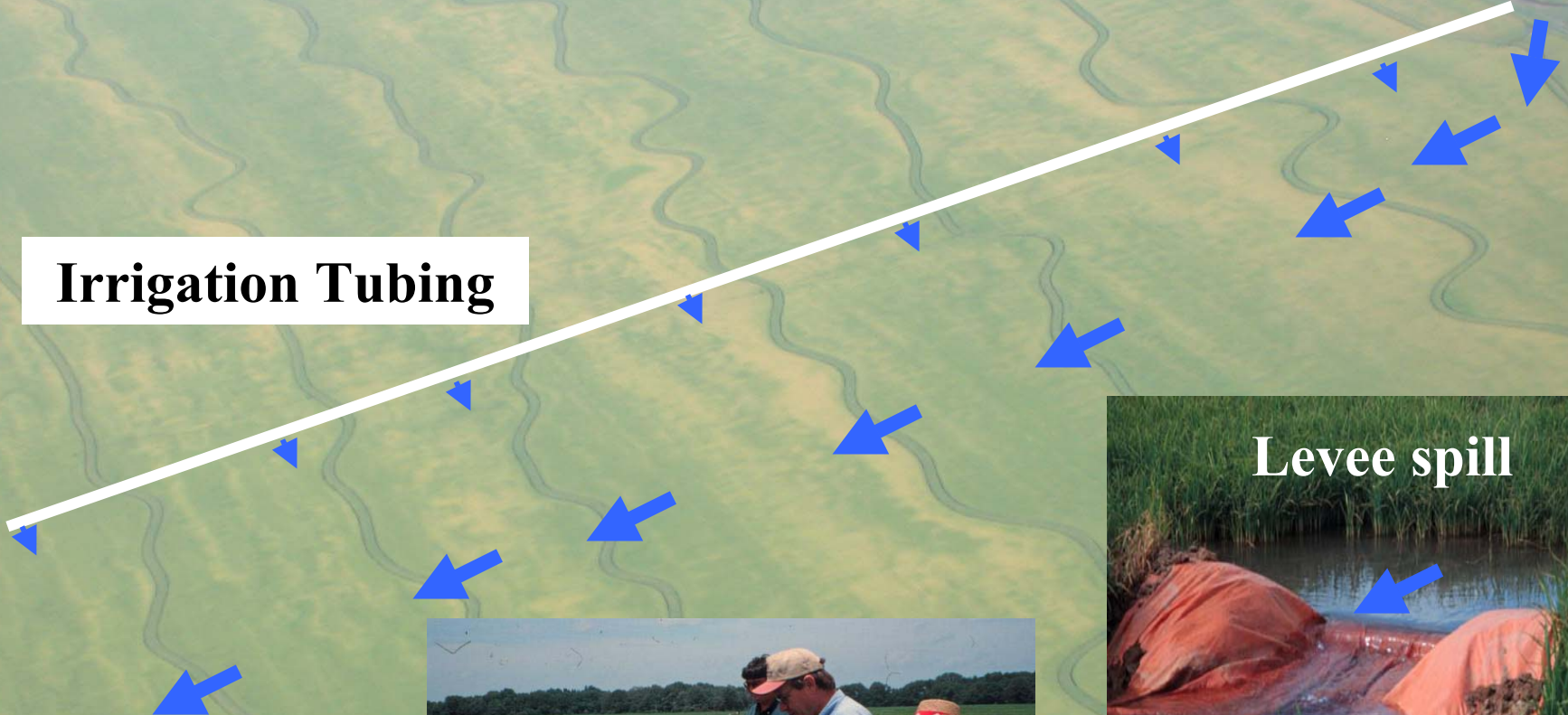
Tubing out in field

General field layout of Multiple Inlet Rice Irrigation

Rice Field

Well

Irrigation Tubing



Levee spill



← Levee

Potential MIRI Advantages

- Flood field quicker *without over-pumping top levee.*
- *Improved fertilizer/herbicide efficiency.*
- Maintain shallower flood.
- Fewer problems with scum and algae.
- Reduced pumping time/costs.
- *Reduced* water pumped/*runoff.*
- Reduced cold water effect.
- Reduced labor (after initial setup).

Disadvantages

- **Tubing and adjustable gate cost**
- **Riser bonnets (universal hydrants) cost**
- **Initial installation and adjustment**
- **Floating, moving and twisting of tubing**
- **Working around tubing with field equipment**
- **Animal damage to tubing - especially coyote**
- **Removal and disposal of tubing**

Study initiated in 1999 to quantify the potential for advantages of a multiple inlet approach and check for any yield penalty

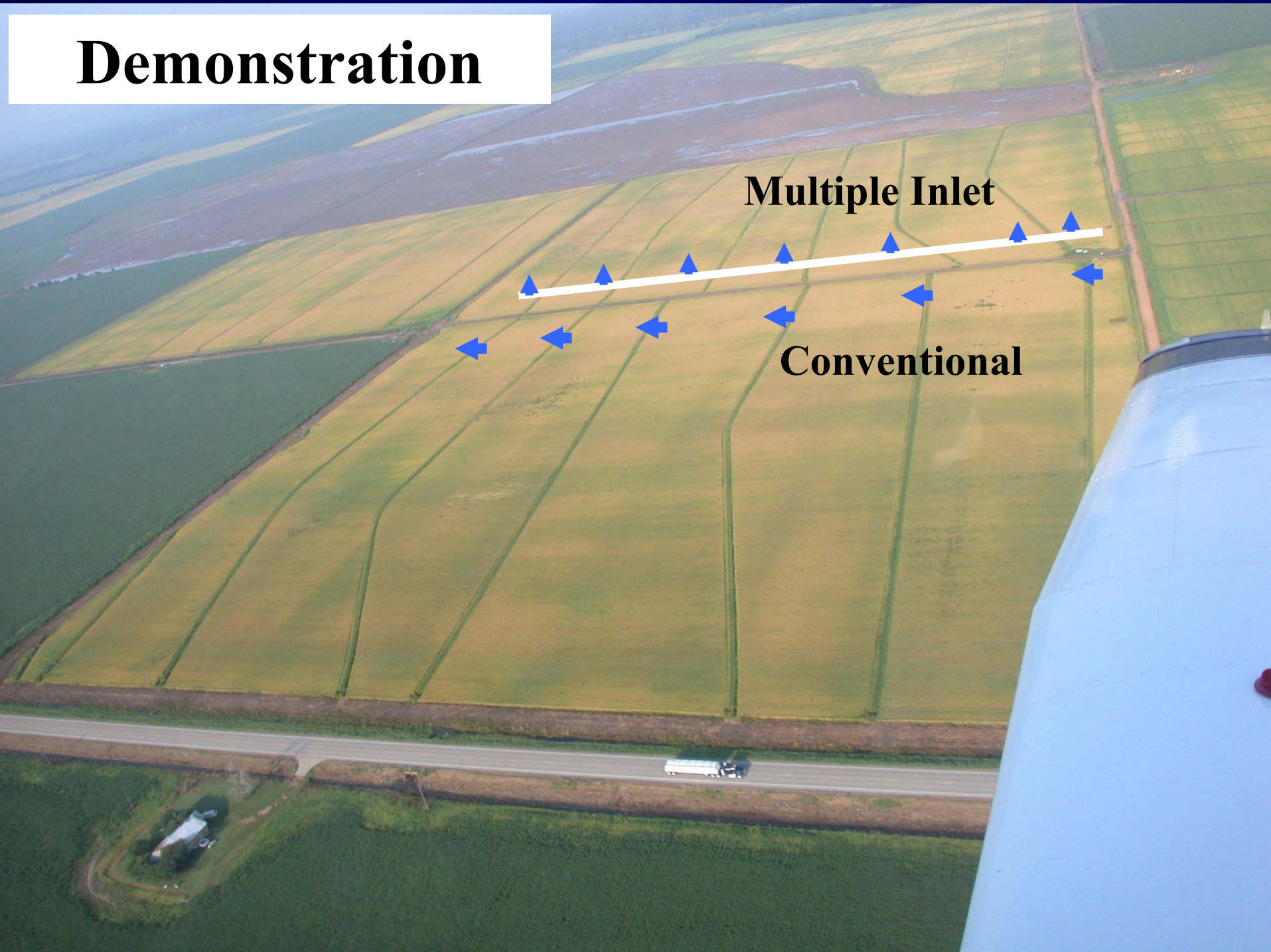
Study Methods

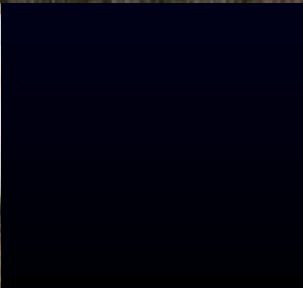
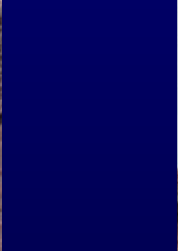
- **Two similar-sized rice fields located close together, same planting, cultivar, soil type, management**
- **One assigned conventional irrigation (CONV), other multiple inlet rice irrigation (MIRI)**
- **Worked with grower in setting set up MIRI**

Demonstration

Multiple Inlet

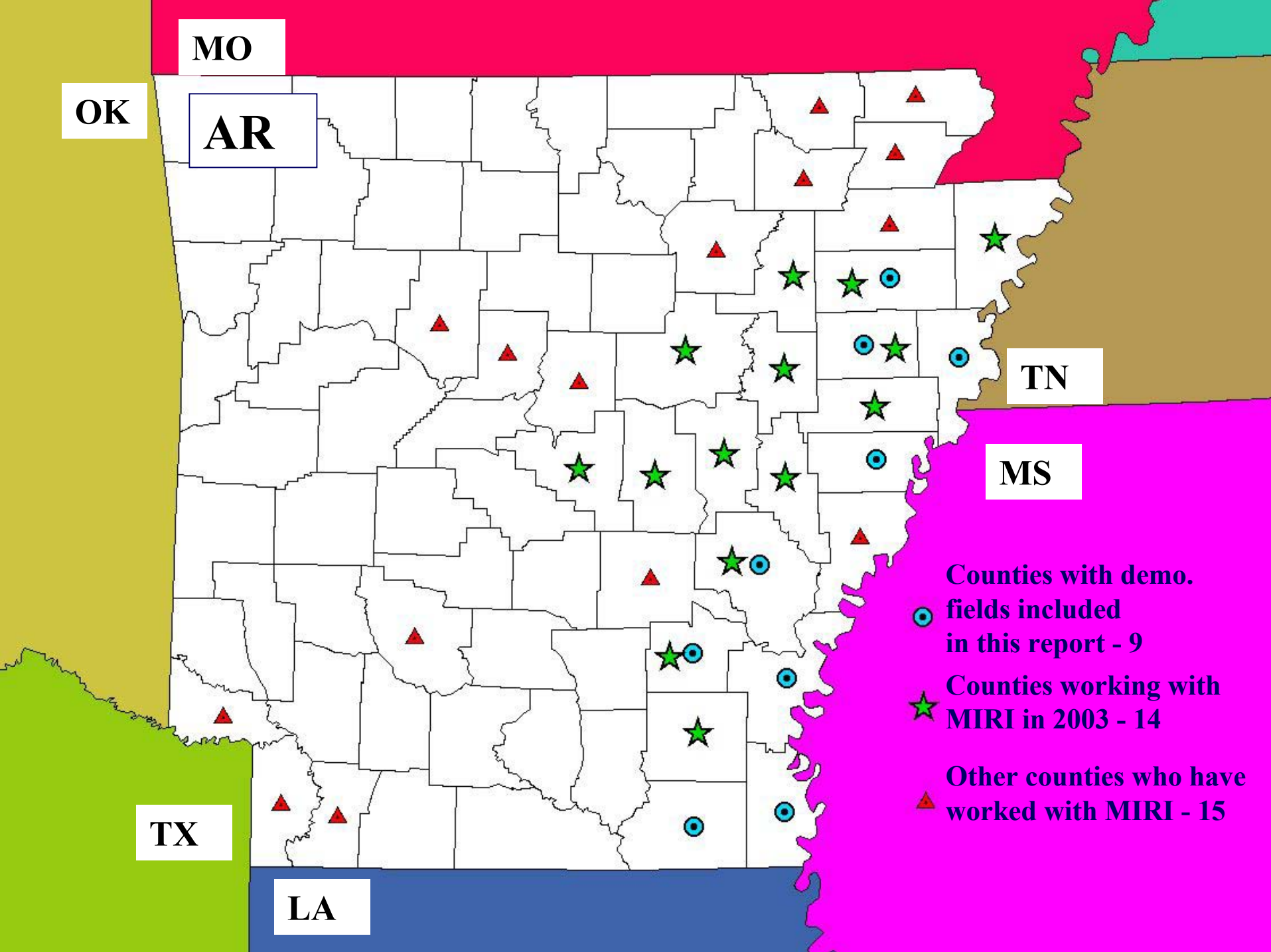
Conventional





Comparison Demonstrations

- **15 pairs of fields from 1999 through 2002 with complete water and yield data**
- **Data set includes counties from southeast (Ashley) to northeast (Poinsett) Arkansas**
- **Soils ranged from sandy loam to clay**
- **Field sizes range from 31 acres – 80 acres**



MO

OK

AR

TN

MS

TX

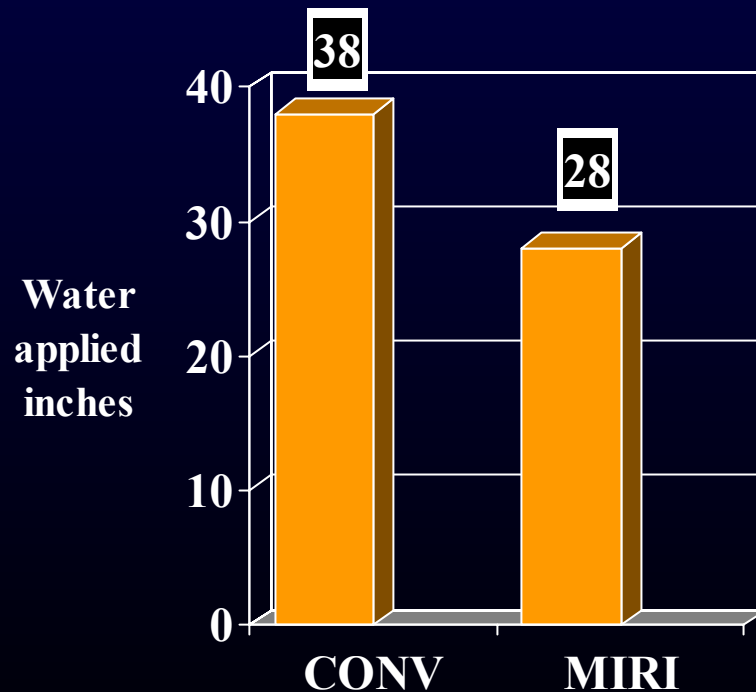
LA

- Counties with demo. fields included in this report - 9
- Counties working with MIRI in 2003 - 14
- Other counties who have worked with MIRI - 15

Findings

Water Applied *

Multiple inlet rice irrigation (MIRI) fields required an average of 26% less water (10 inches) than the conventionally (CONV) flooded fields



* excluding flushing

N CAUSEWAY

EXXON

Self

Regular
Unleaded

Tiger
Mart

Plus
Unleaded

Touch-Free
Wash

Supreme
Unleaded

Water s

Energy


TOM'S SHELL

*Self
Serve*

*Cash or
Credit*

Regular

ARM 9

Plus

LEG 9

Premium

**First 9
Born**

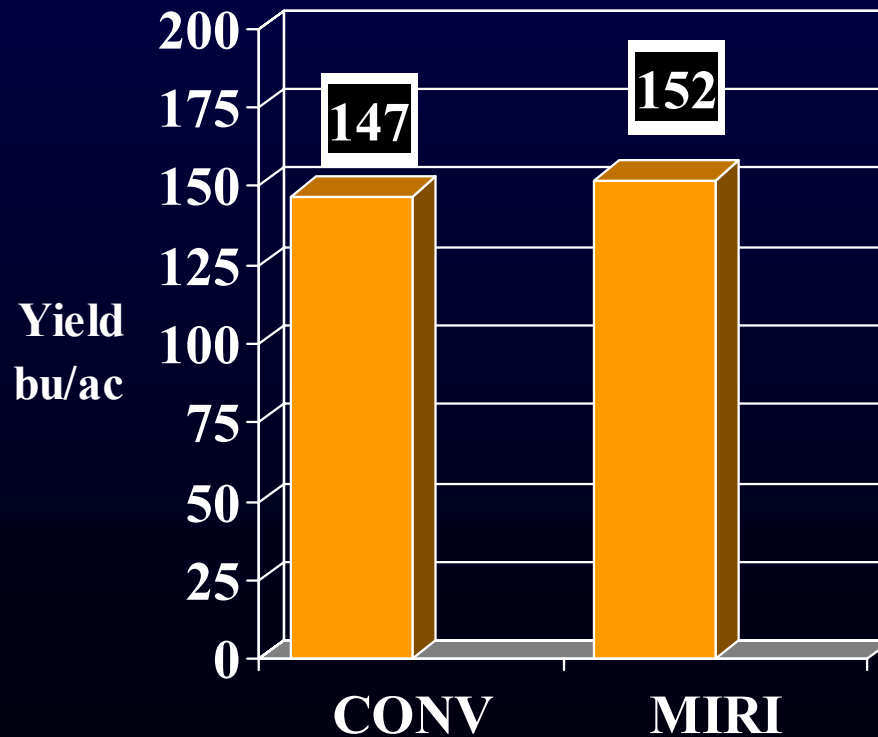
Findings

The labor required with the MIRI fields averaged 30% less than the CONV fields

Findings

Grain Yield *

MIRI yields averaged 3.6% (5 bu/ac) higher than CONV



* adjusted to 12% moisture content

Economic Impact

The savings in water and labor and the yield increase gives an estimated \$16.60 per acre average cost savings (after paying for irrigation tubing) with the MIRI system.

Summary

- **MIRI averaged 26% (10 inches) less water**
- **MIRI averaged 30% less labor**
- **MIRI averaged 3.6% (5 bu/ac) higher yields**
- **Estimated \$16.60 per acre savings with MIRI**

Providing multiple inlets to levee irrigated soybeans can improve water management.

The use of irrigation tubing for the water delivery in place of the canal or flume can conserve water and reduce soil erosion.

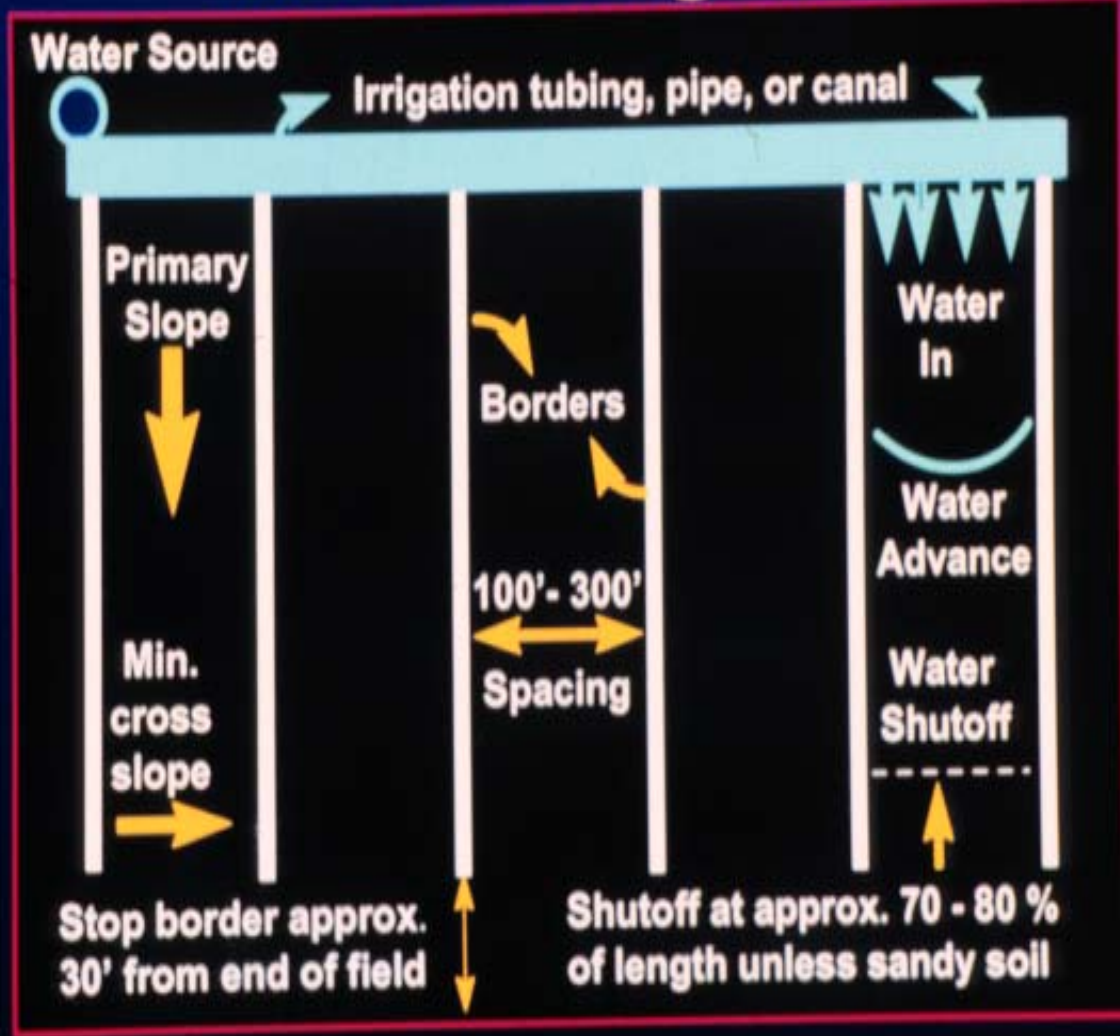


Border irrigation on precision graded (or nearly so) fields



Contour Levees

Border Irrigation



Border Irrigation



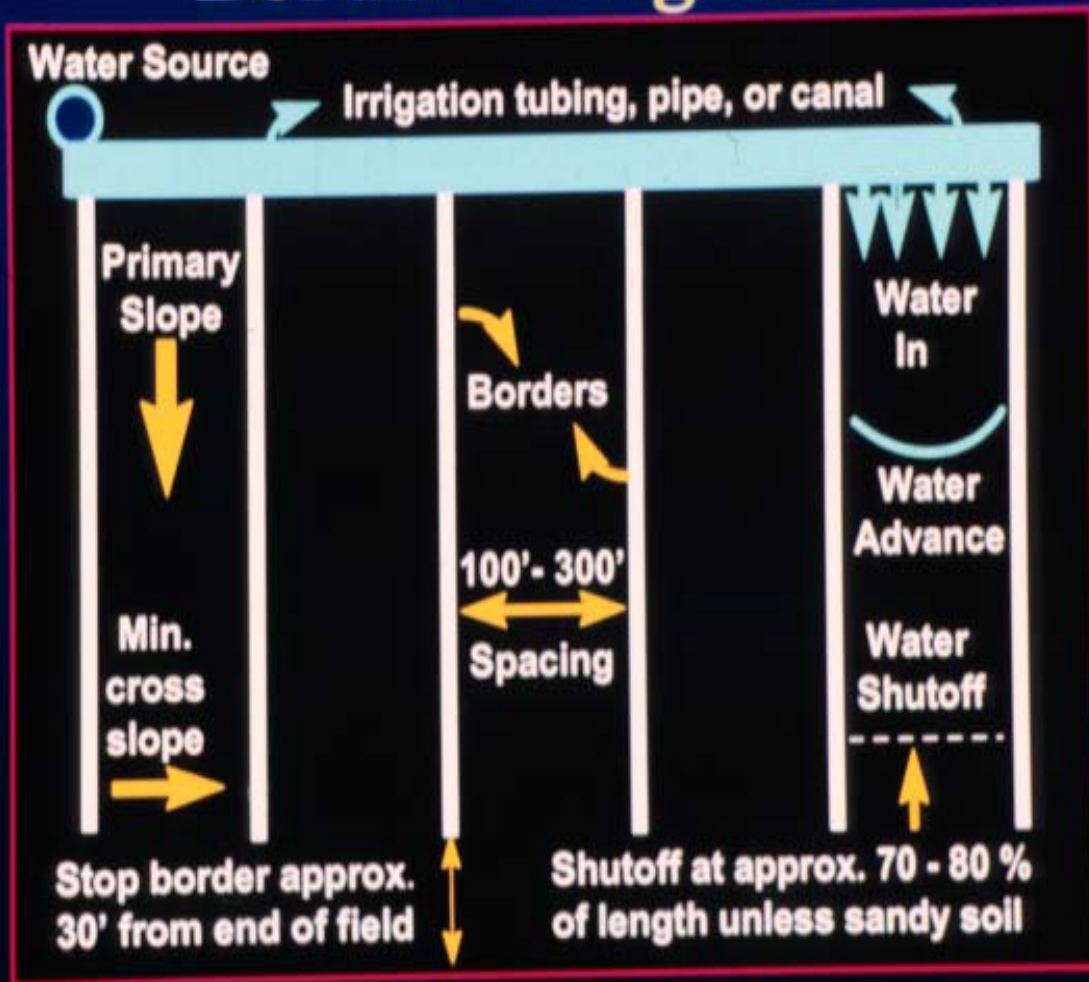
Minimal ground out of production



Less danger to small beans than with flooding

MIRI and Border Irrigation can make it easier to share a well between rice and soybeans

Border Irrigation



Conclusion

University of Arkansas Cooperative Extension Service will continue to recommend that farmers consider multiple inlet rice irrigation, border irrigation etc. We will also work with producers who want to try different water management systems and methods that can help them conserve water and protect water quality.

Acknowledgment



Arkansas Soybean
Promotion Board



Acknowledgments





**Border made with
middle buster type
implement**

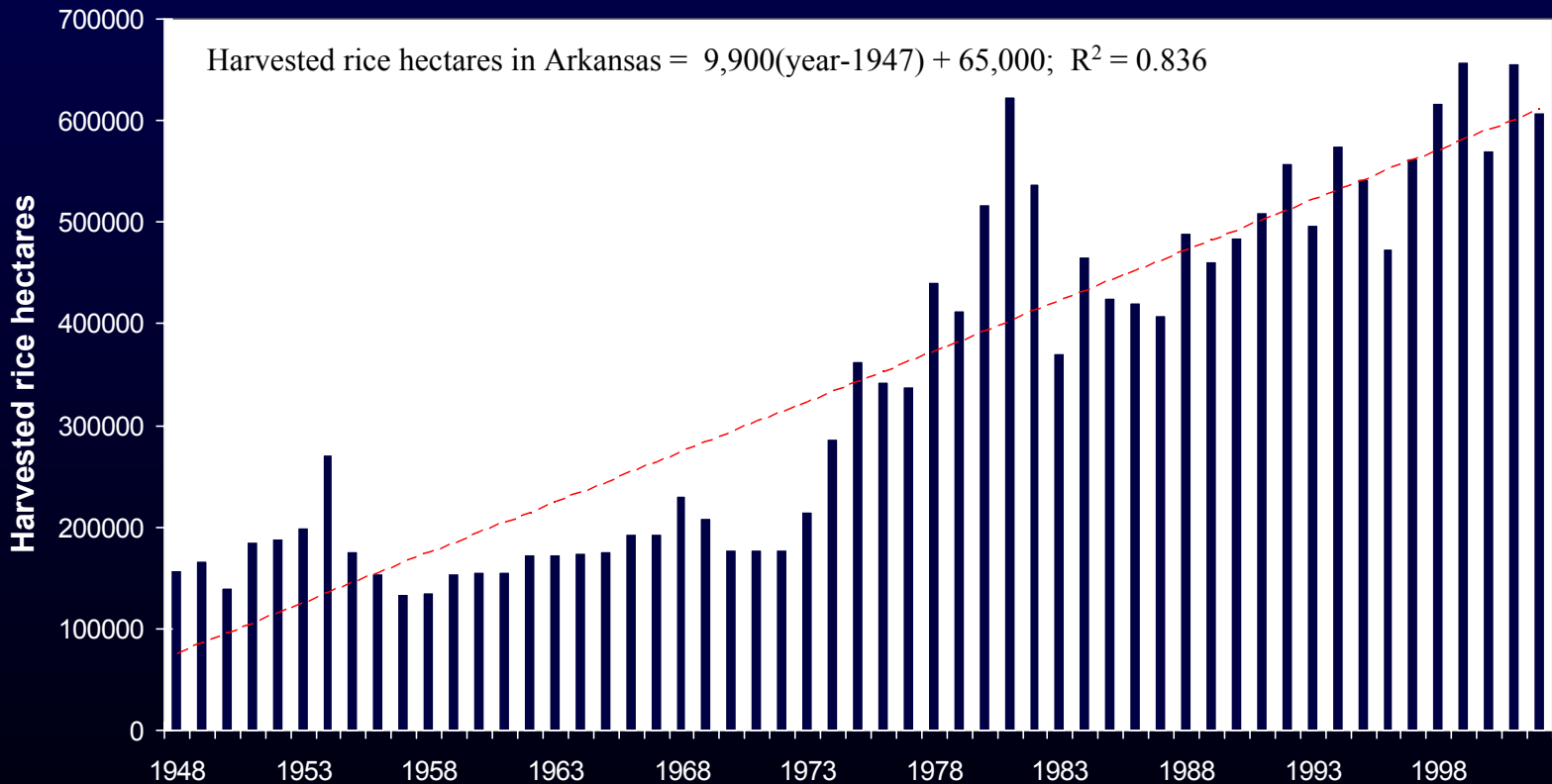
**Disk bedder implement for
border and wiggle as go
through field**



Border irrigation can fit a no-till, double-crop production system.



Arkansas rice area increasing (nearly 10,000 ha/year)

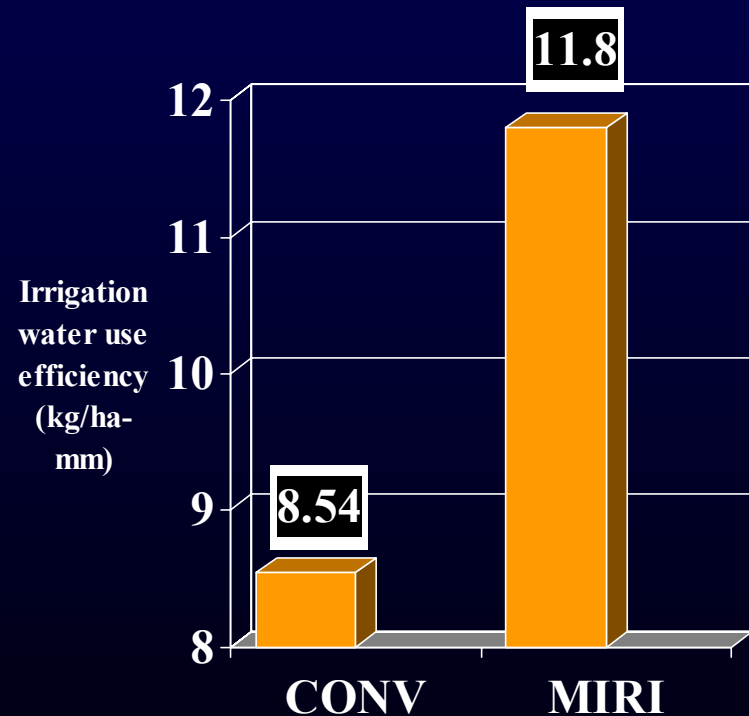


Estimated state average irrigation requirement for rice: 760 mm (Bryant et al., 2001)

Findings

Irrigation Water Use Efficiency – kg/ha-mm

MIRI fields averaged
38% higher irrigation
water use efficiency
than CONV fields



MIRI Example

Well output: 1500 gpm
Field size: 100 acres \longrightarrow **15 gpm/acre**
(1500/100)

Paddy size: 3 acres; then
45 gpm (3*15) needed in paddy

2.5" gate capacity \sim 75 gpm

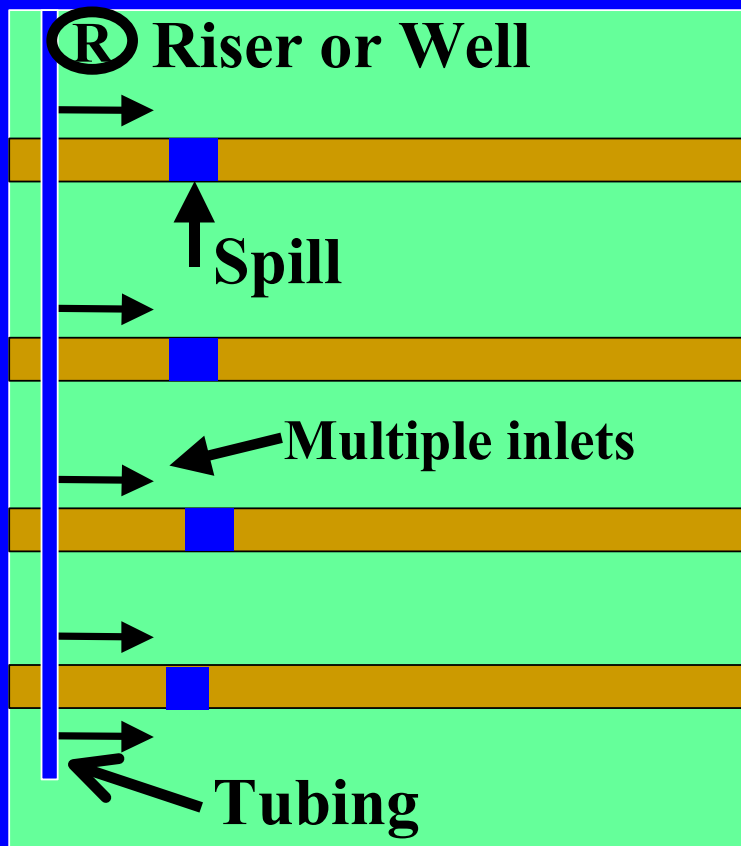
1 gate needed, partially open

Multiple Inlet Rice Irrigation not a “brand new” Idea - these pictures were taken in 1991 near Stuttgart, AR



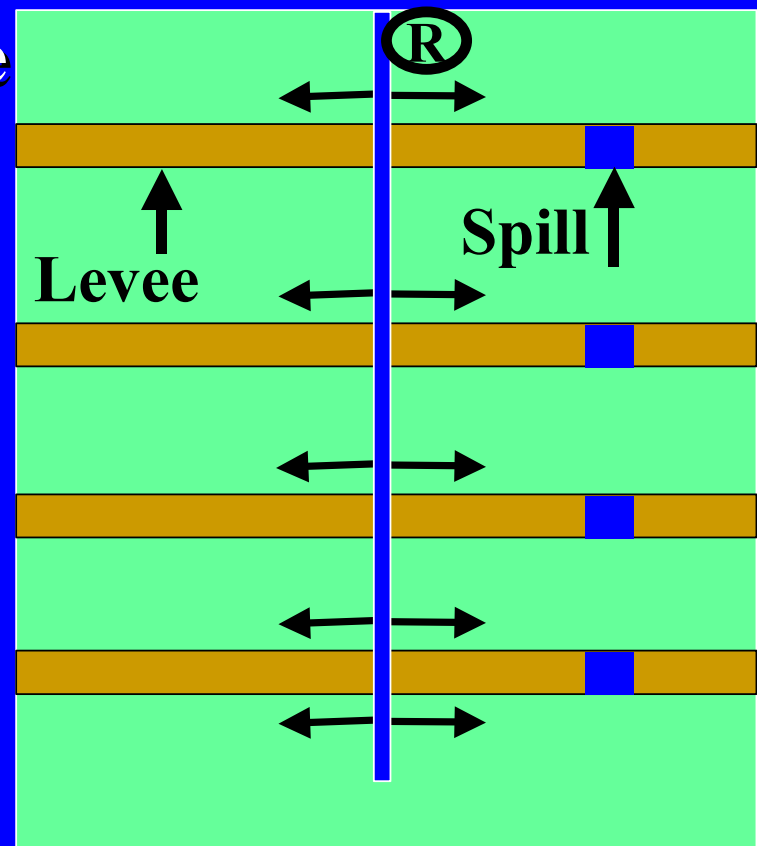
Multiple (Side) Inlet Rice Irrigation

Contour or Straight Levees



Tubing down side of field

Slope



Tubing out in field

OR

General field layout of Multiple Inlet Rice Irrigation

Border irrigation precision graded (or nearly so) fields



Less danger to small beans



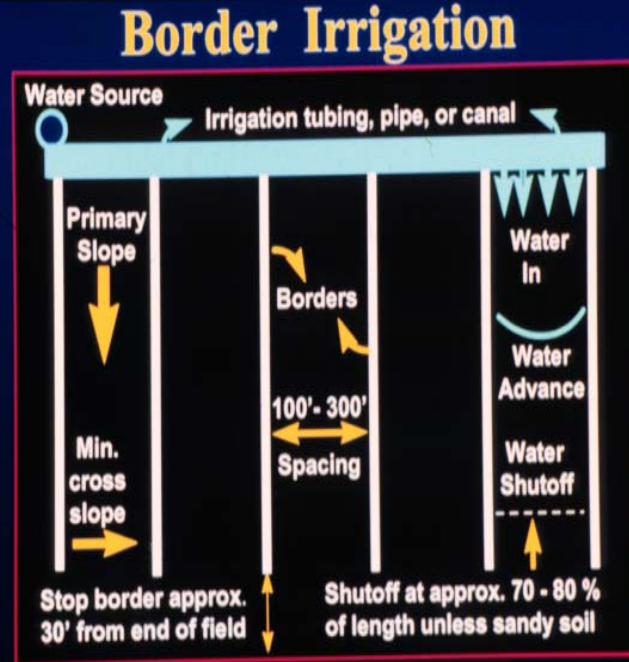
Minimal ground out of production



Multiple-inlet rice can make it easier to share
a well between rice and soybeans



Border irrigation on precision graded (or nearly so) fields



Less danger to small beans

Minimal ground out of production

