ARKANSAS WATER USE REPORTING: A POLICY ANALYSIS…

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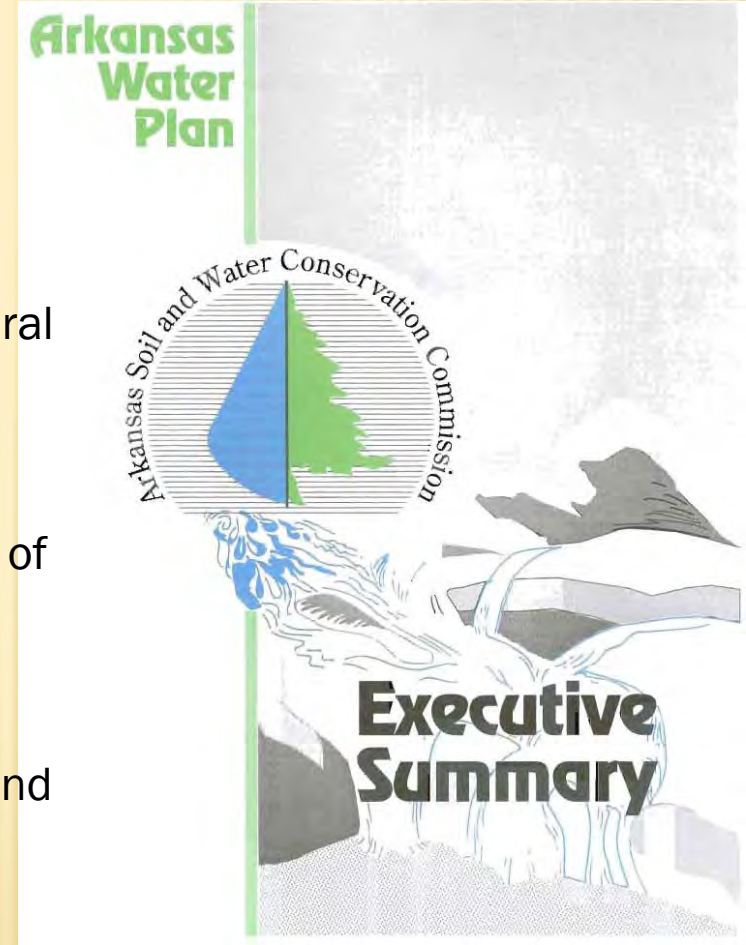
WATER USE REPORTING - THE LAW

Section 401.2 Enabling and pertinent legislation.
A. Ark. Code Ann. §15-20-201 et seq., Arkansas Natural Resources Commission.
B. Ark. Code Ann. §15-22-201 et seq., Allocation and Use, Generally.
C. Ark. Code Ann. §15-22-301 et seq., Determination of Water Use Requirements.
D. Ark. Code Ann. §15-22-501 et seq., Water Development Projects Generally.
E. Ark. Code Ann. §15-22-901 et seq., Arkansas Ground Water Protection and Management Act.



Arkansas Natural Resources Commission
101 East Capitol, Suite 350, Little Rock, AR 72201 • Phone (501) 682-1611 • FAX (501) 682-3991

THE LAW - CONTINUED

Section 301.2 Enabling and pertinent legislation.

A. Ark. Code Ann. §15-22-201, et seq., Allocation and Use of Water.

B. Ark. Code Ann. §15-22-301 et seq., Determination of Water Use Requirements.

C. Ark. Code Ann. §15-22-501 et seq., Water Development Projects Generally.

D. Ark. Code Ann. §15-20-201 et seq., Arkansas Natural Resources Commission.

E. Ark. Code Ann. §15-23-401 et seq., Arkansas River Compact.

F. Ark. Code Ann. §15-23-501 et seq., Red River Compact.

G. Ark. Code Ann. §25-15-201 et seq., Arkansas Administrative Procedure Act.

REPORTING REQUIRED BY RULE – ENABLED BY STATUTE

Applies to both Surface and Ground Water

Requires a $10 per withdrawal point fee – Paid through the local Conservation District

Exempts

- Domestic wells
- Withdrawals less than one acre ft. per year
- Withdrawals from wells with less than 50,000 gal. per day maximum yield
- Water diverted from natural lakes or ponds in the exclusive ownership of one person
- Diffused surface water

Provides penalties for late or non reporting users

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PENALTIES

Failure to register.

A. Any person who fails to timely register surface and ground water withdrawals as required by law and these rules shall, in addition to registration fees, pay reporting fees for late registration as follows:

1. Failure to register by March 1.....Written notice
2. Failure to register by April 1.....$25.00 fee
3. Failure to register by June 30.....$50.00 fee
4. Failure to register by September 30.....$100.00 fee

B. Conservation districts shall not accept late registration without payment of all applicable fees.

C. Late registration penalties are to be assessed per registrant, not per well.

D. The Commission, by its Executive Director, may assess fees as provided by Ark. Code Ann. § 15-22-302 if it is determined that a registrant continues to fail to register following September 30.

E. The maximum annual penalty per registrant is $500 whether for ground or surface water use or both.

F. The Commission will not impose monetary penalties without proof that the late registrant has received notice of the registration requirement.

G. Pursuant to Ark. Code Ann. § 15-22-911(e)(3), a water right may be cancelled for failure to report water use for two consecutive years under Ark. Code Ann. § 15-22-302 or failure to pay the fee as set out in Ark. Code Ann. § 15-22-913 for two consecutive years.

CONSIDERATIONS - REPORTING

A. All persons who use surface or ground water, except as exempted, shall report the withdrawal no later than March 1 for the prior water year.

B. The reports shall be made on forms provided by the Commission and shall be made to the Commission.

Water Year – begins October 1 each year

A. For water used for agriculture:

1. Number and size of wells or diversions.
2. Name, address and phone number of water user.
3. Crops, livestock, poultry, or fish type grown.
4. Acreage:

(a) Irrigated.

(b) Aquacultured.

5. Quantity of water used.
6. Location

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CONSIDERATIONS – DEEP WELLS – SUSTAINING AQUIFERS

Metering and specific use reporting required

Examples of sustaining aquifers include:

- Sparta Aquifer
- Memphis Sand Aquifer
- Others

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CONSEQUENCES (WHY) – POPULATION PROJECTIONS

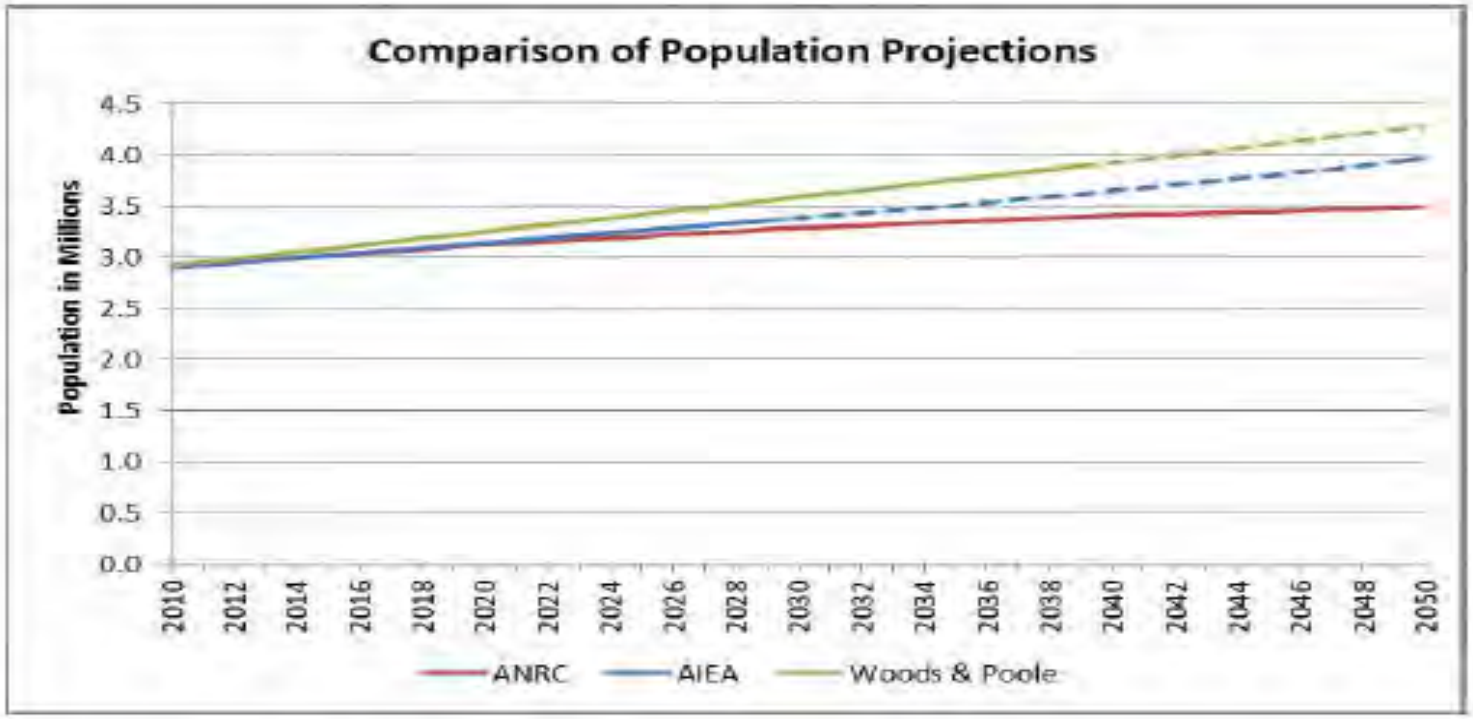

Figure 3.1 Comparison of Population Projections

Table 3.2 Population Scenarios for State of Arkansas in Millions

	2010	2015	2020	2025	2030	2035	2040	2045	2050
W&P	2.916	3.082	3.250	3.420	3.589	3.756	3.924	4.098	4.285
AIEA	2.916	3.018	3.139	3.260	3.381	3.509	3.649	3.801	3.966
ANRC	2.916	3.019	3.122	3.205	3.288	3.349	3.410	3.450	3.491

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MUNICIPAL OR DOMESTIC DEMAND

3,007 Community supply wells serving 435 community water systems

174,667 households or 351,000 residents served by privately owned individual wells

905,461 residents served by groundwater supplied community water systems

The Competition!

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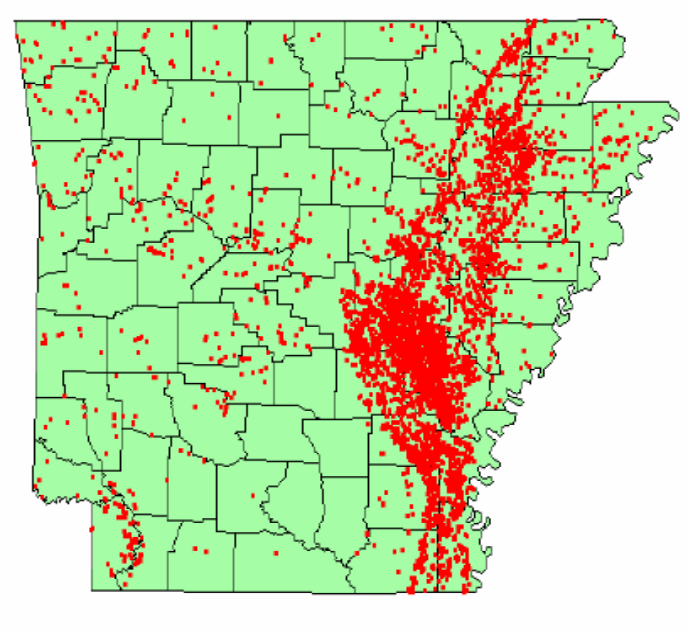
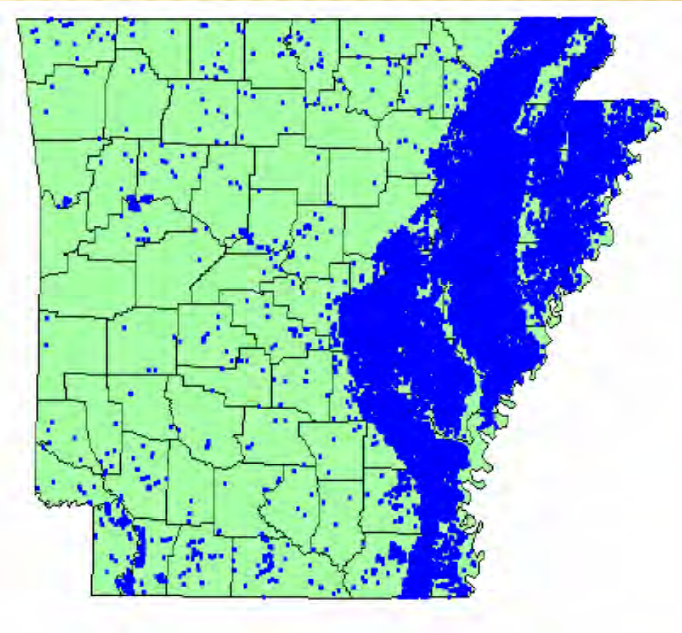
Arkansas Water Use Database
1997 Data

Of a total of 44,700 points of water diversion,
36,000 points (80%) are for irrigation from groundwater

Surface water: 5,600 points



Groundwater: 39,100 points



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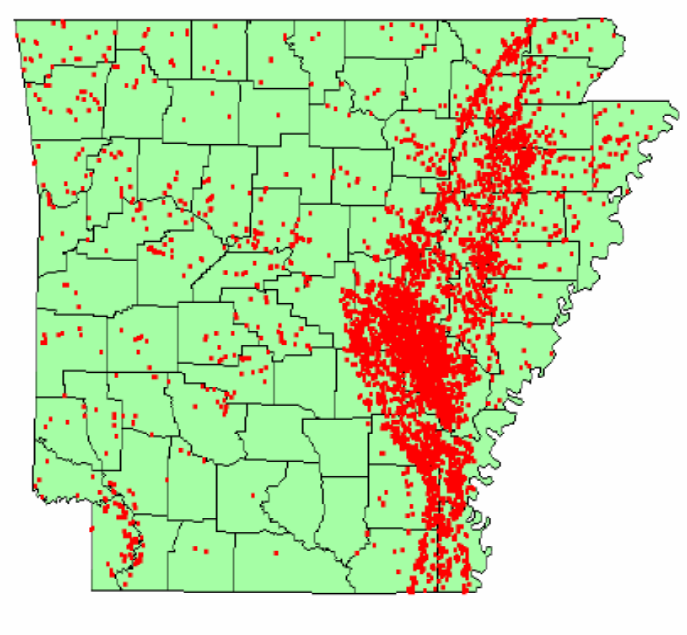
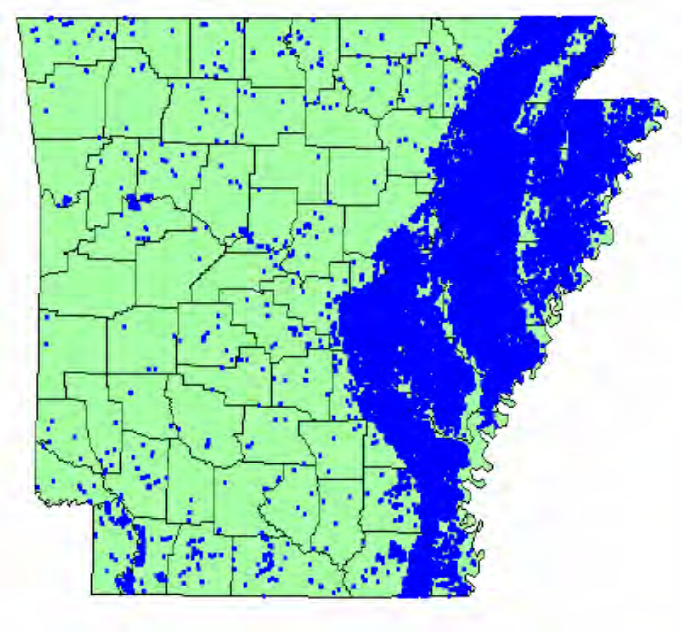
Arkansas Water Use Database
2004 Data

Surface water: 6,192 points



Groundwater: 46,967 points



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CURRENT DEMAND

Today there are approximately 6,100 surface water withdrawal sites and 49,000 groundwater withdrawal sites registered in Arkansas.

Reported withdrawals are stored in the WUDBS, which is managed by the U.S. Geological Survey (USGS) through a cooperative agreement with ANRC.

This data is the basis for our understanding of water use in Arkansas (began in 80s)

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DEMAND PROJECTIONS - INCREASING

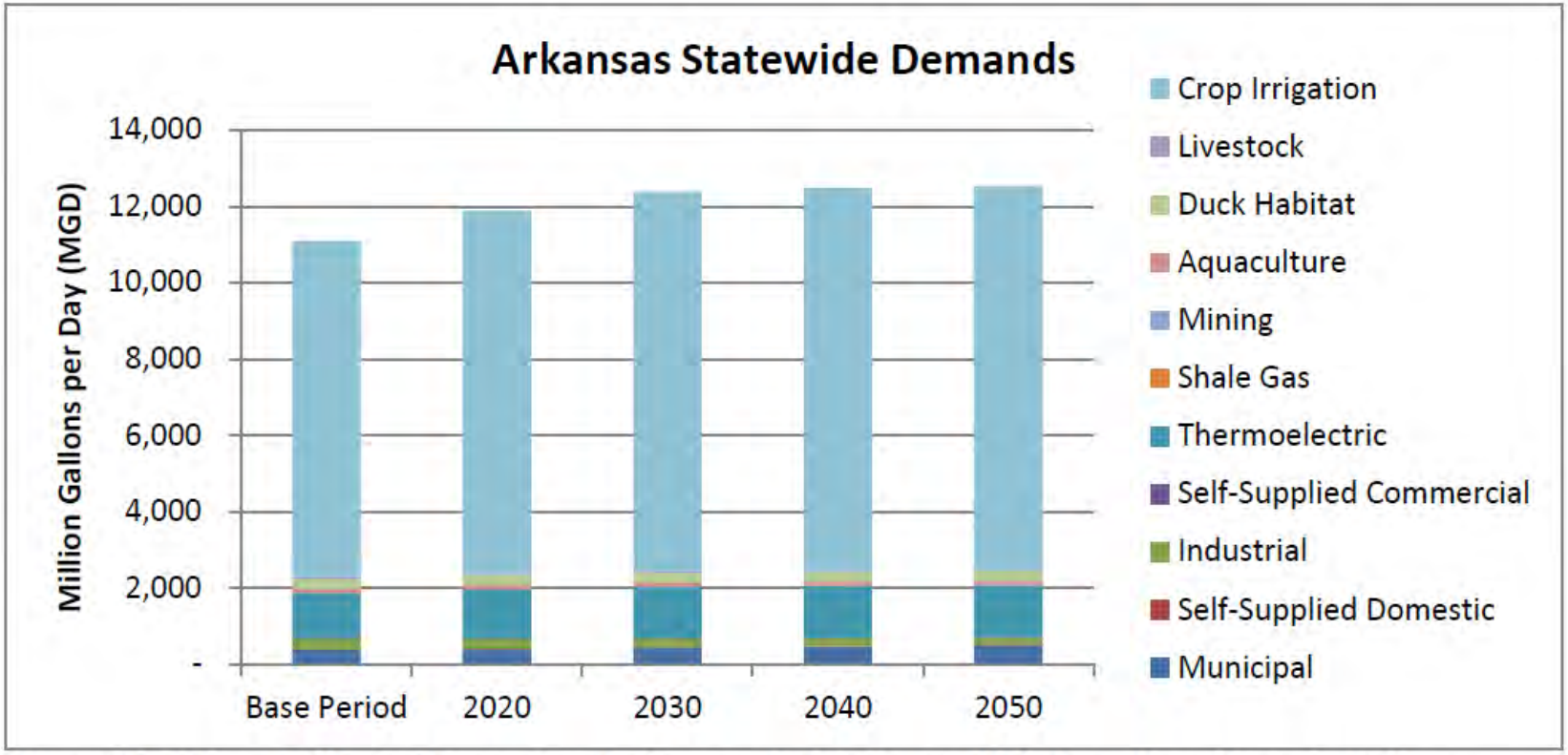

Figure 2.1 Statewide Water Demand, with Thermoelectric Power Withdrawals and Crop Irrigation

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CHOICES – REPORT OR NOT

Reporting – provides a water use history – necessary ?

Reporting – gives the State data for planning – accurate?

Reporting – gives the Farmer data for farm based investment choices – valuable?

Reporting - establishes a baseline from which conservation practices can be measured?

Reporting – costs (annually)

Reporting – penalties for not reporting

Not reporting – off grid use – no government oversight

Not reporting – no annual cost

Not reporting – possible sanctions – loss of use history and standing in times of shortage

Decision support system compromised by off grid water use - Models are bad but really bad if ill informed.

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CONSIDERATIONS – REPORTING: ALLOCATION SURFACE WATER

Section 307.3 Reserved water.

A. Domestic and municipal domestic.

B. Minimum streamflow.

C. Federal water rights.

Section 307.4 Criteria for allocation.

All allocations shall give reasonable preference first to sustaining life, then to maintaining health, and finally to increasing wealth. The allocations shall reserve the water required for domestic and Title III

Municipal-domestic use, federal water rights and for minimum streamflow and shall then give preference in the following order for water uses and for types of water diversions:

A. Priority of Water Use:

1. Agriculture.
2. Industry.
3. Hydropower.
4. Recreation.

B. Priority of Water Diversions:

1. Riparian.
2. Non-riparian intrabasin transfer.
3. Non-riparian interbasin transfer.
4. Out of state transfer.

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CONSIDERATIONS – REPORTING: ALLOCATION SURFACE WATER

Section 307.5 Reserved water-public systems.
Public water systems historically dependent upon the affected stream shall receive a reserved water right for municipal domestic water use prior to allocations for other uses.
Section 307.6 Reserved water-minimum streamflows.
Minimum stream flows as established pursuant Title III Subtitle III of these rules shall receive a reserved water right prior to allocations for other uses.
Section 307.7 Reserved water-federal water rights.
There may be some water over which the United States has a preemptive right that is superior to rights of others.
Section 307.8 Registered riparian user.
Any riparian landowner who has properly registered a water diversion with the Commission in compliance with Ark. Code Ann. §15-22-215 and the rules of the Commission shall be granted an allocation of water.
Section 307.9 Unregistered riparian user.
Any riparian landowner who has not previously diverted water nor timely registered any previous water diversions with the Commission, may not be granted any allocation of water during times of shortage above that required for domestic use.
Section 307.10 Permitted non-riparian user.
Non-riparian uses, including intrabasin, interbasin, and interstate transfers, previously authorized by the Commission which are beneficial and which do not interfere with the uses enumerated herein in Sections 307.5, 307.6, 307.7, 307.8 and 307.9 may be granted an allocation.

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CARROTS FOR REPORTING (INCENTIVES)

Subtitle IV. Tax credits

Section 1404.1 Water impoundments.

Section 1404.3 Surface water conversion for agricultural or recreational purposes within critical areas.

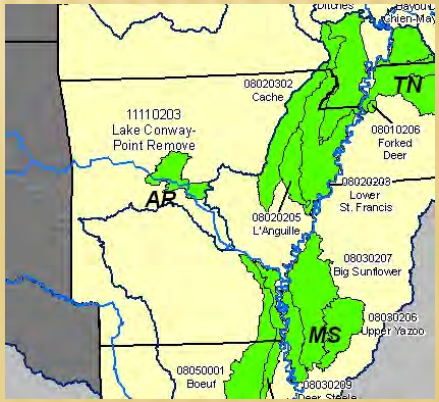
Section 1404.4 Surface water conversion for commercial or industrial purposes within critical areas.

Section 1404.5 Land leveling for water conservation.

Section 1404.6 Installation of a water measuring or metering device.

Section 1404.7 Deduction for project costs above tax credit.

USDA – Project specific resources also available – FSA and NRCS



TOOLS AVAILABLE – ON THE HORIZON

Metering – data logging

Higher efficiency pumps and motors

In-field measuring equipment

Irrigation scheduling and computer assisted controls

Remote control and sensory equipment

Smart phone apps

Power company incentives

Improved varieties – shorter season, drought tolerant, etc.

Irrigation district development

New tech apps coming…

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MEASURED OUTCOMES – A NECESSITY!

The competition for water will require users to defend use and management efforts.

Can't be done without measuring – Guesses will not provide defensible numbers. To prove gains in efficiency there must be a defensible baseline.

If metering is not possible, some systematic protocol for measuring water use must be found and used – documented.

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THE TECH SUPPORT PLAYERS: STATE/LOCAL

- Arkansas Natural Resources Commission
- CDMSmith and FTN – Engineering/Scoping
- Arkansas Department of Environmental Quality
- Arkansas Health Department
- Arkansas Game and Fish Commission
- Conservation Districts and AACD
- Arkansas Waterways Commission
- Arkansas Natural Heritage Commission
- Central Arkansas Water
- UA Division of Agriculture
- UALR Bowen School of Law

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THE TECH SUPPORT PLAYERS: FEDERAL

- USDA – Natural Resources Conservation Svs.
- US Geological Survey
- US Army Corps of Engineers
- EPA
- US Fish and Wildlife Service
- US Forest Service

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STAKEHOLDERS – YOU?

- Riparian and Surface Landowners
- Natural Resource and Wildlife Mgmt.
- Water Utilities
- Shipping and Commerce Interests
- Energy Producers and Consumers
- Agriculture
- Recreational Interests
- Mining and Natural Gas Exploration
- Manufacturing
- Household Water Users

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POTENTIAL FOR CONFLICT?

- Between States
- Between Communities
- Between Neighbors
- Between National, State and Local Government
- Priorities of Interest
- Groundwater/Surface Water Users

The update of Arkansas' Water Plan can offer management solutions and a long term view of protecting this necessary resource. It needs your voice.

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HOW TO GET INVOLVED!

- Participate in local stakeholder meetings
- Stay tuned to developments through your affiliated agencies and organizations
- Comment directly through:

ArkansasWater@CDMSmith.com

- Watch for developments on:

arkansaswater.org

Irrigation Water Conservation Practices for the Mid-South Region

Arkansas Water Plan Meeting

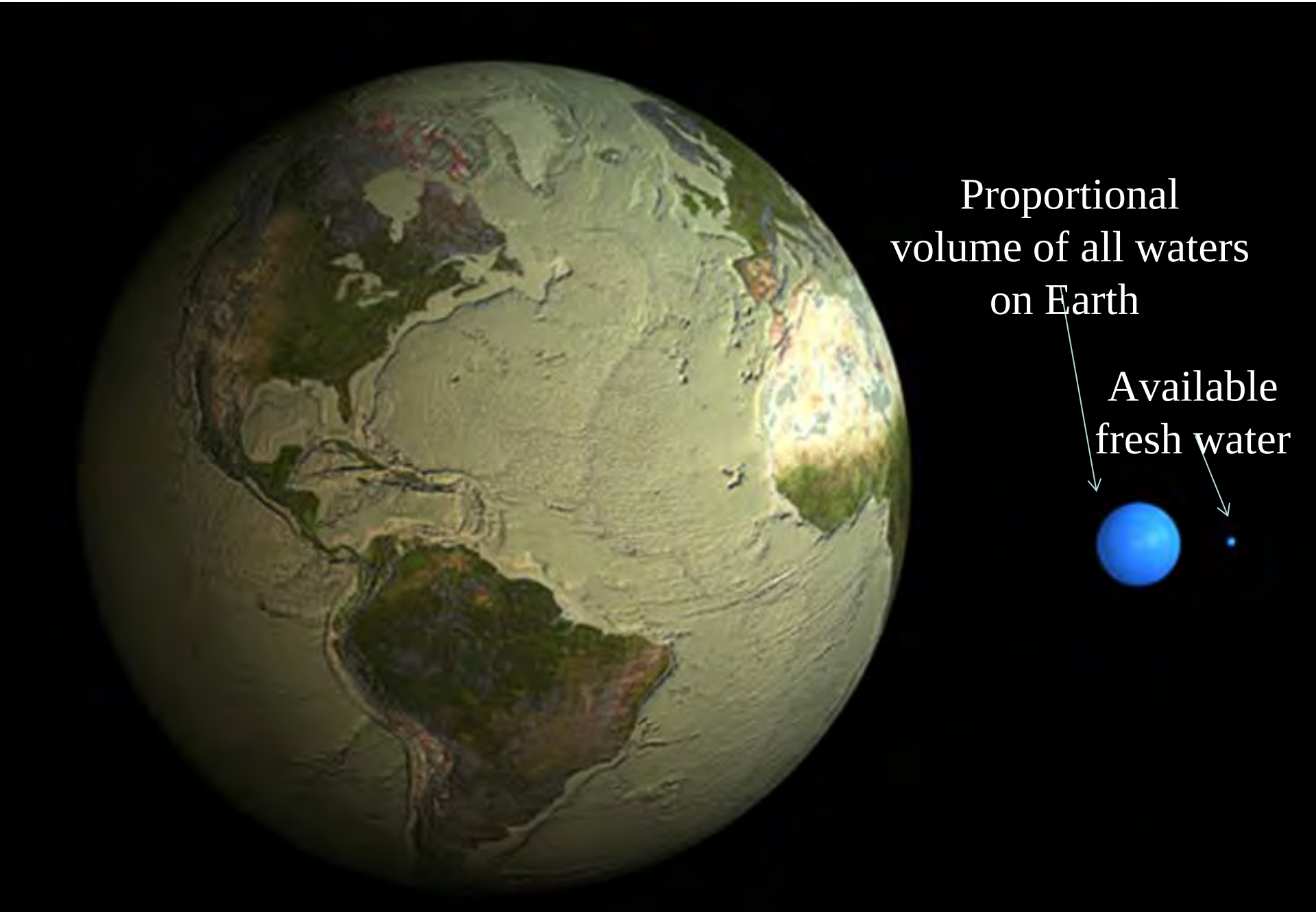
Stuttgart, March 17, 2014

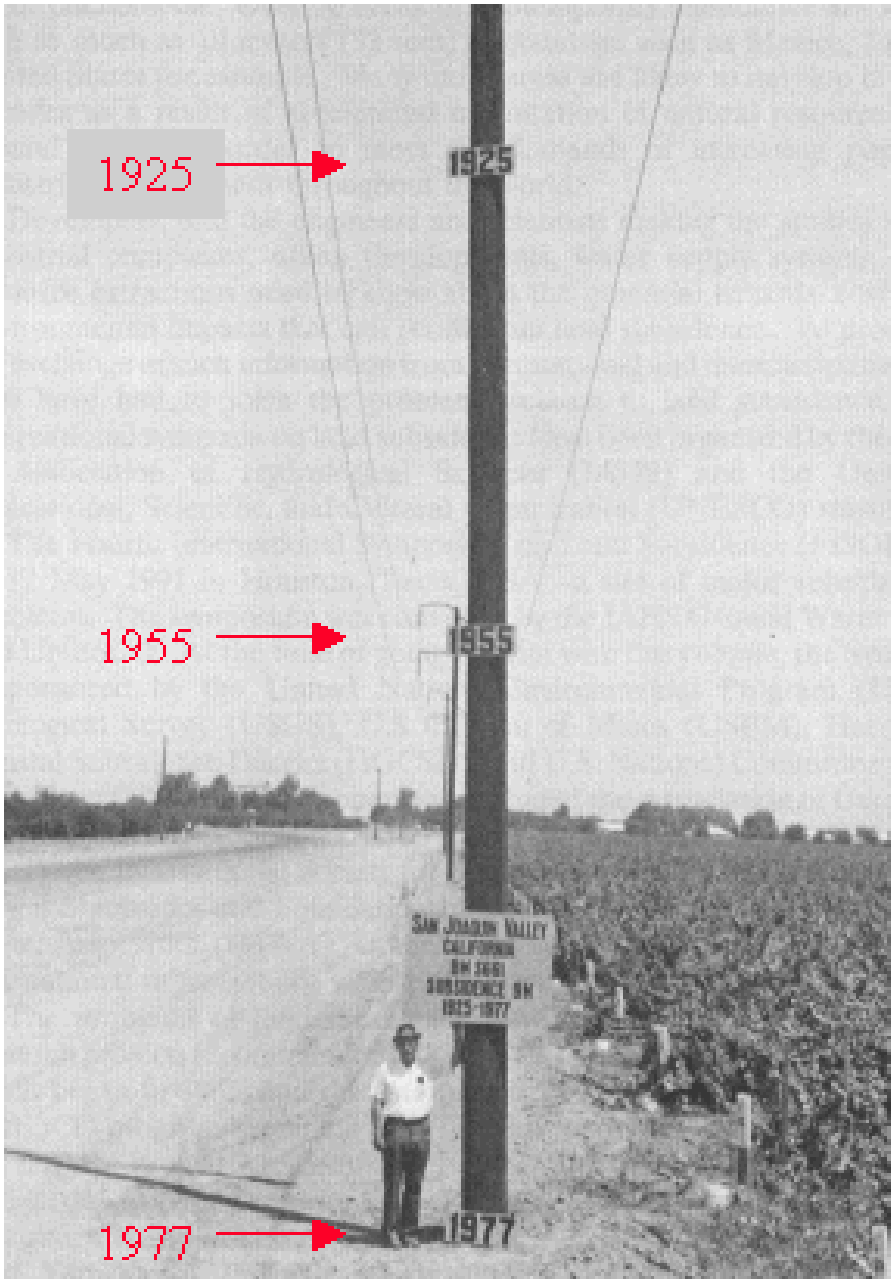
Chris Henry, Ph.D., P.E.

Assistant Professor and Water Management Engineer,

University of Arkansas Rice Research and Extension Center, Stuttgart, AR

Cook (2013) Woods Hole Oceanic Institute

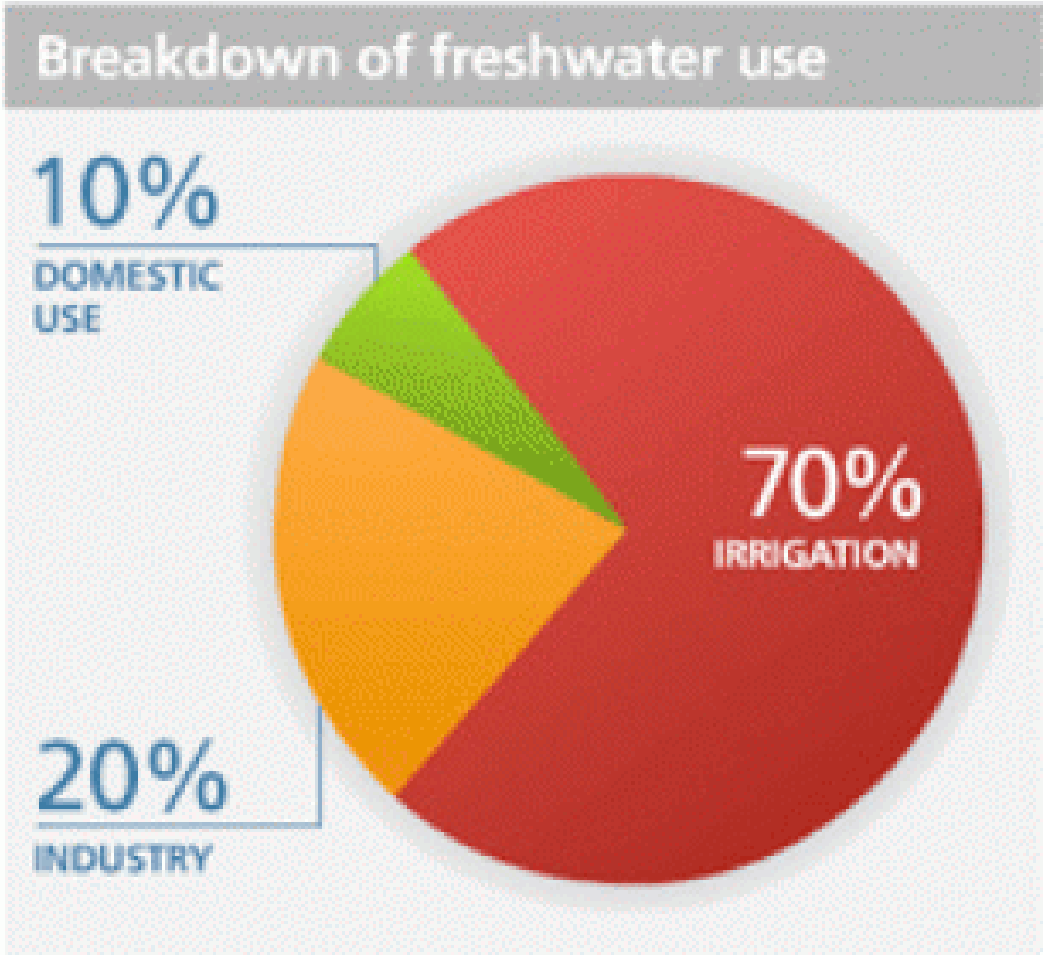




Dr Joseph F. Poland (Sacramento, CA) retired USGS Senior scientist for land subsidence research, stands at a site near benchmark S661 in the San Joaquin Valley SW of Mendota, CA. The benchmark subsided 8.93m between 1925 and 1977 as a result of heavy pumping of ground water.

Photograph by Richard L. Ireland, USGS.

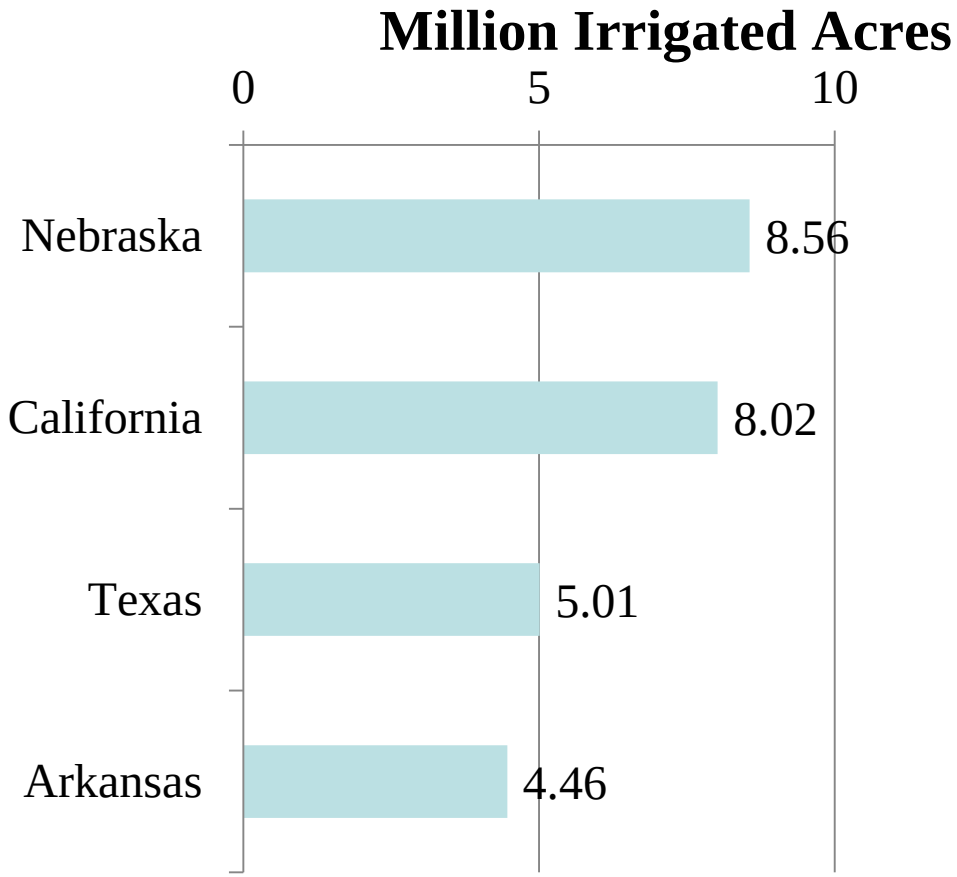
Global Water Use



GLOBAL WATER USE HAS BEEN GROWING AT MORE THAN TWICE THE RATE OF POPULATION INCREASE IN THE LAST CENTURY

Source: United Nations Water, unwater.org

Top 4 States in Irrigated Acres (2007)



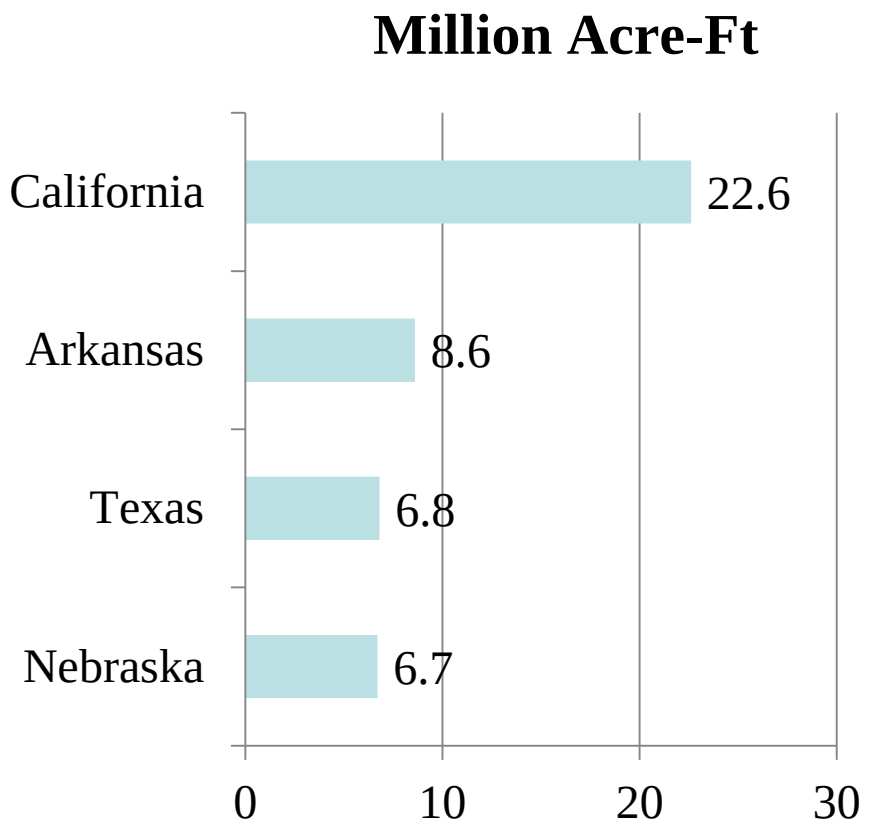
Original data source: NASS, Farm and Ranch Irrigation Surveys, data compiled by Johnson, B., C.A. Thompson, A. Giri,. S.V, Newkirk. 2011

Change in Irrigated Acres (2002-2007)

National Ranking	State	Change in Irrigated Acres
1	Nebraska	12.2%
2	California	-8.0%
3	Texas	-1.3%
4	**Arkansas**	**7.5%**
5	Idaho	0.3%
6	Colorado	10.6%
7	Kansas	3.2%
8	Montana	1.9%
9	Oregon	-3.3%
10	Washington	-4.8%

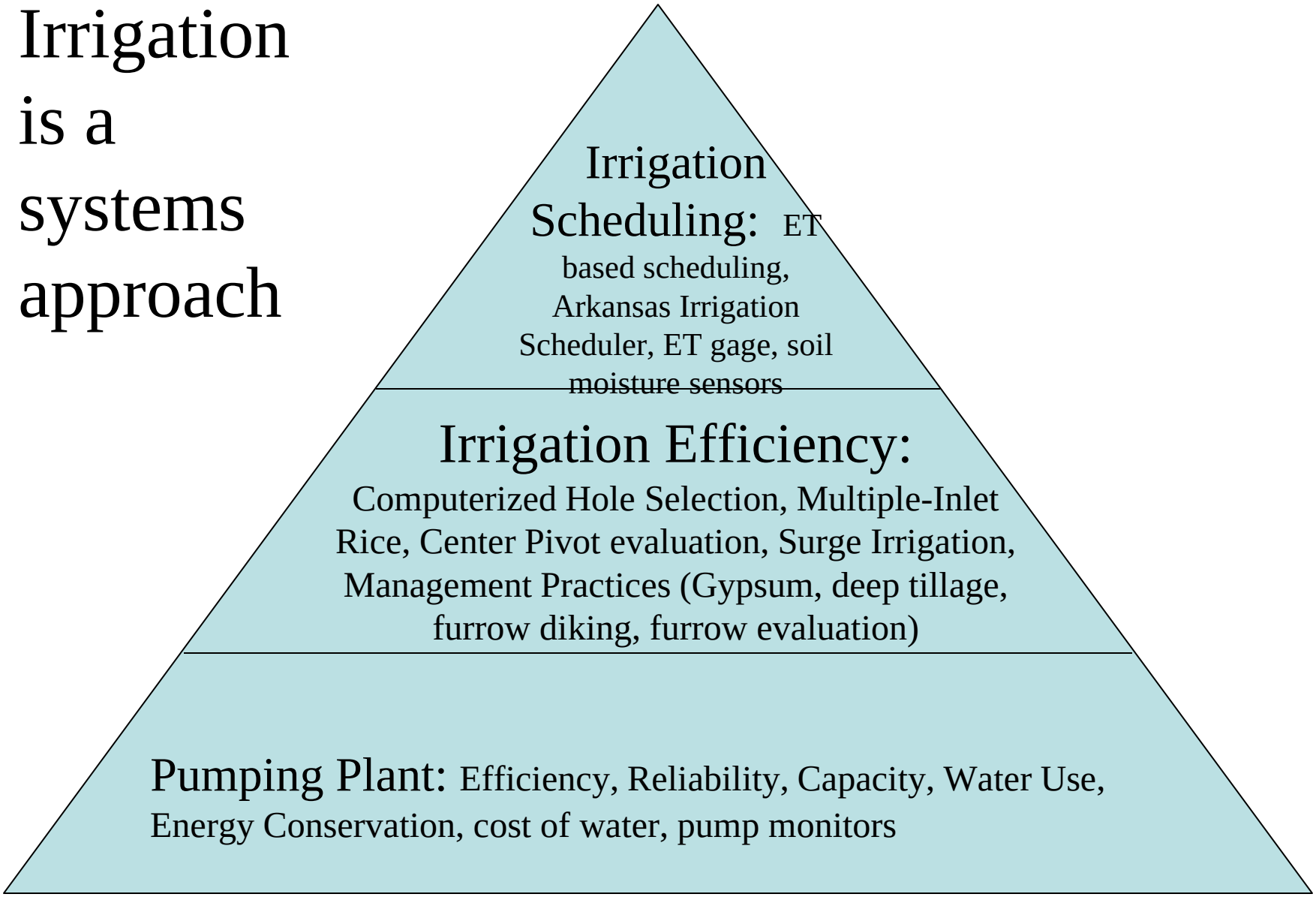
Original data source: NASS, Farm and Ranch Irrigation Surveys, data compiled by Johnson, B., C.A. Thompson, A. Giri,. S.V, Newkirk. 2011

Top 4 States in Quantity of Water Applied for Irrigation (Million ac-ft)



Original data source: NASS, Farm and Ranch Irrigation Surveys, data compiled by Johnson, B., C.A. Thompson, A. Giri,. S.V, Newkirk. 2011

Irrigation is a systems approach



THE Most Effective Conservation Practice

Management, the rest is just technology.

Tips for Conserving Irrigation Water in the Southern Region

1. Measure Irrigation Water Use
2. Use an ET base Scheduling System
3. Improve irrigation efficiency of furrow irrigation by using Computerized Hole Selection for lay-flat pipe.
4. Use Surge Irrigation
5. Replace CP Sprinkler package
6. Use soil moisture sensors to track soil water
7. Irrigate on-time and at the right time
8. Evaluate irrigation performance using aerial imagery or yield monitor
9. Reduce or remove soil compaction
10. Improve irrigation management by using timers or pump monitors to shut off wells at appropriate times.
11. Maintain grades and ensure good field drainage.
12. Design irrigation sets to maximize infiltration and minimize deep percolation
13. Irrigate every other row on cracking clays soils.
14. For rice irrigating, use zero grade and depth gauges or multiple inlet.
15. Use tail-water recovery

Irrigating Smart
Conserves Water
Saves Money
Reduces Energy
Irrigation Pumping Plant Efficiency Testing

Google: lsu irrigating smart

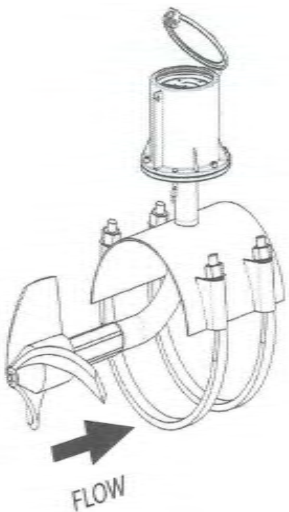
Irrigation System Capacity and Demand

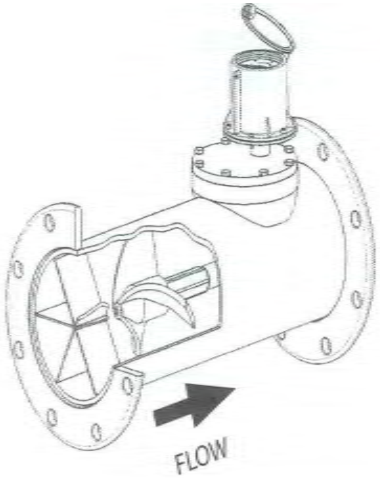
System Type	Application Efficiency	Capacity Need for Soybeans in Arkansas
Furrow	40-75%	10 gpm/acre
Furrow with Tail Water Recovery	60-85%	10 gpm/acre
Flood	60-85%	15 gpm/acre
Border	50-85%	12 gpm/acre
Center Pivot	75-90%	5 gpm/acre

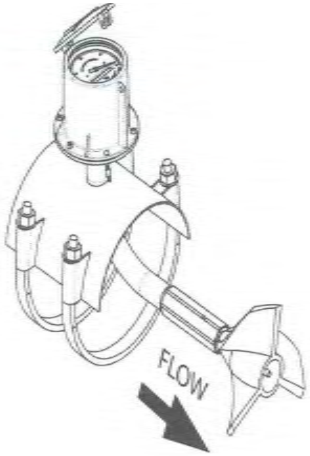
Sources: Management of Farm Irrigation Systems, ASABE monograph, 1990 & Soybean Production Handbook, University of Arkansas

Flow meters are a Irrigation Tool

1. Adequate capacity
2. Pump Performance
3. Feedback to Irrigator.







Soybean RVP Irrigation Water Use 2012

Average irrigation water use: 13.7 inches
Average total water use: 23.4 inches

County	Irrigation (Acre-in)	Depth of Irrig.	# of Irrigations	Irrig. Method	Rainfall	Total water	Yield
Arkansas S	13.43	2.24	6.00	Furrow	11.25	24.68	59
Chicot	13.52	2.25	6.00	Furrow	16.50	30.02	56
Crittenden	17.09	1.71	10.00	Furrow	5.00	22.09	70
Drew	12.69	2.54	5.00	Furrow	9.00	21.69	73
Greene	15.53	2.59	6.00	Furrow	7.00	22.53	--
Lafayette	6.89	2.30	3.00	Furrow	7.50	14.39	52
Mississippi	16.96	2.42	7.00	Furrow	11.22	28.18	68

AR Water Plan Estimates: Average 16.3 in, min 1.0 in, max 32.3 in

Address compaction and soil-related factors:

Cover crops, no-till, & furrow diking have been shown to have benefits.

Rice into wheat stubble

Improve water holding capacity of soils

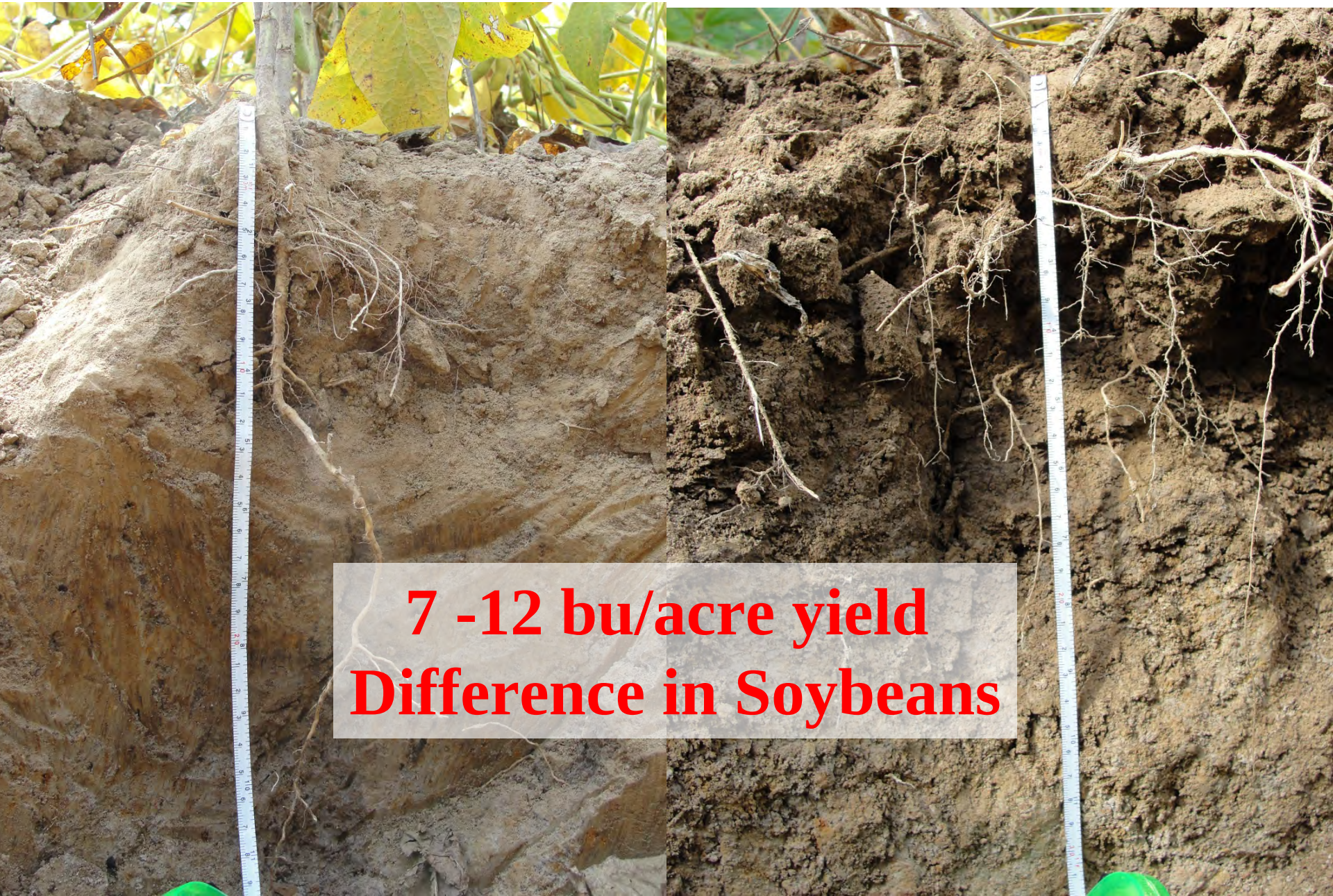
Soybeans into wheat stubble

Tip: Address Compaction and Soil Related Factors i.e. Deep Tillage

No-till ripper
GPS on bed center

Deep Tillage removes tillage pan and compaction and Improves infiltration and returns soil's ability to hold water

Not-Ripped **Ripped**



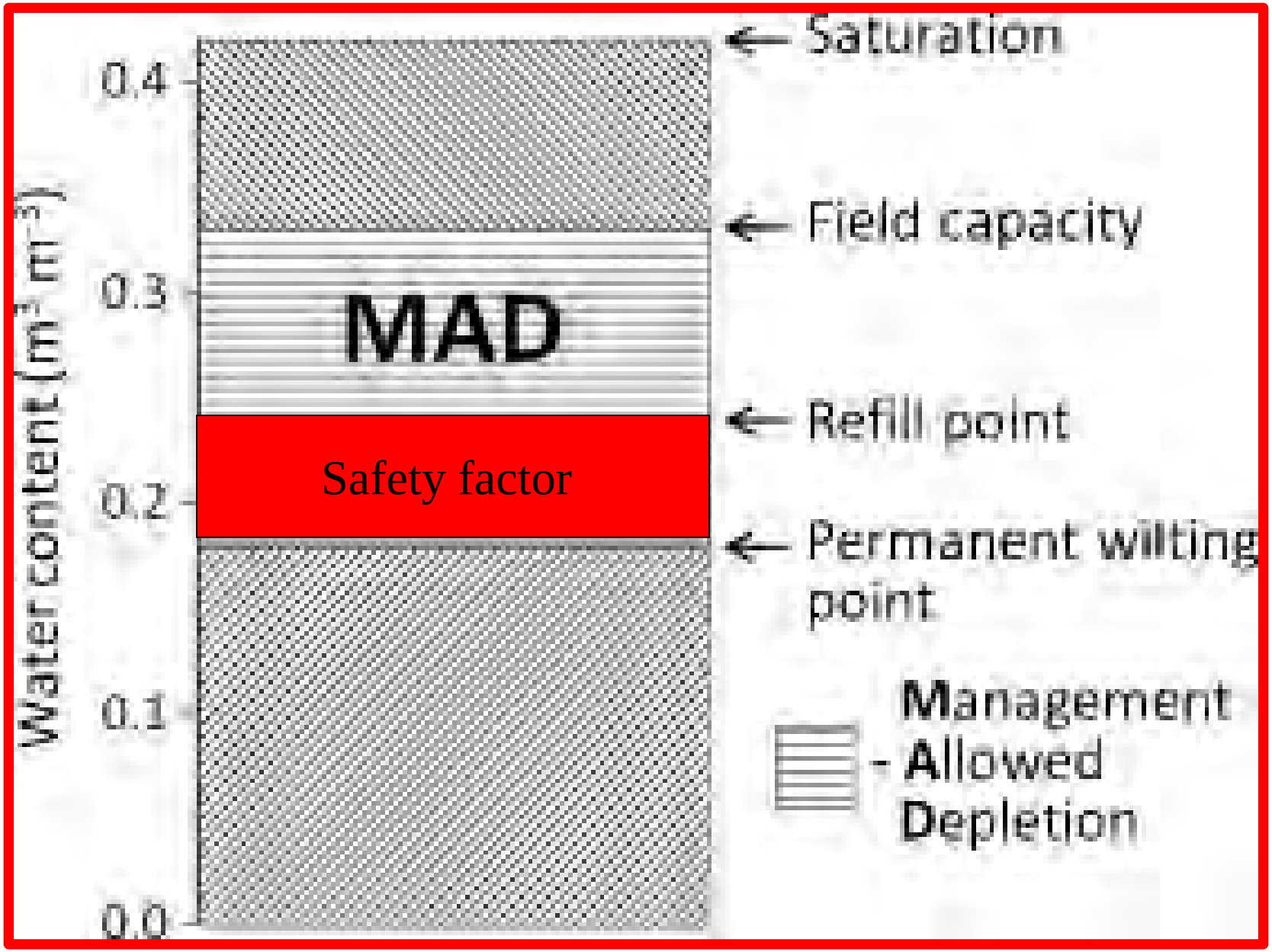
7 -12 bu/acre yield Difference in Soybeans

How do I know how much I need to Irrigate?

Soil Water Balance Equation

Irrigation + Precipitation – Evapotranspiration +- Drainage +-Runoff = Water Balance

Rule of Thumb: **Peak ET around 0.3”/day**

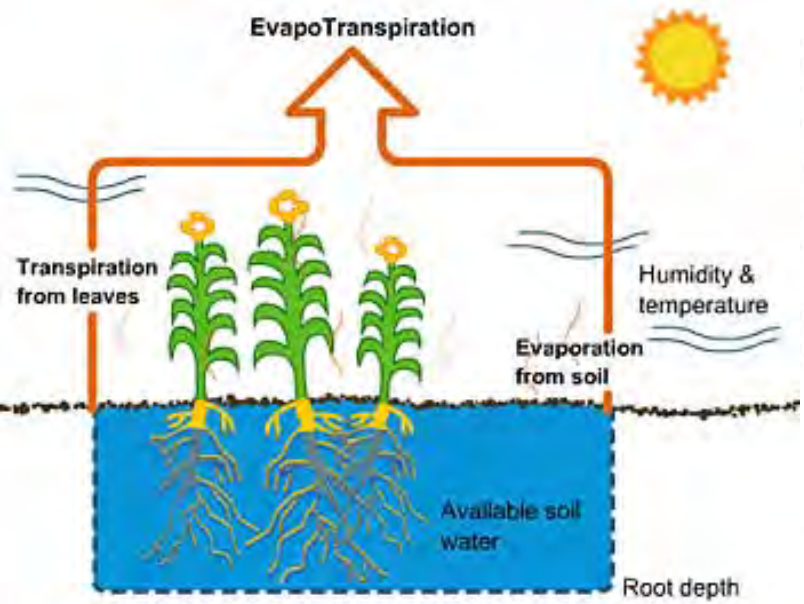

Saturation
Field capacity
MAD
Refill point
Safety factor
Permanent wilting point
Management - Allowed Depletion
Water content (m³ m⁻³)
0.4
0.3
0.2
0.1
0.0

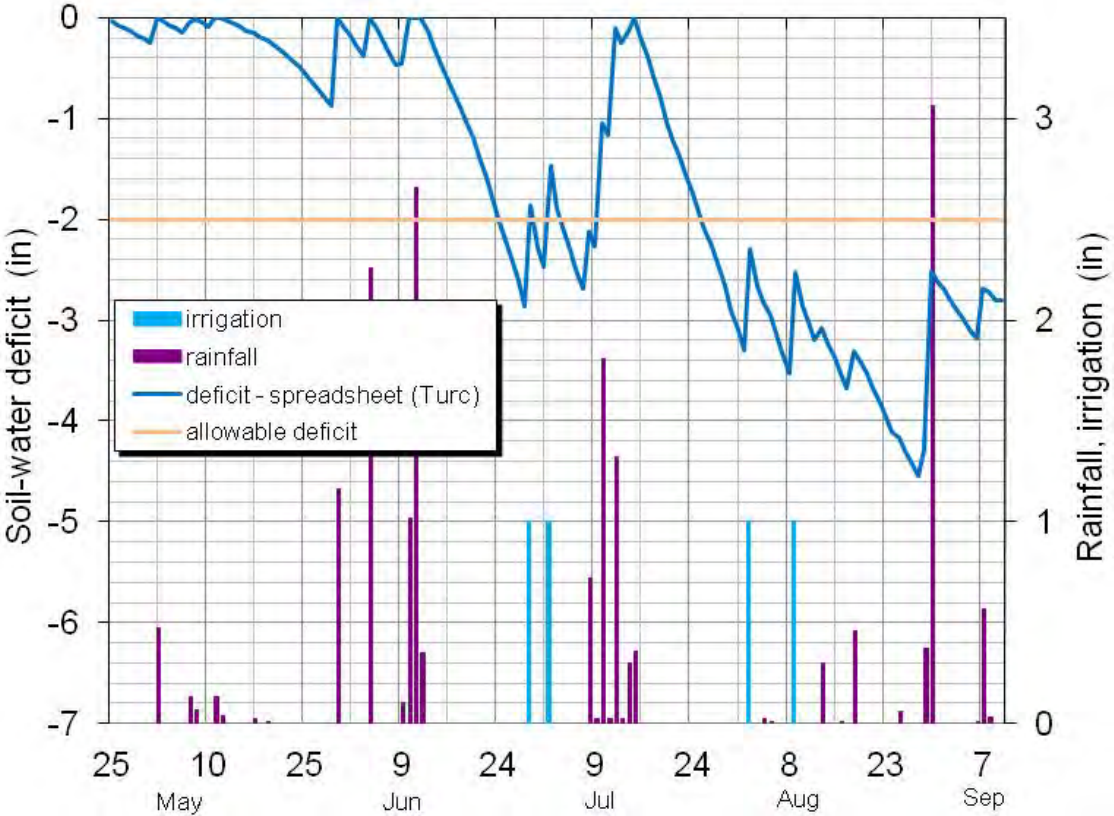
General Soybean Growth and Water Use

Crop Development	Water User (in/dy)
Germination and seeding	0.05-0.10
Rapid vegetative growth	0.10-0.20
Flowering to pod fill (full canopy)	0.20-0.30
Maturity to harvest	0.05-0.20

ET-Based Irrigation Scheduling

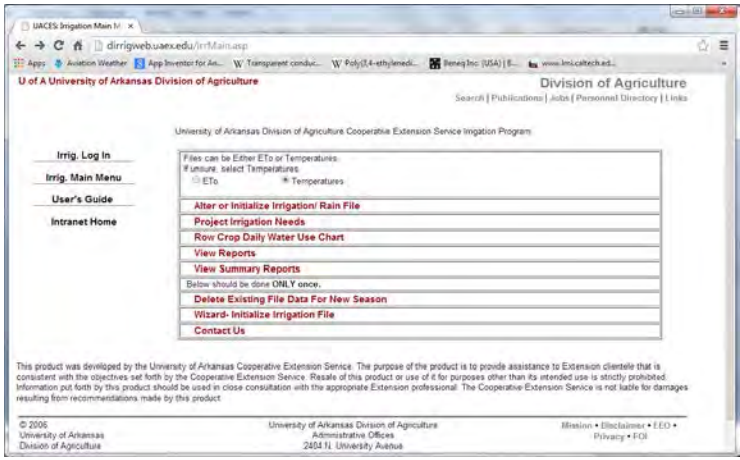
- Uses a reference Evapotranspiraton method and crop physiology to estimate crop irrigation water needs.





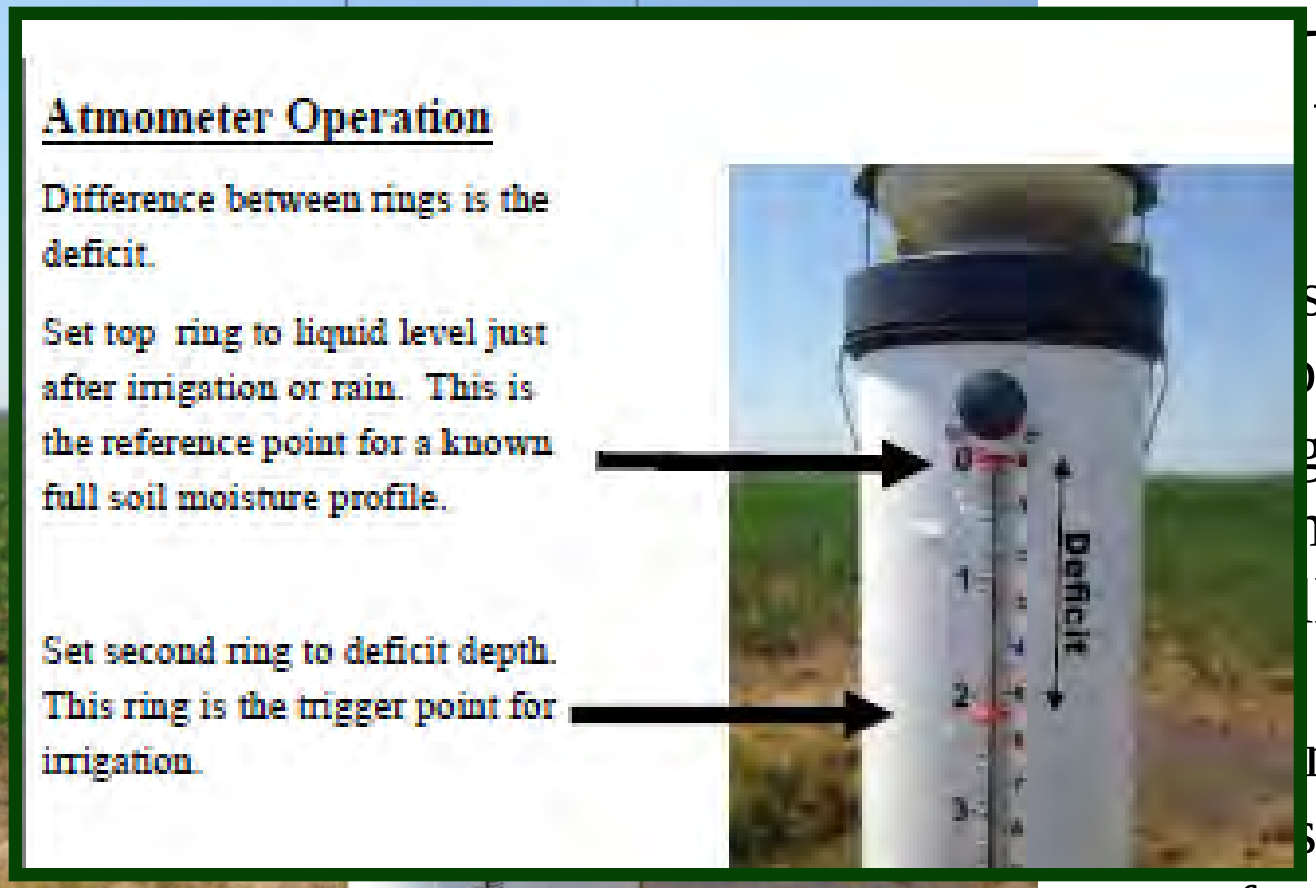
ET-based Irrigation Scheduling

- Provides guidance on "when to irrigate."
- Computer-based Irrigation Scheduling Systems
  - Need reliable agricultural station network
  - Arkansas Irrigation Scheduler
- Atmometer



http://irrigweb.uaex.edu/

Atmometer aka
T gage



sures Crop
otranspiration
g canvas cover,
mic cup, and
lled water.
$200
measure alfalfa,
s or in-canopy
reference ET.

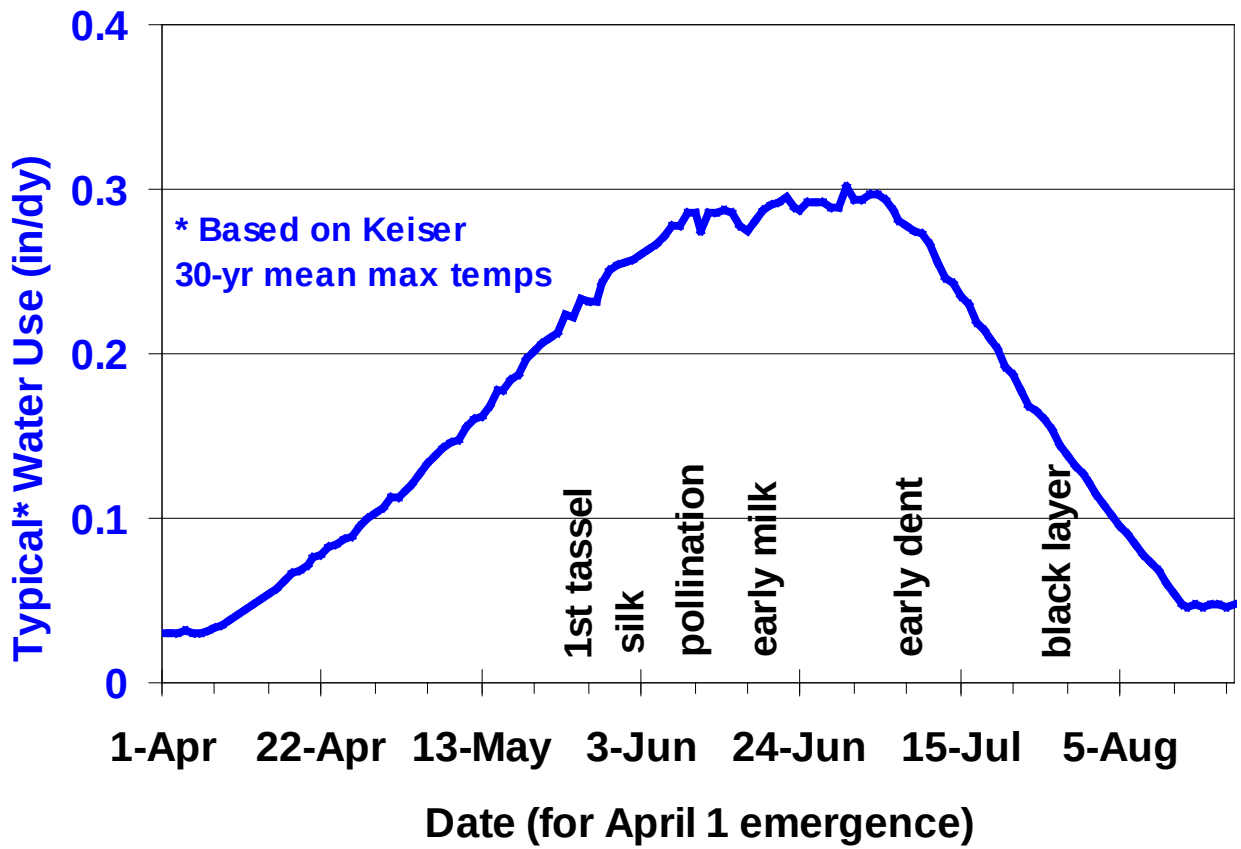
http://www.etgage.com

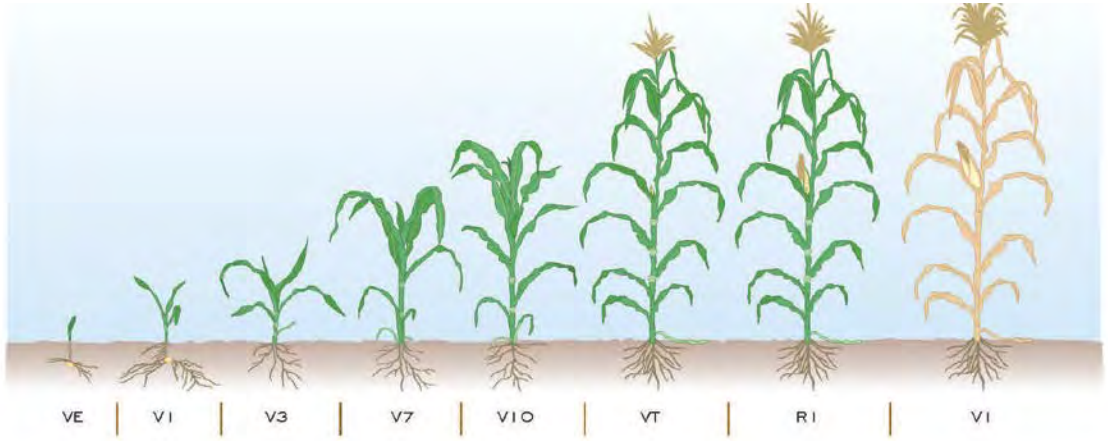
Irrigation Termination

A Key Water Savings Management Practice

Goal is to use remaining soil moisture in profile.

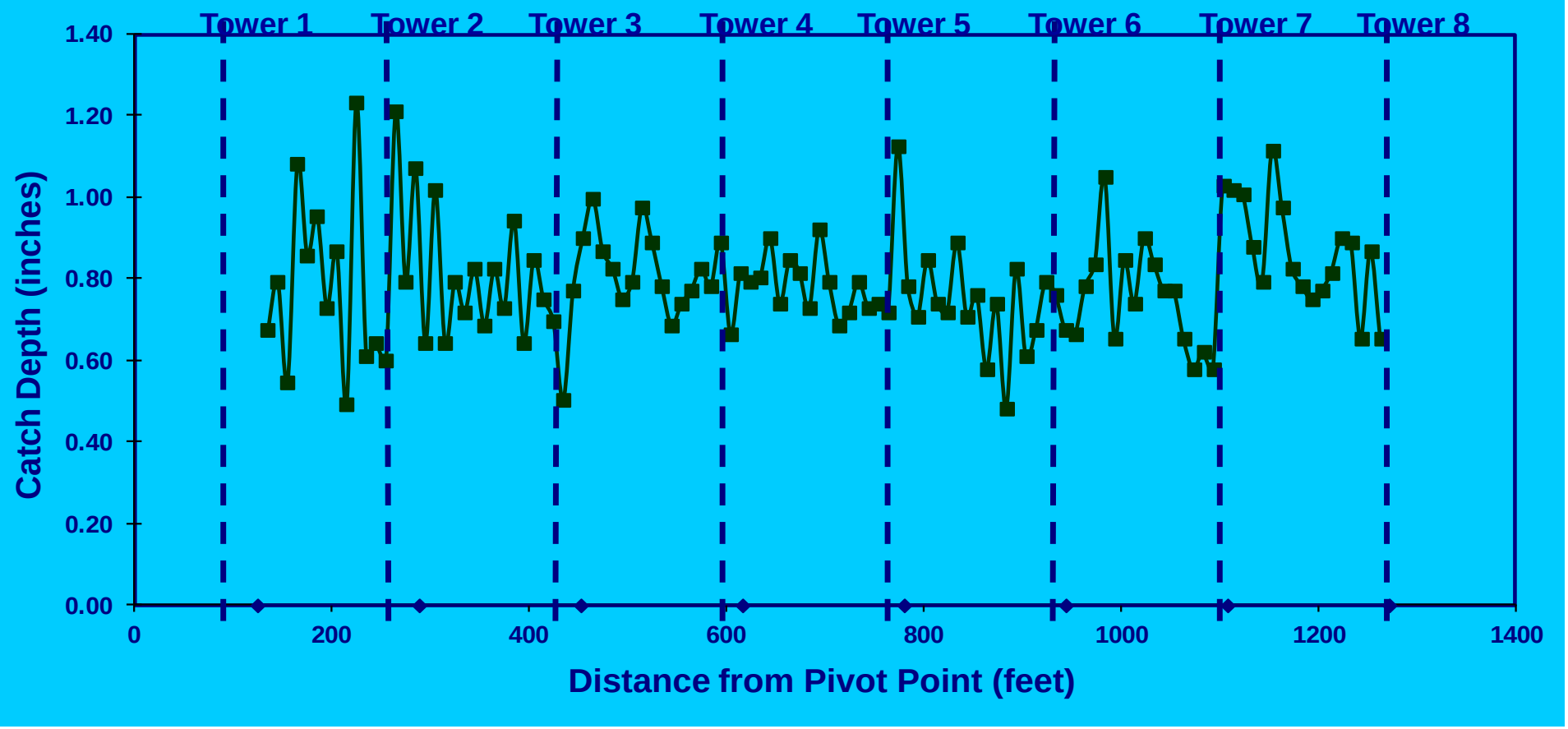
Potential to save 1-2 irrigations





Sprinkler Nozzle Evaluation and Replacement

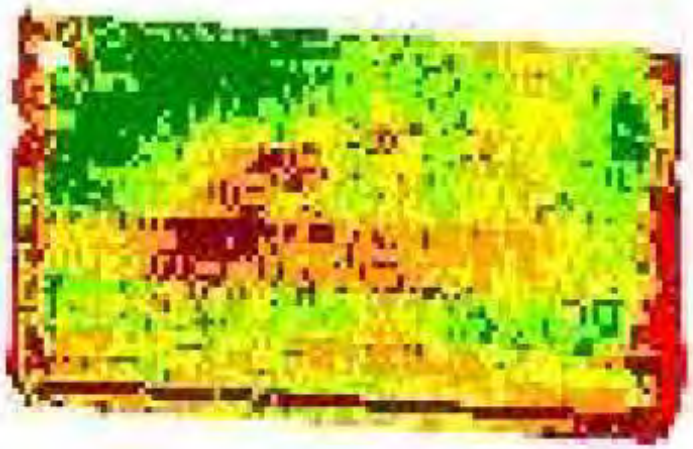
Liquid Distribution Uniformity Test

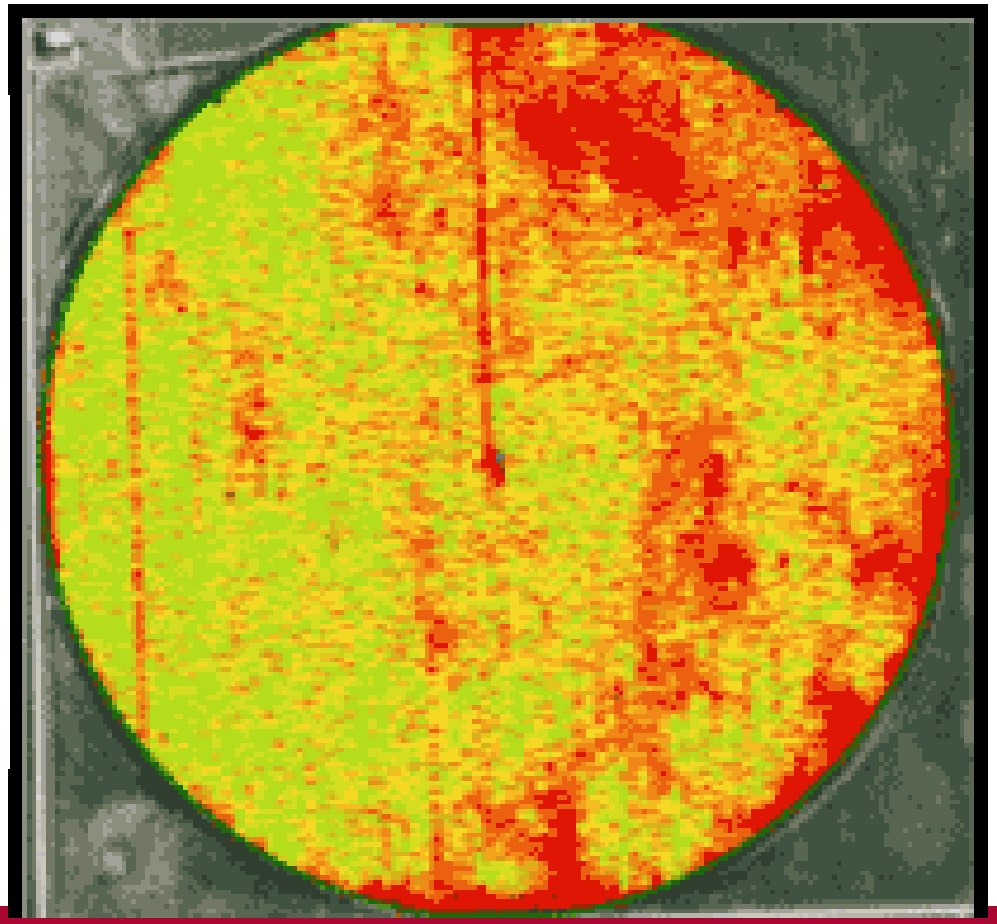


System Length = 1314 feet
Number of Sprinklers = 105
System Flow Rate = 975 gpm
First Three Spans - TR3000 w/D4 plates
Remainder - TD3000 fine grooved flat plates

Slide courtesy of Bill Kranz

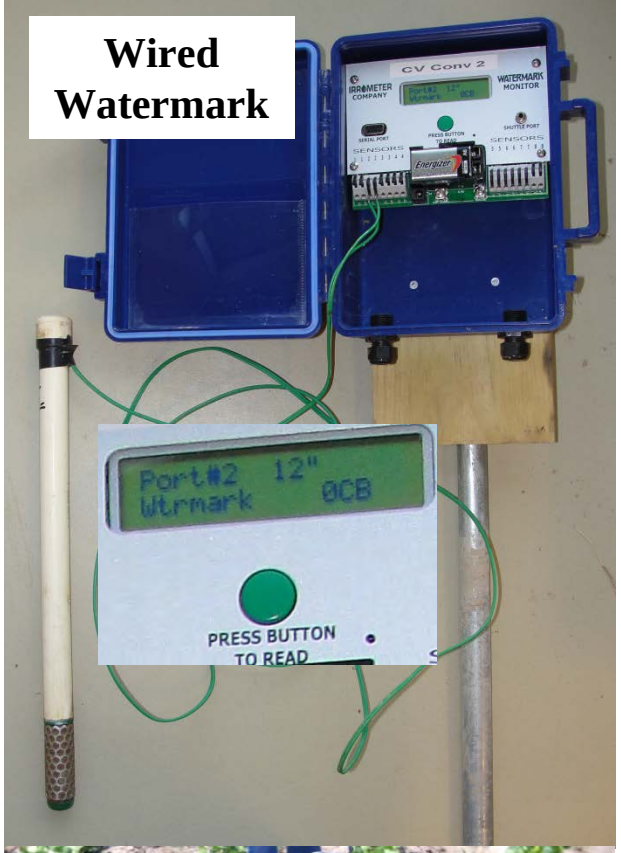
Evaluate Irrigation Management using Yield Monitor data or Aerial Imagery



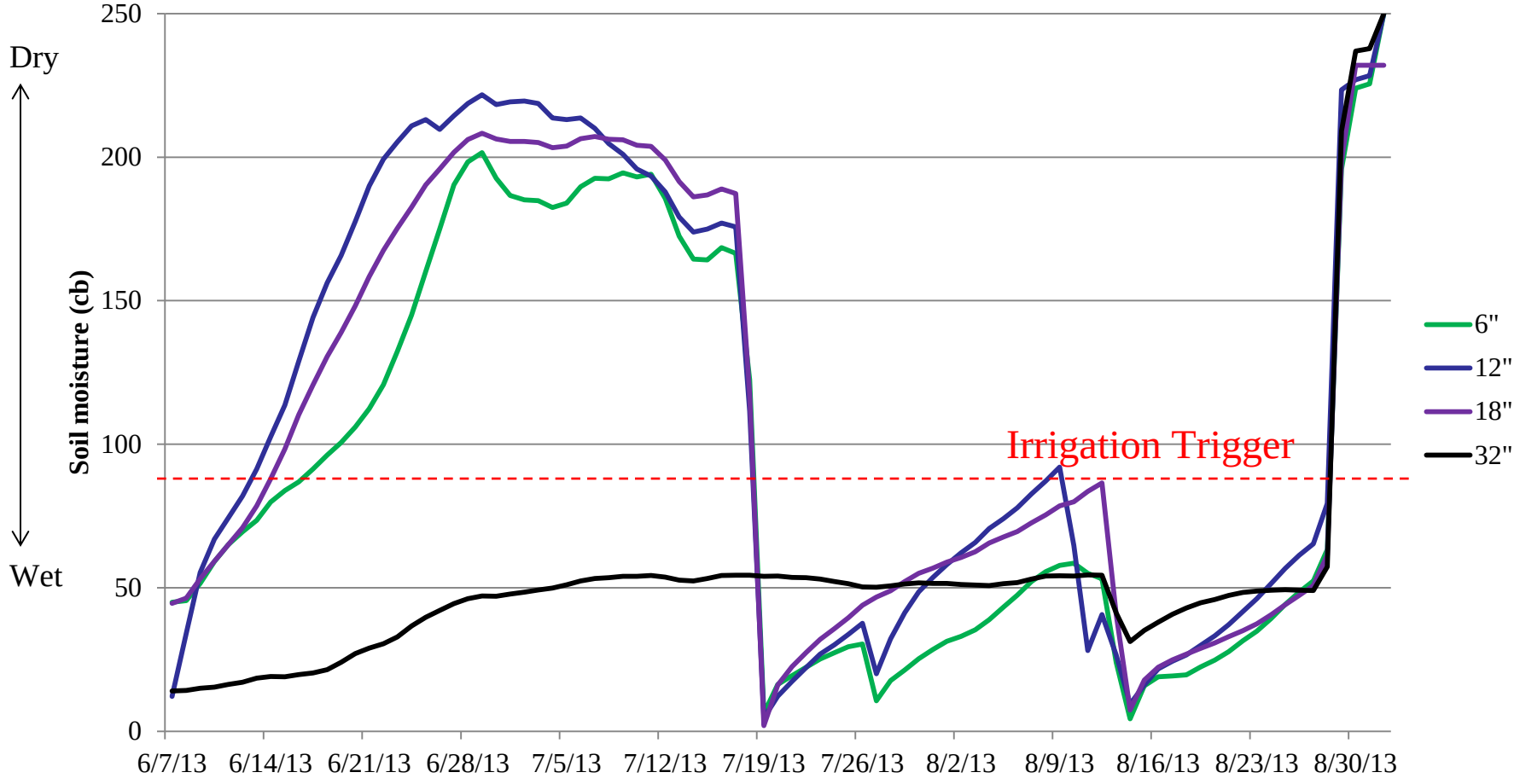


Soil Moisture Sensors to schedule irrigation or evaluate irrigation management

Watermark soil moisture sensors and dataloggers



Corn Farm 3


Dry
Wet
Soil moisture (cb)
250
200
150
100
50
0
6/7/13
6/14/13
6/21/13
6/28/13
7/5/13
7/12/13
7/19/13
7/26/13
8/2/13
8/9/13
8/16/13
8/23/13
8/30/13
Irrigation Trigger
6"
12"
18"
32"

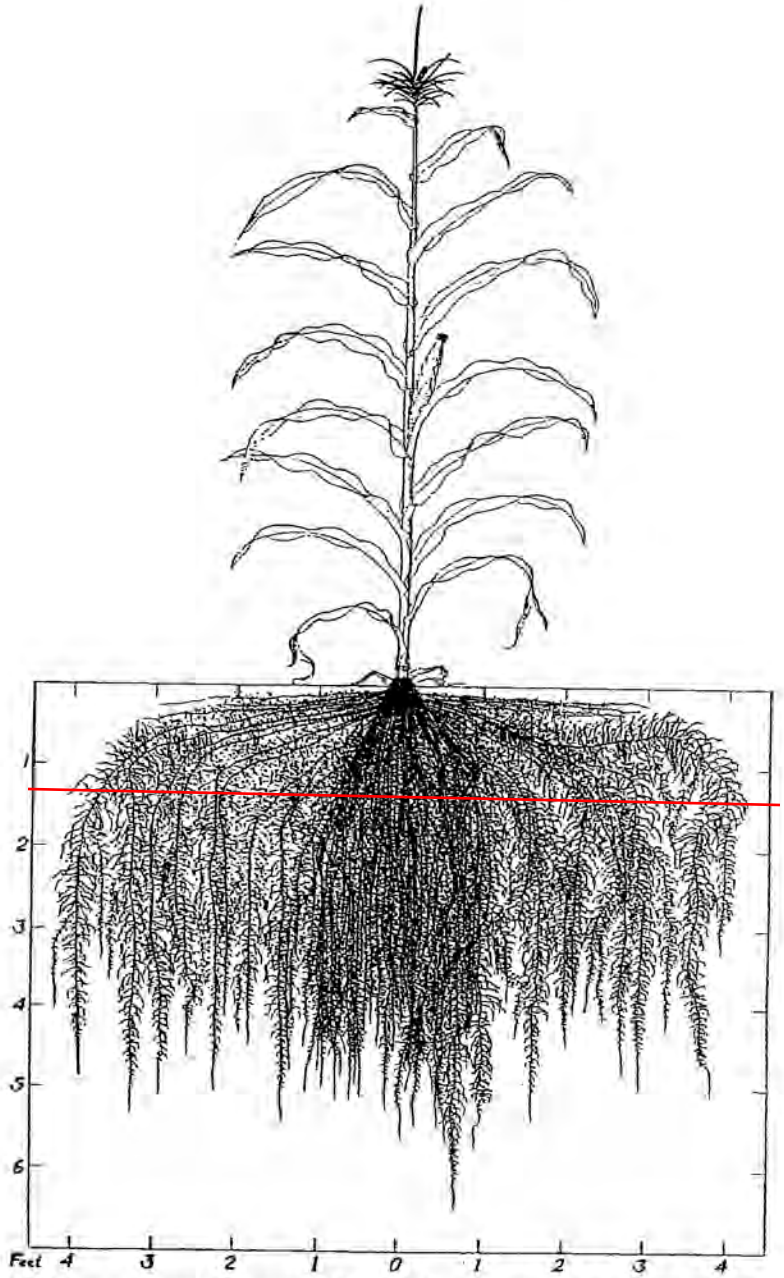


FIG. 12.—Mature stalk and root system of a typical corn plant (Krug variety) grown on the Experiment Station farm in 1933. About 25 per cent of the fine branch roots are included. In both Figures 11 and 12 the roots were drawn in position during excavation, except that they are shown in a single plane.

18” deepest roots found, after deep tillage

Computerized Hole Selection

For Furrow Irrigation

- Helps determine size of holes to punch in tubing
- Calculates pressure change along the tubing
- Can help address different row lengths in the same set
- May increase number of rows irrigated in a set
- Should help rows water out more evenly
- Can help reduce runoff and irrigation pumping time

Experience (Phil Tacker) showed a 25% average reduction in irrigation pumping time.

Slide courtesy of Jason Krutz, MSU

CHS Research Results

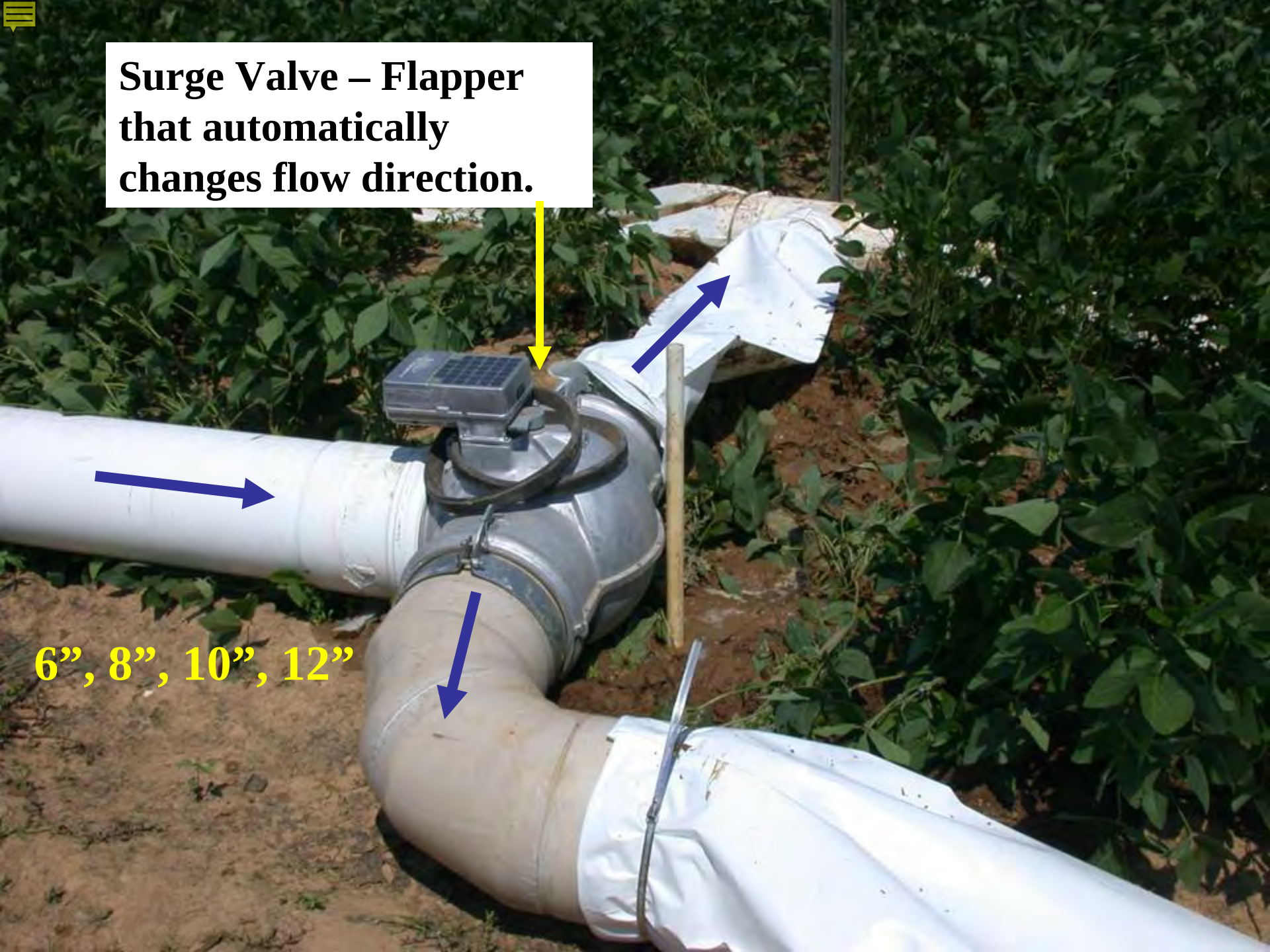
- Water and fuel reduced by 20% on regularly shaped fields
  - Savings likely higher on irregularly shaped fields
  - Landscape water savings potential 226,430 ac-ft/yr
- Given current or increasing fuel costs, PHAUCET program increases profitability by 70 dollars acre^{-1} on regularly shaped fields.
  - Profit margin likely higher on irregularly shaped fields

Design Irrigation Sets for soils, fields, and pump capacity

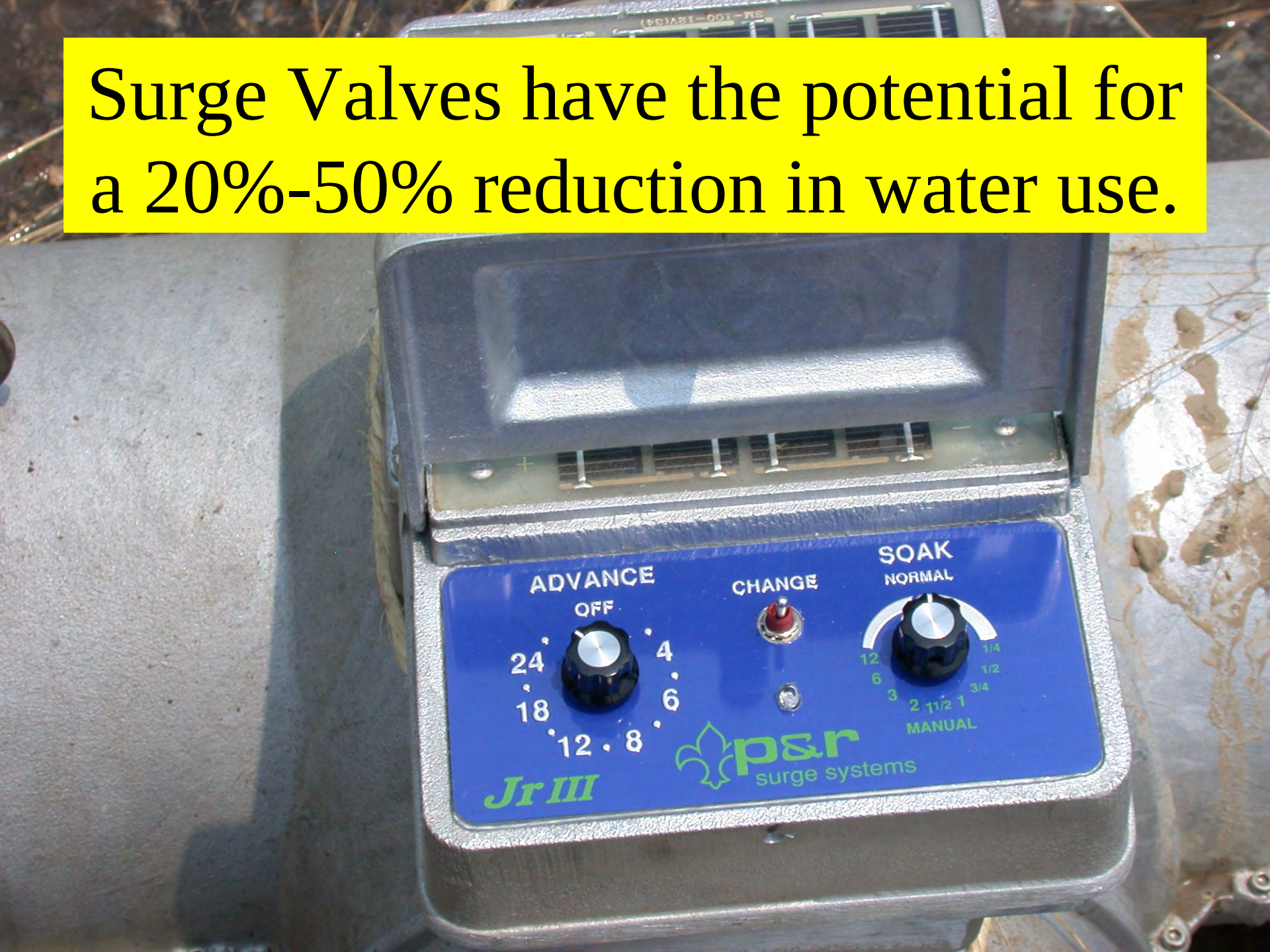
Irrigate alternate rows on cracking clays (using CHS)

Surge Irrigation

- Oscillating valve causes alternating wetting and drying cycles
- Intake rate of dry soil is initially high then decreases with time.
- Soil particles settle and consolidate sealing the surface which reduced water intake vertically
- Water tends to skip over wetted surfaces, infiltrating less resulting in more uniformity across furrow length (this is called reducing the opportunity time for the top of the furrow).


Surge Valve – Flapper that automatically changes flow direction.
6”, 8”, 10”, 12”

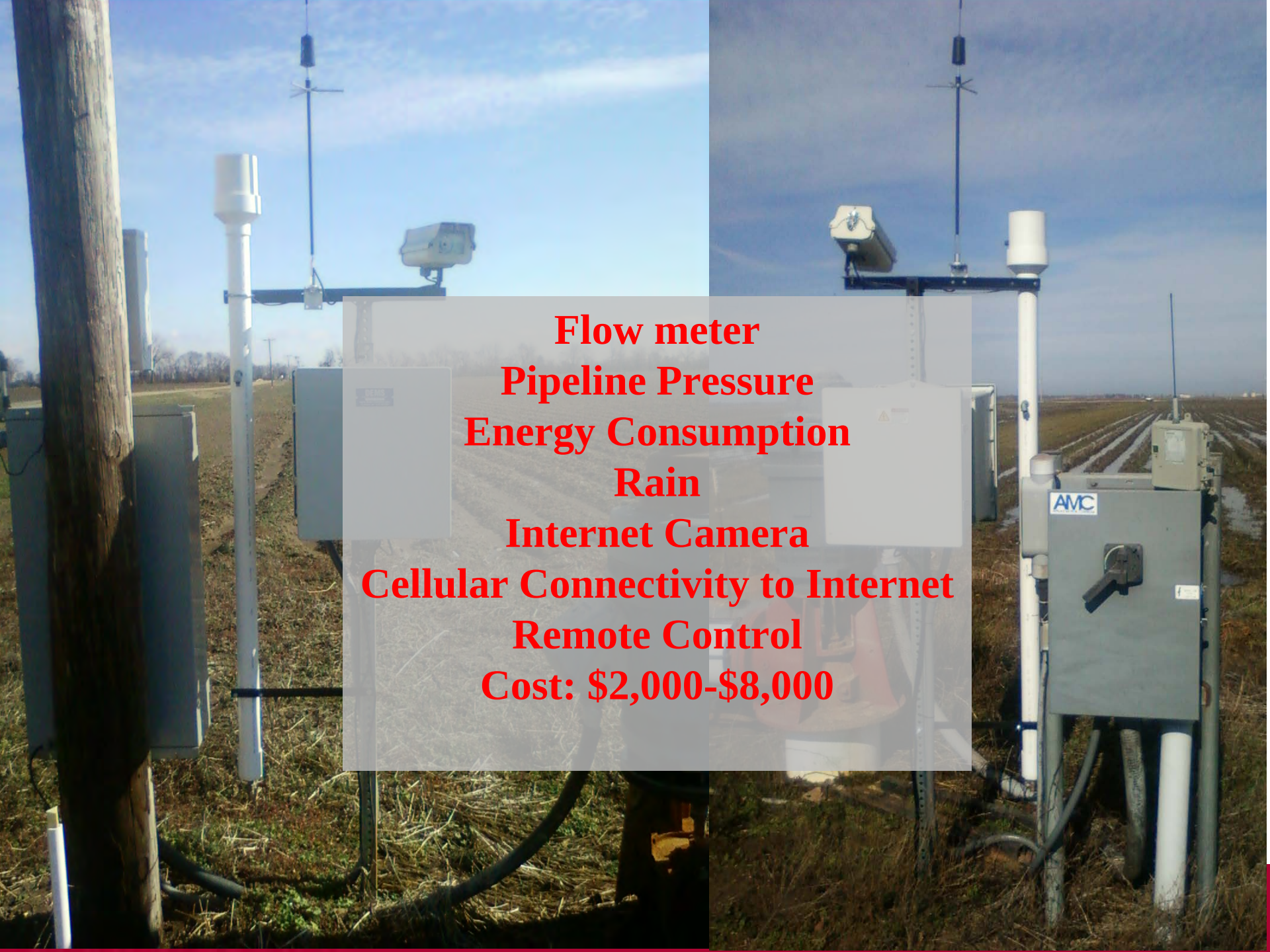
Surge Valves have the potential for a 20%-50% reduction in water use.



Irrigation Pump Automation

- Industrial automation for agriculture.
- Provides producer with information regarding individual pumping plant operation (1 hour data reported).
- Allows for remote control operation using cell phone modem or wireless 802.11g connectivity through web-based interface.
- Tracks energy and water use over time.
- Timers on irrigation pumps are also a very low cost technology to allow for cessation of pumping without operator intervention.

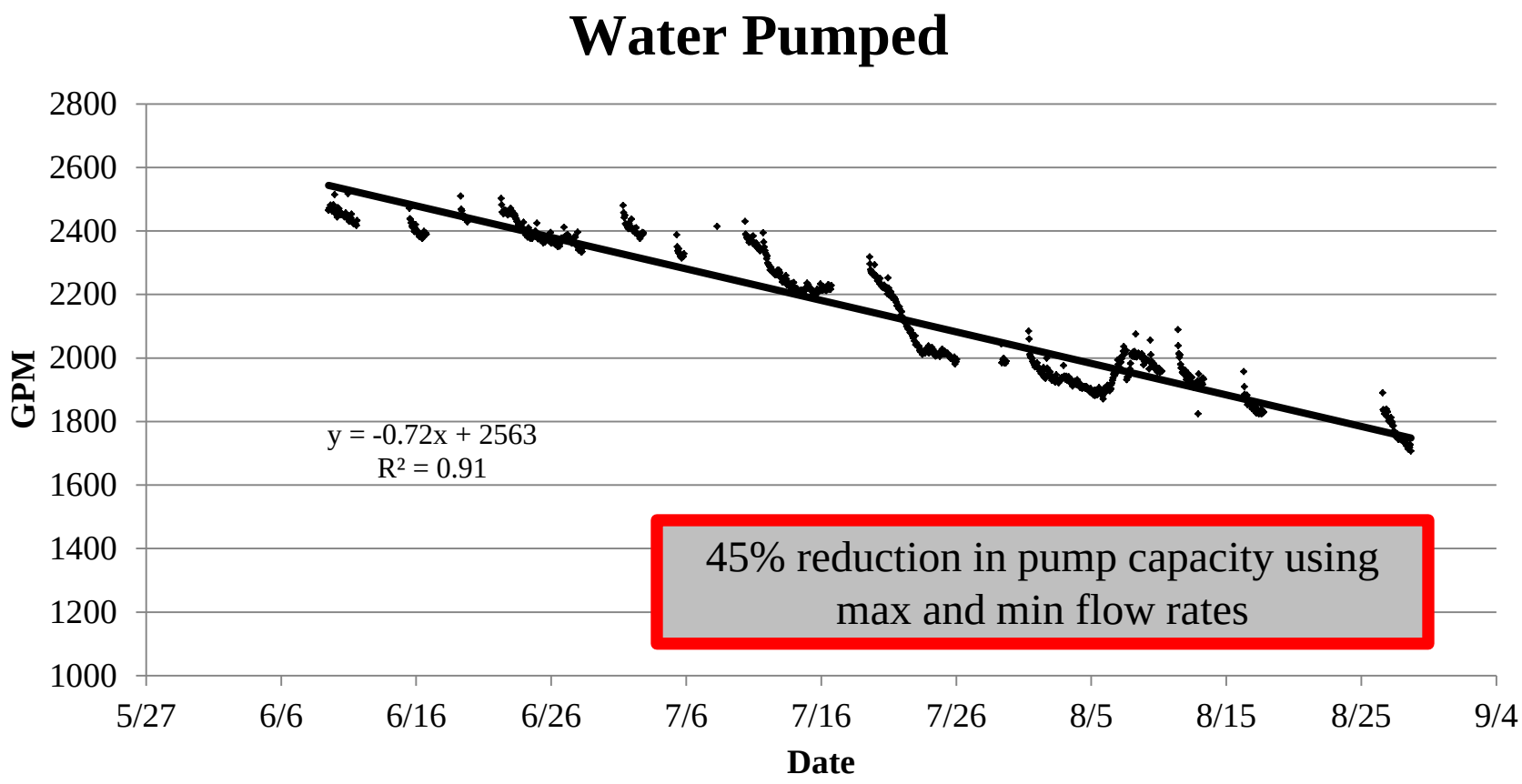
Cost: $200 installed



Flow meter
Pipeline Pressure
Energy Consumption
Rain
Internet Camera
Cellular Connectivity to Internet
Remote Control
Cost: $2,000-$8,000

Pumping Plant Monitoring

AR Alluvial Well, electric



Data Source: White River Irrigation District, Diesel Engine Motors, Dennis Carman
Analyzed by Henry and McDougall.

Tail Water Recovery

Increases irrigation efficiency by 25-30%

Source: I. Broner (2003) and D. Carmen

Rice Irrigation Systems

- Contour Levee Systems
  - Levees placed on natural topography
- Precision Grade/Straight Levee Systems
  - Land Leveling has been done so levees are "straight" on grade
- Zero Grade
  - Entire field has been leveled to one elevation
  - 40% less water needed
- Alternative Systems
  - Sprinkler or Center Pivot Rice
  - Row Rice
  - Alternate Wetting and Drying/ Intermittent Flooding

Multiple Inlet or Side Inlet uses lay-flat pipe or a canal to distribute water to the levees. Technology and management can reduce water use by 25%

Historical Rice Water Use (2003-2011)

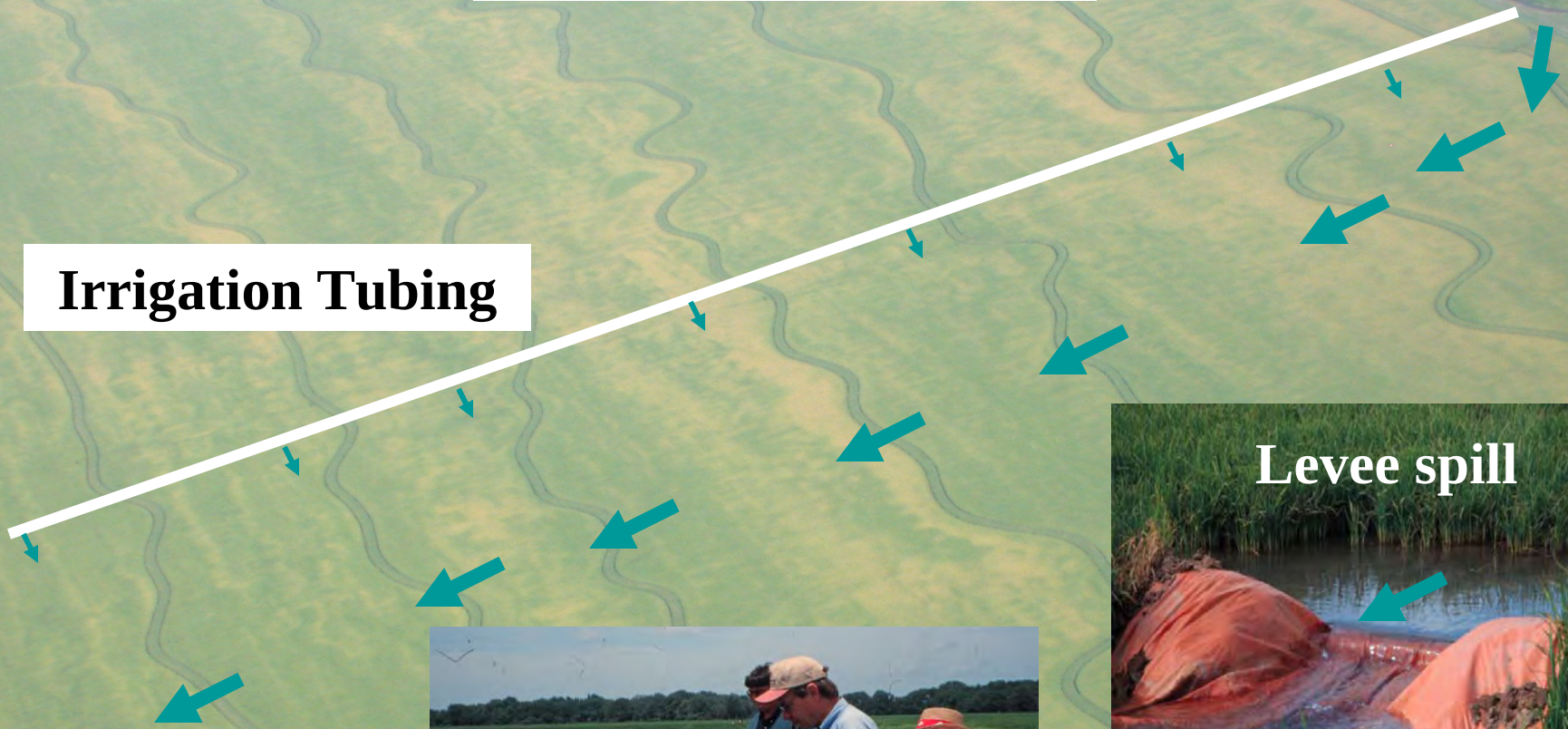
Irrigation System Type	n	Average Irrigation Water Use	Range	Standard Error
Contour	29	814 mm (32.0 in) [a]	406 – 1430 mm (16.0 – 56.3 in)	53.3 mm (2.1 in)
Straight Levee	37	814 mm (32.1 in) [a]	356 – 1880 mm (14.0 – 74.0 in)	45.7 mm (1.8 in)
Zero Grade	10	481 mm (18.9 in)	254 – 864 mm (10.0 – 34.0 in)	96.5 mm (3.8 in)

Year	Annual Average Irrigation Water Use in mm (inches)	Range in mm (inches)
2003	724 (28.5)	478-973 (18.8-38.3 inches)
2004	621 (24.4)	460-889 (18.1-35 inches)
2005	985 (38.8)	691-1,430 (27.2-56.3 inches)
2006	847 (33.3)	356-1,245 (14.0-49.0 inches)
2007	573 (22.6)	330-838 (13.0-33.0 inches)
2008	620 (24.4)	254-889 (10.0 – 35.0 inches)
2009	704 (27.7)	381-1,179 (15.0-46.4 inches)
2010	955 (37.6)	500-1,880 (19.7-74.0 inches)
2011	688 (27.1)	508-965 (20.0-38.0 inches)
Average	757 **(29.8)**	574-986 (22.6 – 38.8 inches)
Standard Deviation	149 (5.9)	

Type	**% AR Acreage**
Contour	51%
Straight Levee	43%
Zero Grade	6%

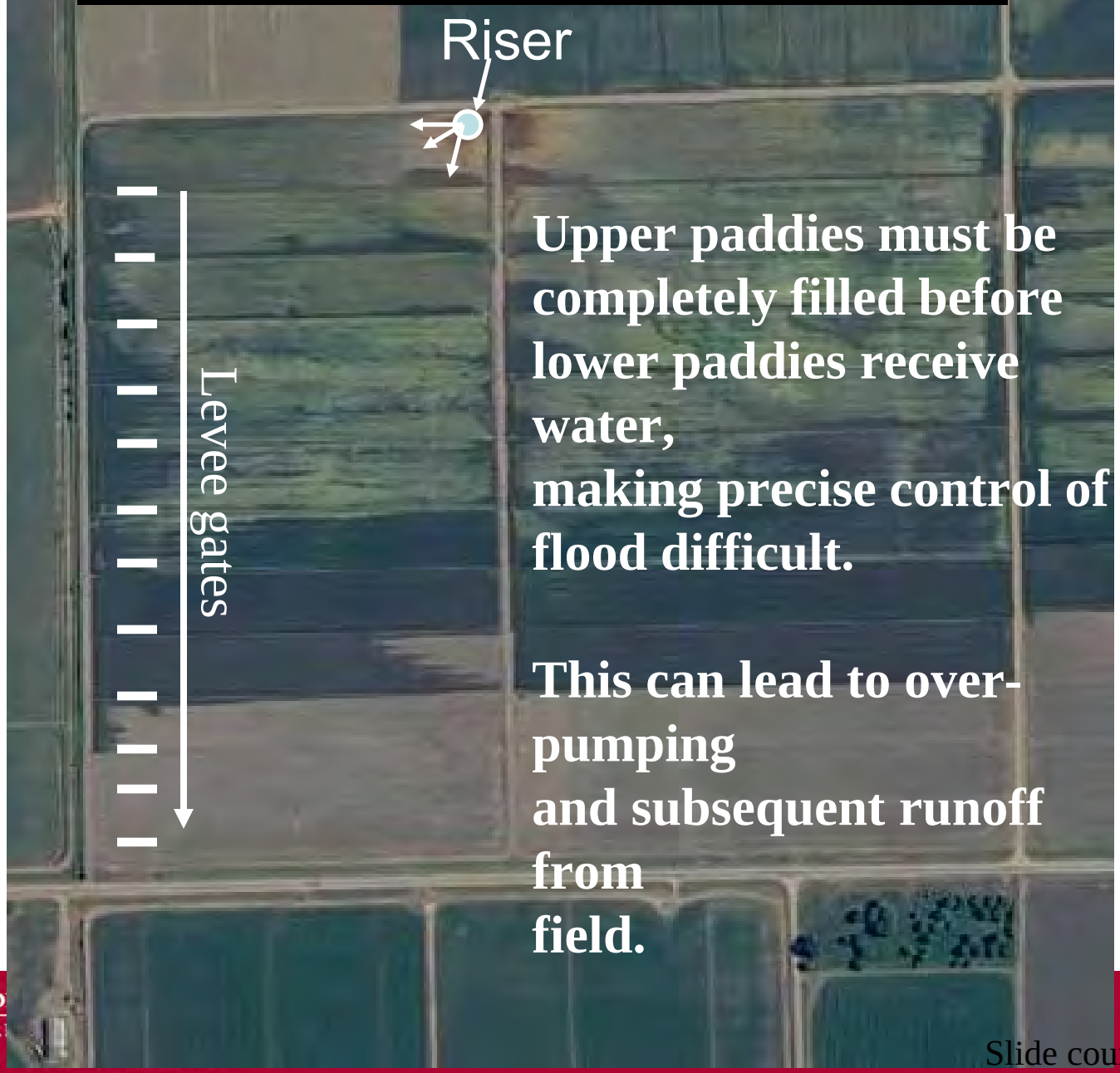
[a] Means within a column followed by the same letter are not significantly different at α=0.05

Rice Field



Slide courtesy of Phil Tacker

Straight-Levee System



Upper paddies must be completely filled before lower paddies receive water,
making precise control of flood difficult.

This can lead to over-pumping
and subsequent runoff from
field.

Slide courtesy of Joe Massey

Multiple-Inlet Irrigation
in Straight-Levee Systems

Slide courtesy of Joe Massey

Multiple-Inlet Irrigation
in Straight-Levee Systems

MAFES Publication No. 2338
Thomas et al. (2004)

Advantages of Side-Inlets:

- Facilitates adoption of other water-saving practices.
- More rapid flood establishment.
- Improved herbicide activation.
- Reduced nitrogen loss.

Tacker (2012): Approximate cost ~ $14/A (tubing + labor)

Slide courtesy of Joe Massey

Multiple/Side Inlet

- Vories et al. (2005) found a 24% reduction when multiple inlet was used in contour and straight levee systems.

- Phil Tacker reported a 25% reduction from field experience

Rice irrigation efficiency can be optimized by using a combination of practices that:

(A). Shorten duration of flood.

(B). Reduce edge-of-field losses and tail water runoff.

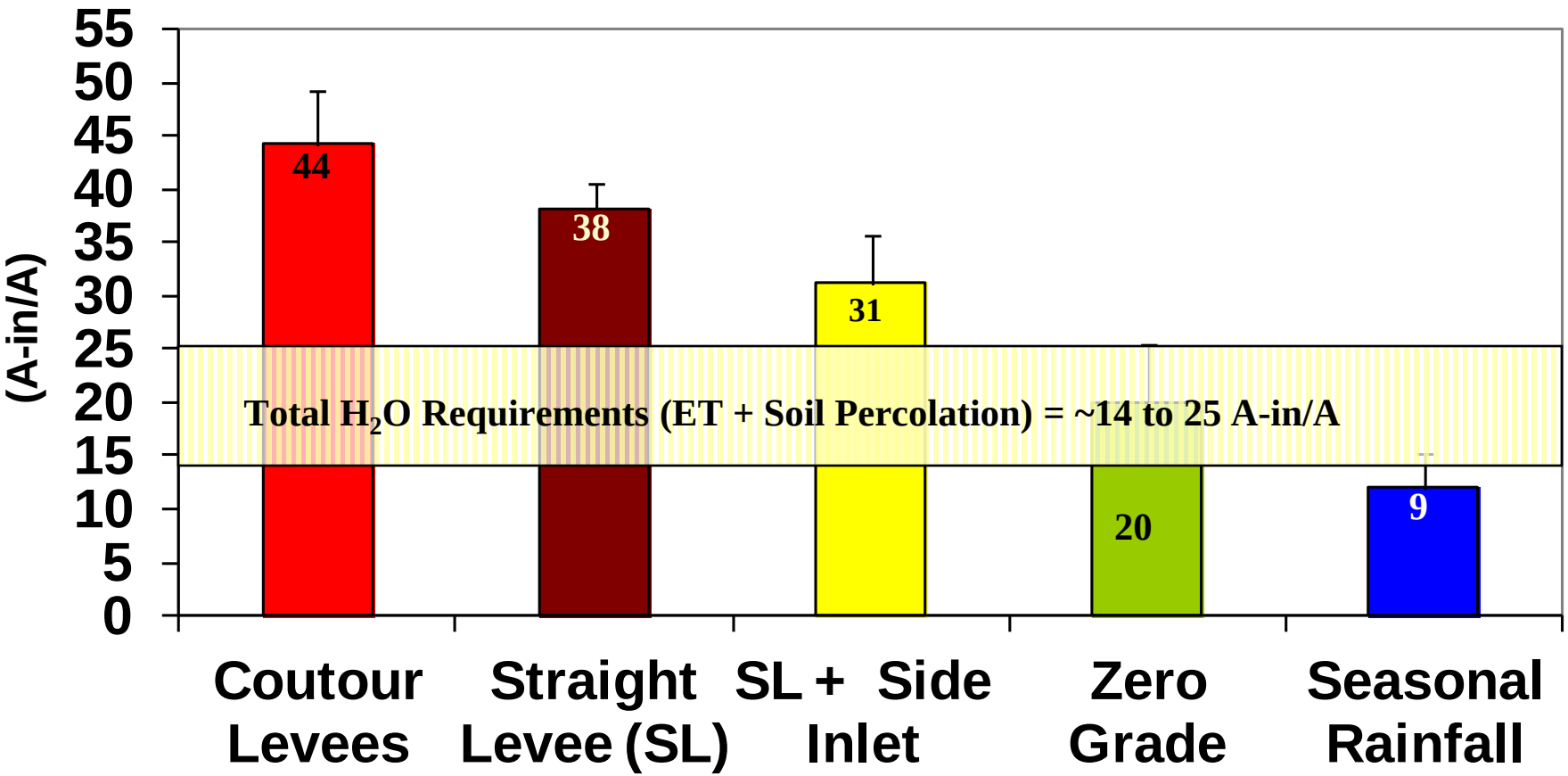
(C). Increase precision of flood delivery so as to reduce over-pumping.

(D). Make full use of in-season rainfall.

(E). Reduce seepage losses.

YMD (2009)

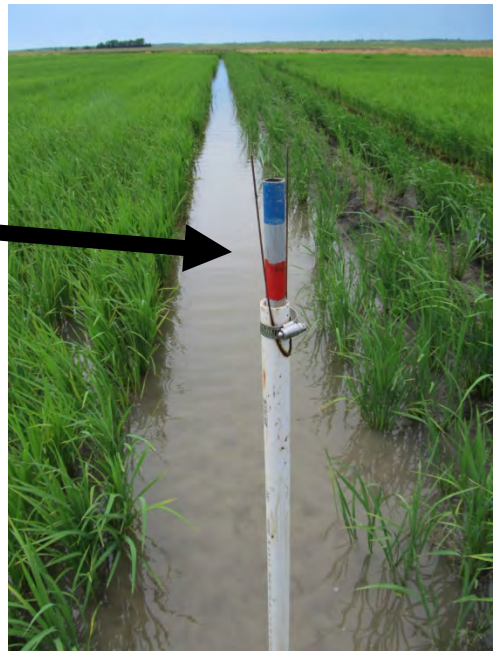
6-yr average water use in Mississippi rice production



Pringle (1994): Water Use Requirements for Rice in the MS Delta

Slide courtesy of Joe Massey

Depth Gauges Aid in Flood Management of Zero Grade Fields



- Allows rapid determination of flood status.
- **Farmer constructed 200 in one afternoon.**

Slide courtesy of Joe Massey

Tips for Conserving Irrigation Water in the Southern Region

1. Measure Irrigation Water Use
2. Use an ET base Scheduling System
3. Improve irrigation efficiency of furrow irrigation by using Computerized Hole Selection for lay-flat pipe.
4. Use Surge Irrigation
5. Replace CP Sprinkler package
6. Use soil moisture sensors to track soil water
7. Irrigate on-time and at the right time
8. Evaluate irrigation performance using aerial imagery or yield monitor
9. Reduce or remove soil compaction
10. Improve irrigation management by using timers or pump monitors to shut off wells at appropriate times.
11. Maintain grades and ensure good field drainage.
12. Design irrigation sets to maximize infiltration and minimize deep percolation
13. Irrigate every other row on cracking clays soils.
14. For rice irrigating, use zero grade and depth gauges or multiple inlet.
15. Use tail-water recovery

Irrigating Smart
Conserves Water
Saves Money
Reduces Energy
Irrigation Pumping Plant Efficiency Testing

Google: lsu irrigating smart

Contact Information: 870-673-2661 cghenry@uark.edu

Take Home Message

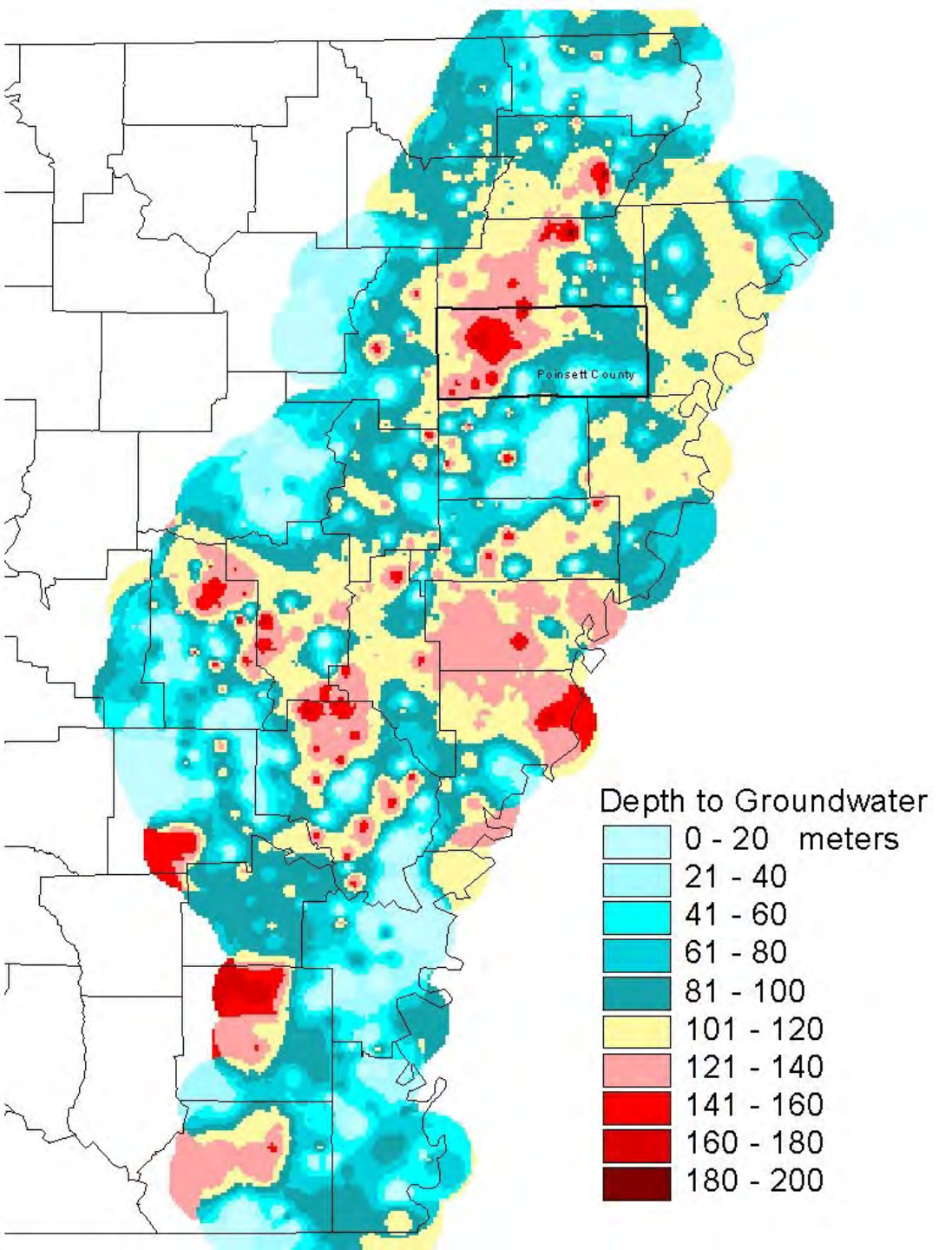
- There are many other ways to conserve water or increase efficiency, but these are the most appropriate for the southern region.
- Measuring irrigation water use is a valuable tool for farmers
- Management is key to conservation, not technology
- Goal should be a targeted efficiency or metric, not forced technology adoption, let farmer decide how to get there.
- More research and education is critically needed in irrigation in the southern region.

Contact Information: 870-673-2661 cghenry@uark.edu

Water Management in Rice and Soybeans

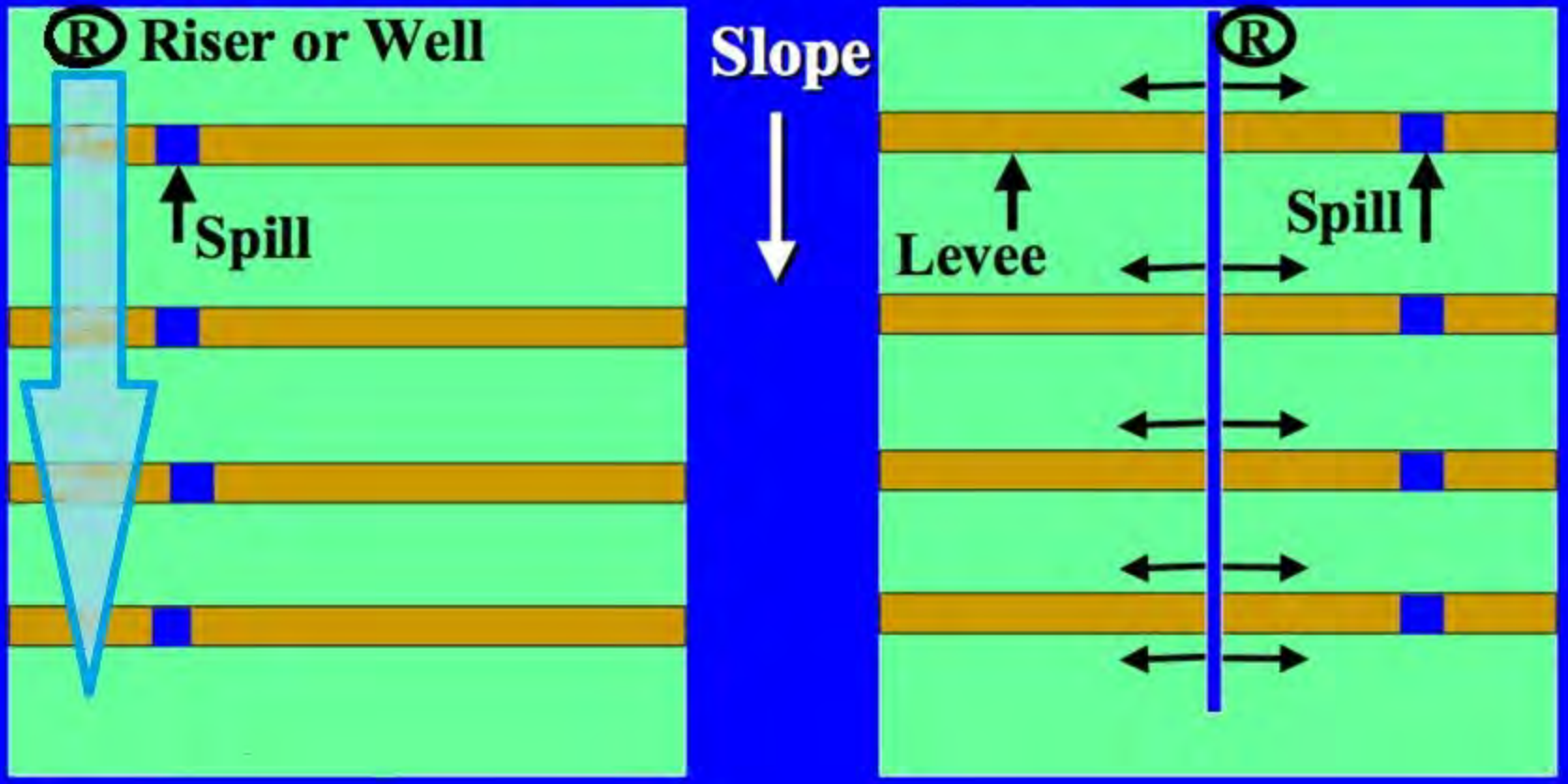
Mike Hamilton
CEA-AGRI
Poinsett County

Groundwater Drawdown Map of the Arkansas Delta



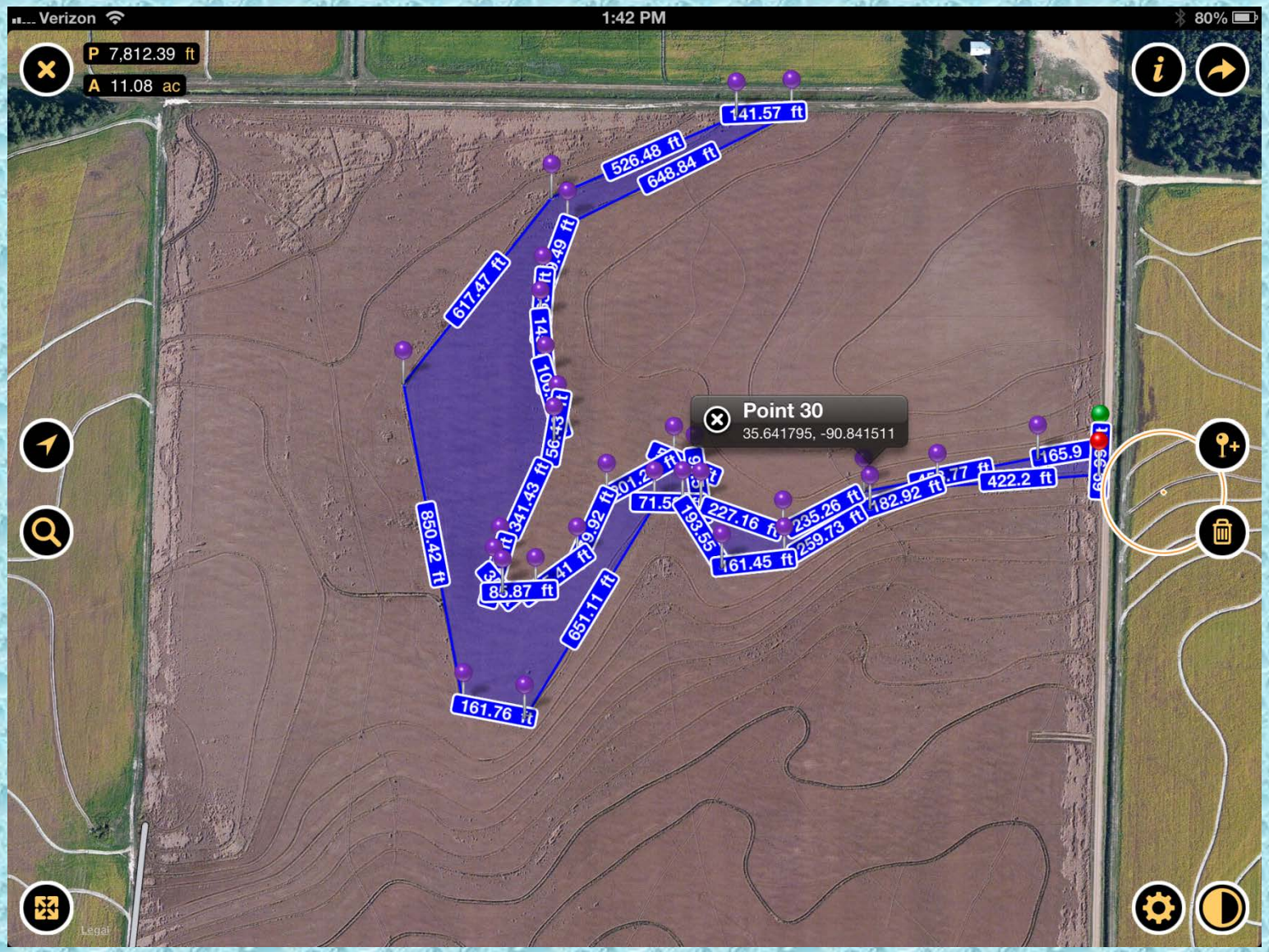
Land Leveling on Sitzer Farm in Poinsett Co.

Multiple Inlet Rice Irrigation



Must have good help

What about a field with contour levees with paddys?


Verizon
1:42 PM
80%
P 7,812.39 ft
A 11.08 ac
141.57 ft
526.48 ft
648.84 ft
617.47 ft
850.42 ft
341.43 ft
85.87 ft
651.11 ft
161.76 ft
Point 30
35.641795, -90.841511
227.16 ft
235.26 ft
259.73 ft
182.92 ft
161.45 ft
422.2 ft
165.9
Legal

2013 RRVT Wimpy Farms

1716 GPM Total used

349 GPM from NE Riser

NE Riser

0.78 - small hole

3.97 - 47.6 GPM
1 Gate - 60% open

5.05 - 60 GPM
1 Gate - 80% open

8.54 - 102 GPM
2 gates
1 - Full open
1 - 40% open

6.87 - 82 GPM
2 Gates
1 - Full
1 - 5% open

4.79 - 57.5 GPM
1 gate - 75% open

SE Riser

6.88 - 82.56 GPM
1 - Full open
1 - 10% open

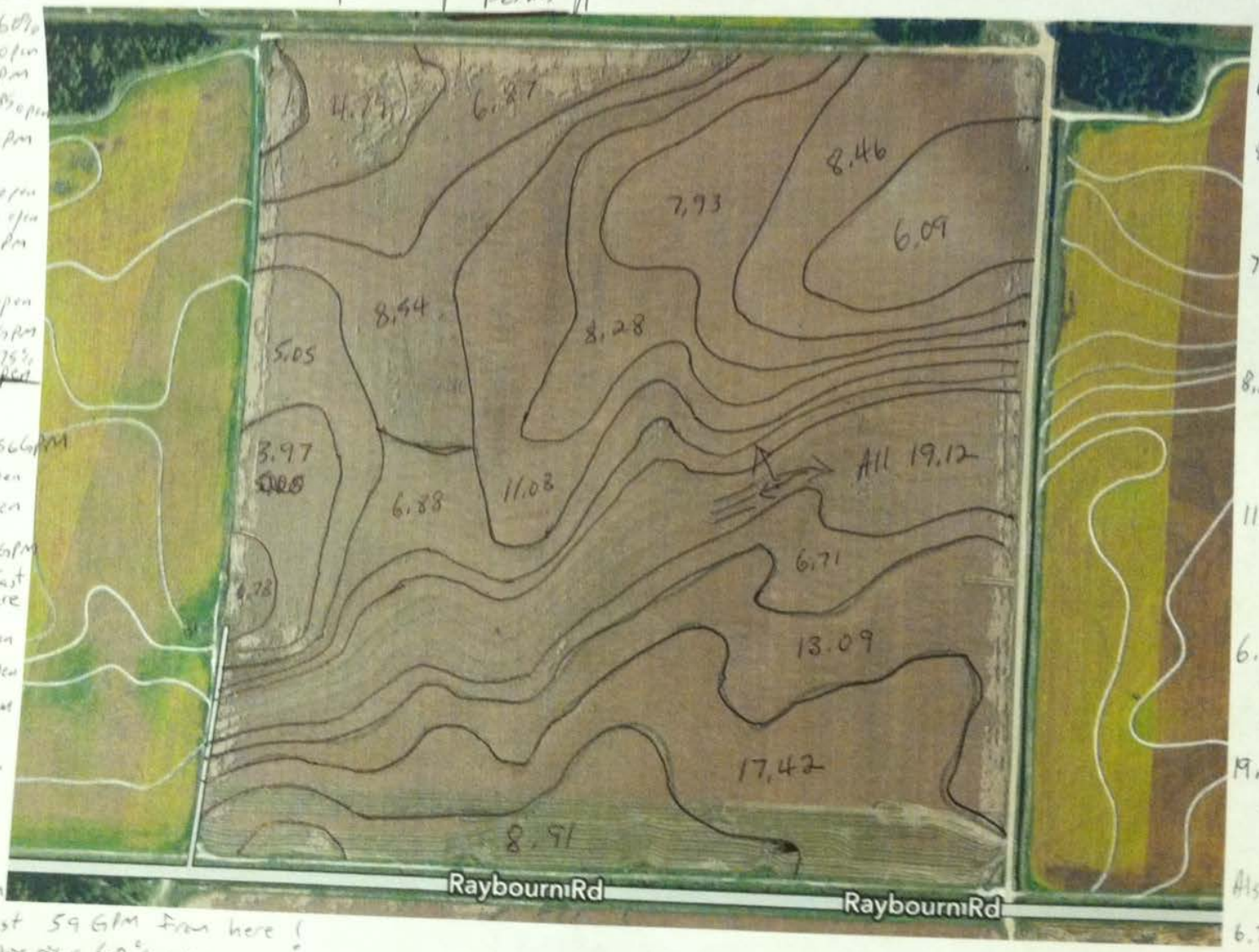
19.12 - 230 GPM
115 from East
115 from Here
2 gates
1 - Full open
1 - 60% open

6.71 - 80.5 GPM
2 gates
1 - Full open
1 - 5% open

13.09 - East!

17.42 - 209 GPM
150 from East 59 GPM from here!
1 - Gate on this riser 60% open

8.91 - 107 GPM
2 gates
1 - Full open & one 1/3 open



East Riser

6.09 - 73 GPM
1 gate Full

8.46 - 101 GPM
2 gates
1 - Full
1 - 1/4 open

7.93 - 95.2 GPM
2 gates
1 - Full
1 - 1/4 open

8.28 - 99 GPM
2 gates
1 - Full
1 - 1/4 open

11.08 - 133 GPM
2 gates
1 - Full
1 - 85% open

6.88 - None
water from S. East Riser

19.12 - 230 GPM
2 gates (115 from this side)
1 - Full
1 - 60 open

Also 2 on SE Riser

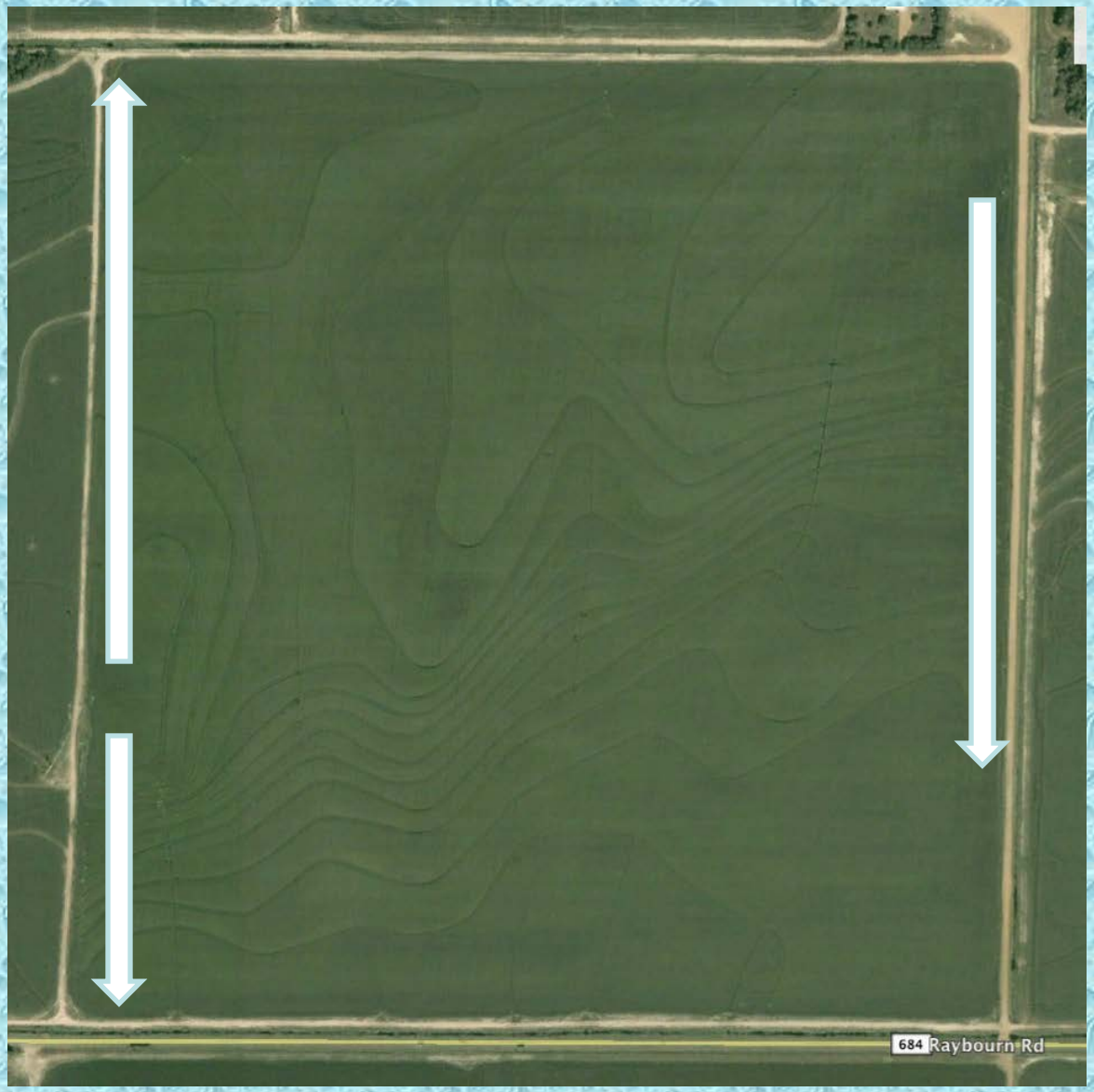
6.71 - do from SE

13.09 - 157 GPM
2 - Full

17.42 - 209 GPM

444 GPM from SE Riser

923 GPM from East Riser



“The Multiple Inlet helped. This is the first year that we was able to irrigate the entire field from the reservoir only.” – Jerry Wimpy, Poinsett Co Farmer

Advantages

- **Reduced our labor needs**
- **Reduced Pumping Cost**
- **Reduced Cold water affects on rice**
- **Shallower flood on the rice reducing stretching**
- **Less waste out the bottom of the field**
- **Uniformly pump up each paddy at the same time**
- **Averaging 25% reduction in pumping costs. Some comparisons showing as much as 44%.**

What are the Negatives?

- **Setup and installation**
- **Collection and Disposal of tubing**
- **Pipe can twist and bust**
- **Animals will sometimes tear the pipe**

"I will not grow rice without multiple inlet irrigation, period. I use it on every acre."- Steve Craig, Poinsett County Farmer

Furrow irrigation of Soybeans

Phaucet or Pipe Planner?

Siphoning Irrigation

Not for EVERY Field!!!

Phaucet Program For Furrow Irrigation

- Helps determine size of holes to punch in tubing

- Pressure

-Change tubing size

-Point rows

- May increase number of rows irrigated in a set

- Should help rows water out more evenly

- **Can help reduce runoff and irrigation pumping time:**
  - **40 hours down to 30**
  - **24 hours down to 18**
  - **36 hours down to 2 sets of 12**

Experience is showing 20% average reduction in irrigation pumping time.

What are the Negatives?

So What?

- If every rice acre had multiple inlet irrigation, we could save 217 billion gallons of water and $18 million, annually. (1 million acres)

- If every irrigated soybean field implemented Phaucet or Pipe Planner, we could save 108 billion gallons of water and save $59.9 million, annually. (2 million acres out of the 3.3 million acres in Arkansas)

Thank You!!!!

Mike Hamilton

East Region Area Workgroup Meeting

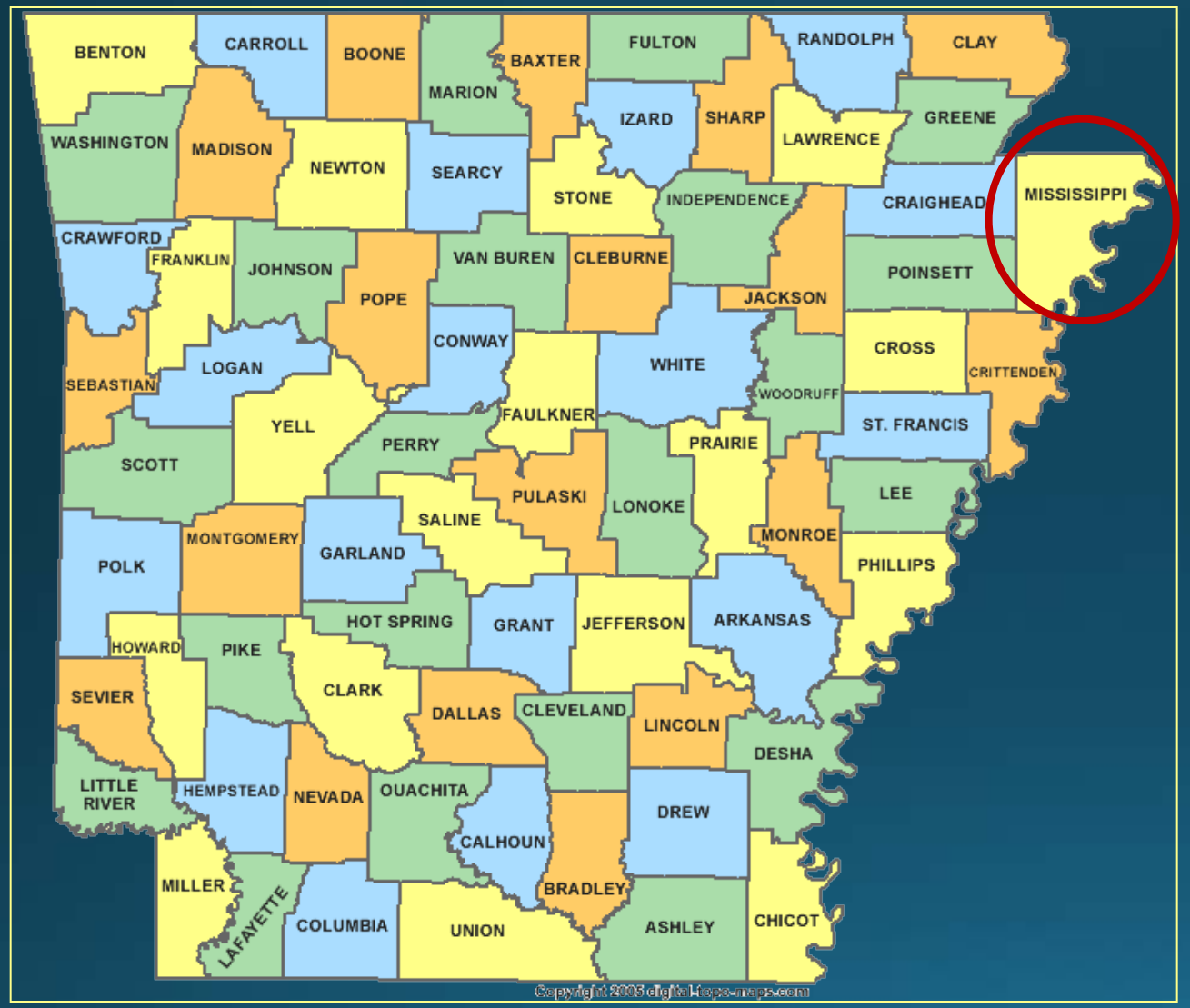
The Arkansas State Water Plan

Water Management in Corn and Cotton

Ray Benson
Mississippi County Extension Service

Overview of topics

- Mississippi County information
- “Common” irrigation practices for corn and cotton in the county
- On-farm programs (last 2 years) devoted to irrigation
- What we see that represent “obstacles” to adopting new irrigation practices



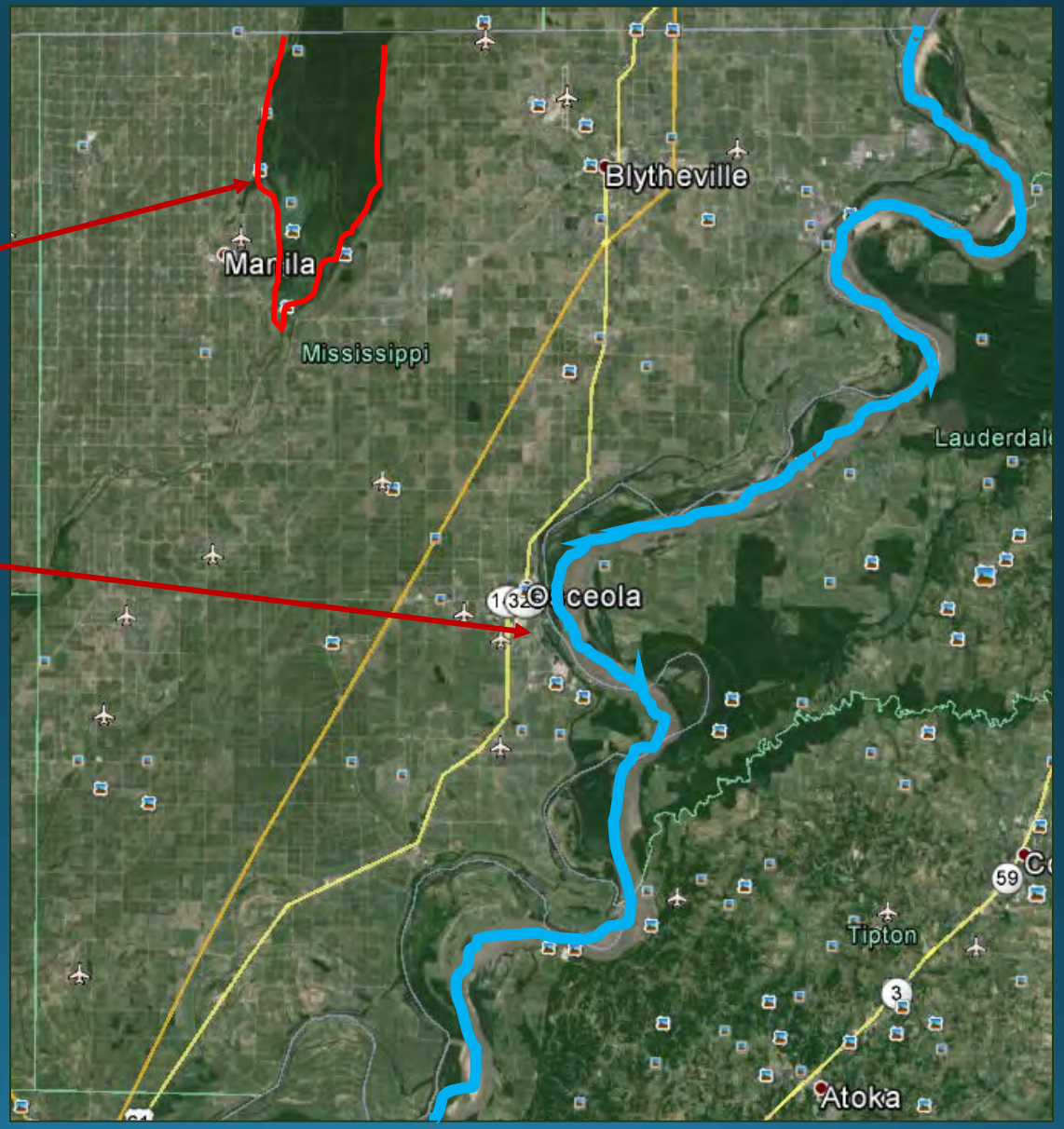
- Over 500,000 acres in production
- 230,000 acres of soybeans (2012)
  - 150,000 irrigated
- 28,000 acres of corn
- 168,000 acres of cotton (2012)
  - 120,000 irrigated

Northeast corner of the state

Big Lake Wild Life Refuge (22,000 Acre)

Eastern border is the Mississippi River

Soil Type ranges from coarse sand to heavy clay.



Common to both corn and cotton

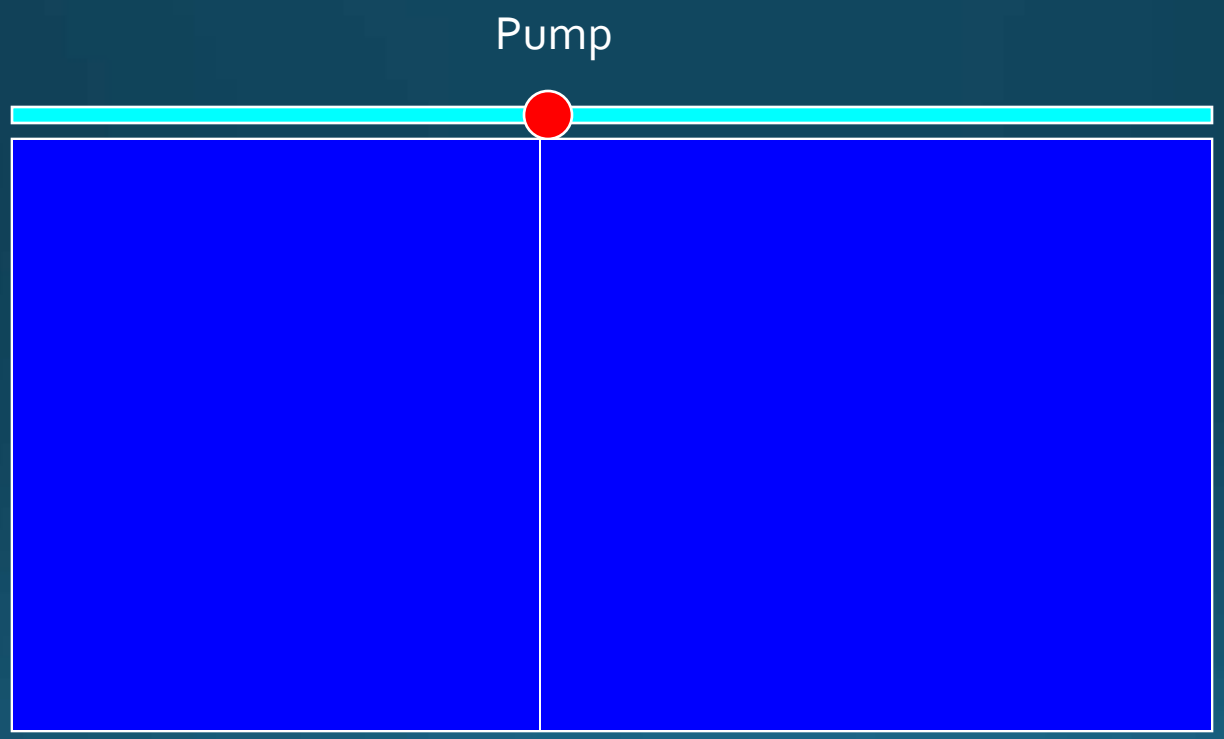
- ✓ Once irrigation starts the “calendar” dictates the schedule
- ✓ Not sure about the effectiveness of our furrow irrigation
- ✓ When to stop irrigation at the end of the season is a guess

County efforts to demonstrate timing, surge valve and termination

Surge Valve Irrigation

- Simple “butterfly” valve
- Electric motor driven
- Powered by battery
- Charge maintained by solar panel

Surge Irrigation



Surge valve demonstrations

- Corn verification
- Cotton Verification
- Stand alone demonstrations
  - Used flow meters to document water use/savings.

Results of 2012 on-farm surge demonstrations

Reduced water use (pumping time) by 30%
ie. 30% more efficient irrigation.

Surge helps eliminate “lower end flooding”

E.T. Gage Demonstrations

- Corn and Cotton Verification
- "Stand alone" demonstrations in cotton

Estimates
EvapoTranspiration and
helps time irrigation

Saturation is based
on first full irrigation
or sufficient rainfall
– the deficit is
"ZERO"

E.T. Gage Demonstrations

At field capacity, the water level in the gage is at “0”

Each day, the water level moves down – away from “0”; more deficit

Once the level in the gage reaches the allowed deficit, start irrigation

Observations using E.T. gage in cotton and corn demonstrations

- Did not alter deficits during the season (introduce the concept)
- Good visual of the “benefits” of rain…how much time did a rain buy
- W/O adjusting for changing crop deficits, save one (maybe 2) irrigations
- Could see additional savings by adjusting growth stage specific deficits
- MUST be able to “estimate” effectiveness of the irrigation/rain

Irrigation Termination

How do I know when to stop irrigating?

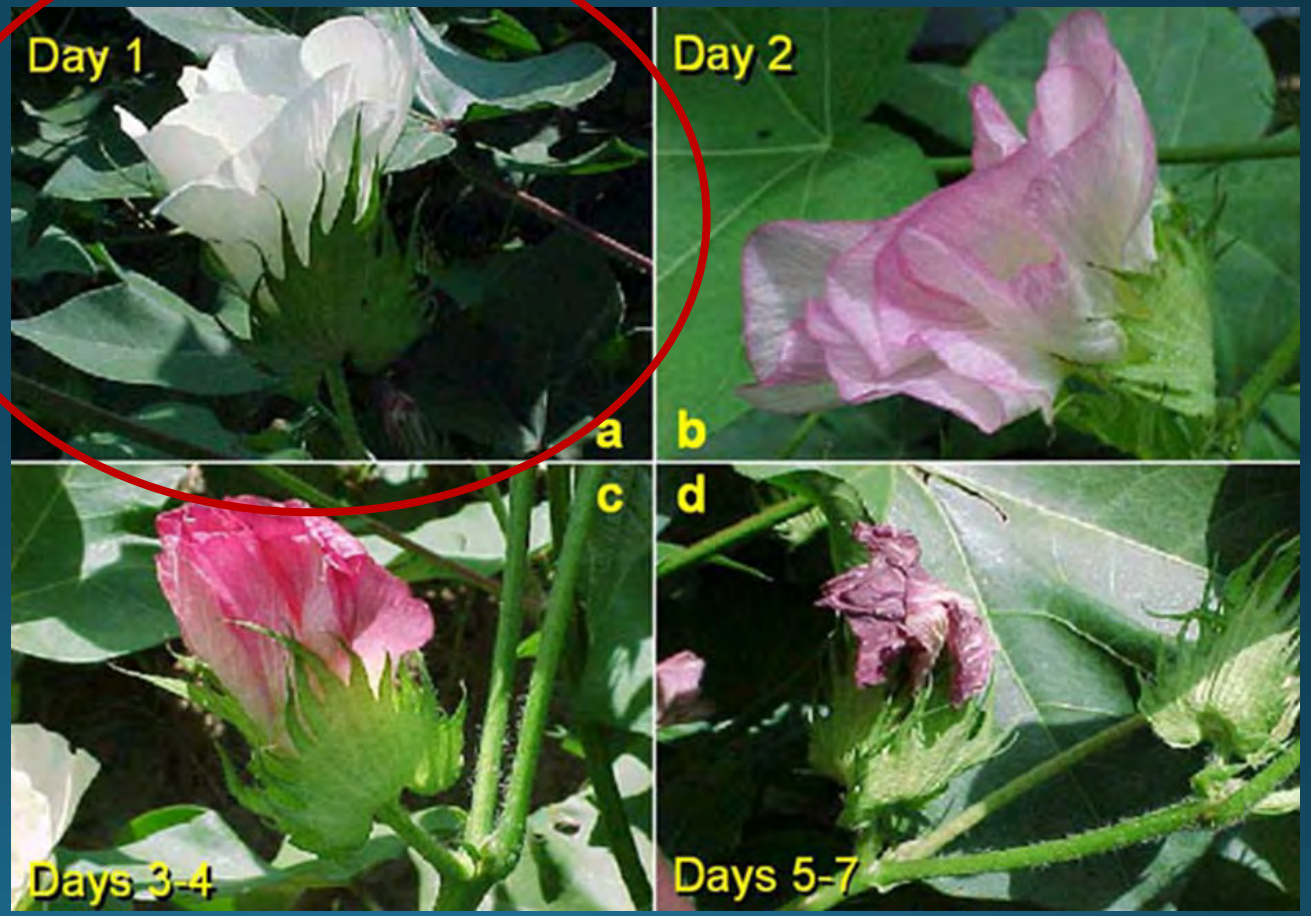
Corn – Irrigation Termination

- • Furrow Irrigation – terminate irrigation when starch line movement is >50% and there is adequate moisture

- • Pivot Irrigation – terminate irrigation when starch line movement is >75% and there is adequate moisture

Cotton – Irrigation Termination

Identify crop maturity
"Cutout"



White Flower development is key to measure the maturity of cotton

Cotton

As the crop matures, the 1st position white flowers “move” closer to the terminal

When the average **N**odes **A**bove **W**hite **F**lower is 5 (**NAWF = 5**) the crop is at cutout.

Field at NAWF = 5

Once a cotton field is at NAWF = 5

Track Heat Units

350 – 450 Heat Units = Stop irrigation

Saves 1 – 2 irrigation

Just completed 3 county irrigation trainings (1/2 day updates)

"Pre-Test" Results

- 100% Concerned about water and think we should do better

- 50 % say they know the flow from their wells
  - ✓ 33% Flow Meter
  - ✓ 44% Well Co information
  - ✓ 22% Best Guess

- How do they time irrigation
  - ✓ 8% Consultants advice
  - ✓ 46% When the field looks dry
  - ✓ 8% Calendar
  - ✓ 8% Crop Condition

Just completed 3 county irrigation trainings (1/2 day updates)

"Pre-Test" Results

When asked about how they determine what size hole to use in irrigation pipe

- 13 % say they use Phaucet program
- 87 % Use a combination of
  - ✓ "poke and hope"
  - ✓ Trial and error
  - ✓ Experience

What we are seeing as obstacles & some “misleading” information about irrigation

- When in doubt, water one more time
- Timing based on calendar is convenient
- Many irrigation decisions are based on consultant recommendations
- Cost of equipment (surge, flow meters, E.T. Gage)
- Time – to set up the equipment

- All irrigations are not 100% based on the idea of crop water needs
  - ✓ Activate herbicide
  - ✓ Fertilizer

Changing Irrigation Practices = a Daunting Challenge

But….
If we don’t back down from the task, we can accomplish positive results