



EXTENSION

How to Grow 200 Bushel Sorghum with Less Water

CHUCK BURR

NEBRASKA EXTENSION EDUCATOR - WCREC

Limited Water – Rainfed Principles

- Demonstration at Monsanto's Water Utilization Learning Center near Gothenburg, NE
- Summer of 2012
- Side by side comparisons

Drought Management Demonstration



- Yield = 6.2 bu/ac
- Conventional Tillage
- 1" planting depth (too shallow)
- Poor Weed Control (Roundup on 20" weeds)
- Poor Hybrid for Drought Conditions
- No Insect Trait Technology
- Not a Genuity DroughtGard Hybrid



- Yield = 53 bu/ac
- No-Till (regulated)
- 2 inch Planting Depth
- Poor Weed Control (Roundup on 20" weeds)
- Poor Hybrid for Drought Conditions
- No Insect Trait Technology
- Not a Genuity DroughtGard Hybrid



- Yield = 95 bushels/ac
- No-Till
- 2 inch Planting Depth
- Residual Herbicide + Roundup Burndown
- Poor Hybrid for Drought Conditions
- No Insect Trait Technology
- Not a Genuity DroughtGard Hybrid



- Yield = 92 bushels/acre
- No-Till
- 2 inch Planting Depth
- Residual Herbicide + Roundup Burndown
- Proper Hybrid for Drought Conditions
- No Insect Trait Technology
- Not a Genuity DroughtGard Hybrid



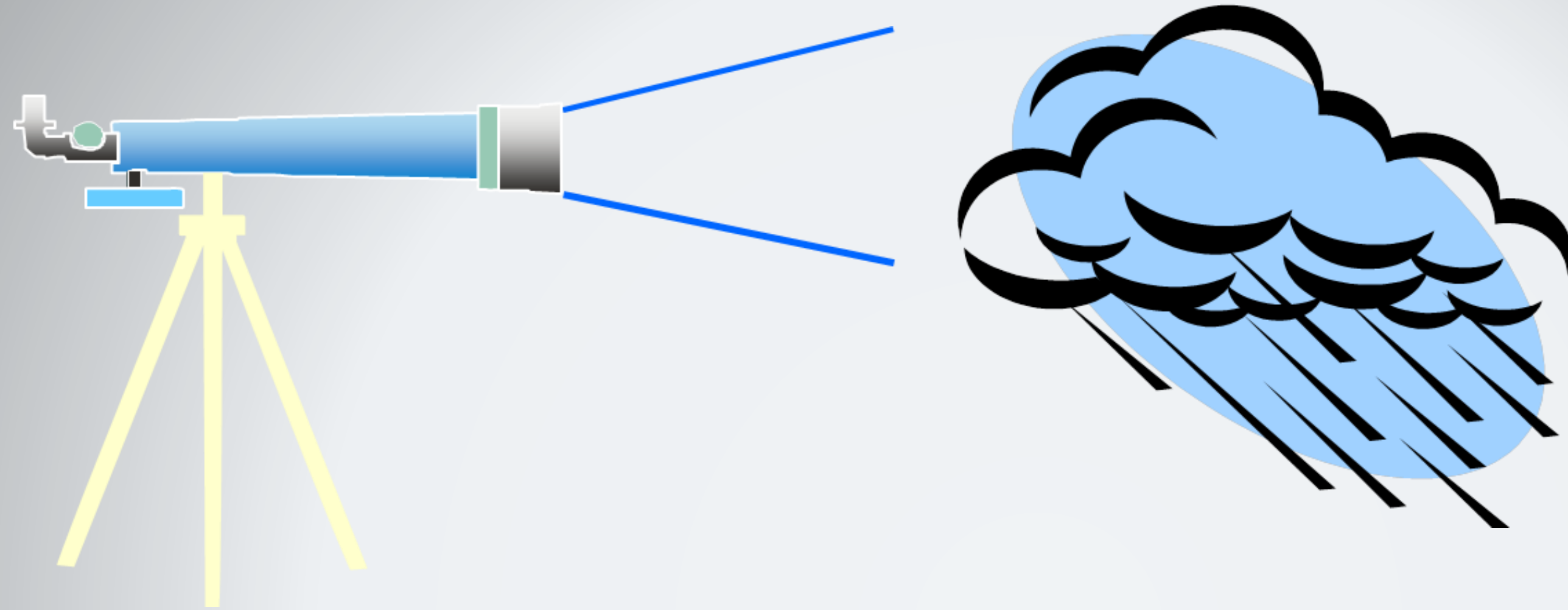
- Yield = 109 bushels/acre
- No-Till
- 2 inch Planting Depth
- Residual Herbicide + Roundup Burndown
- Proper Hybrid for Drought Conditions
- Insect Trait Technology YieldGard VT2
- Not a Genuity DroughtGard Hybrid



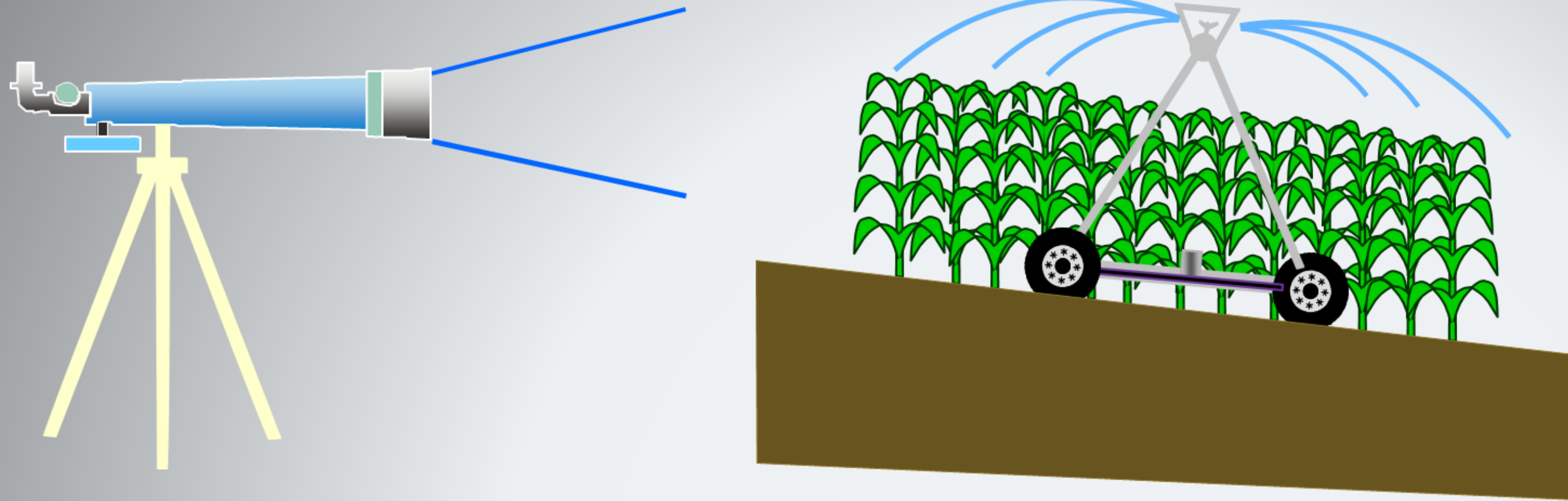
- Yield = 121 bushels/acre
- No-Till
- 2 inch Planting Depth
- Residual Herbicide + Roundup Burndown
- Proper Hybrid for Drought Conditions
- Insect Trait Technology YieldGard VT3
- Genuity DroughtGard Hybrid

Strategies to Maintain Yield with Limited Water

- Use efficient irrigation system – application efficiency
- Increase water use efficiency
- Limit evaporation
- Reduce non-yield producing transpiration
- Select hybrid with high water use efficiency and drought tolerance

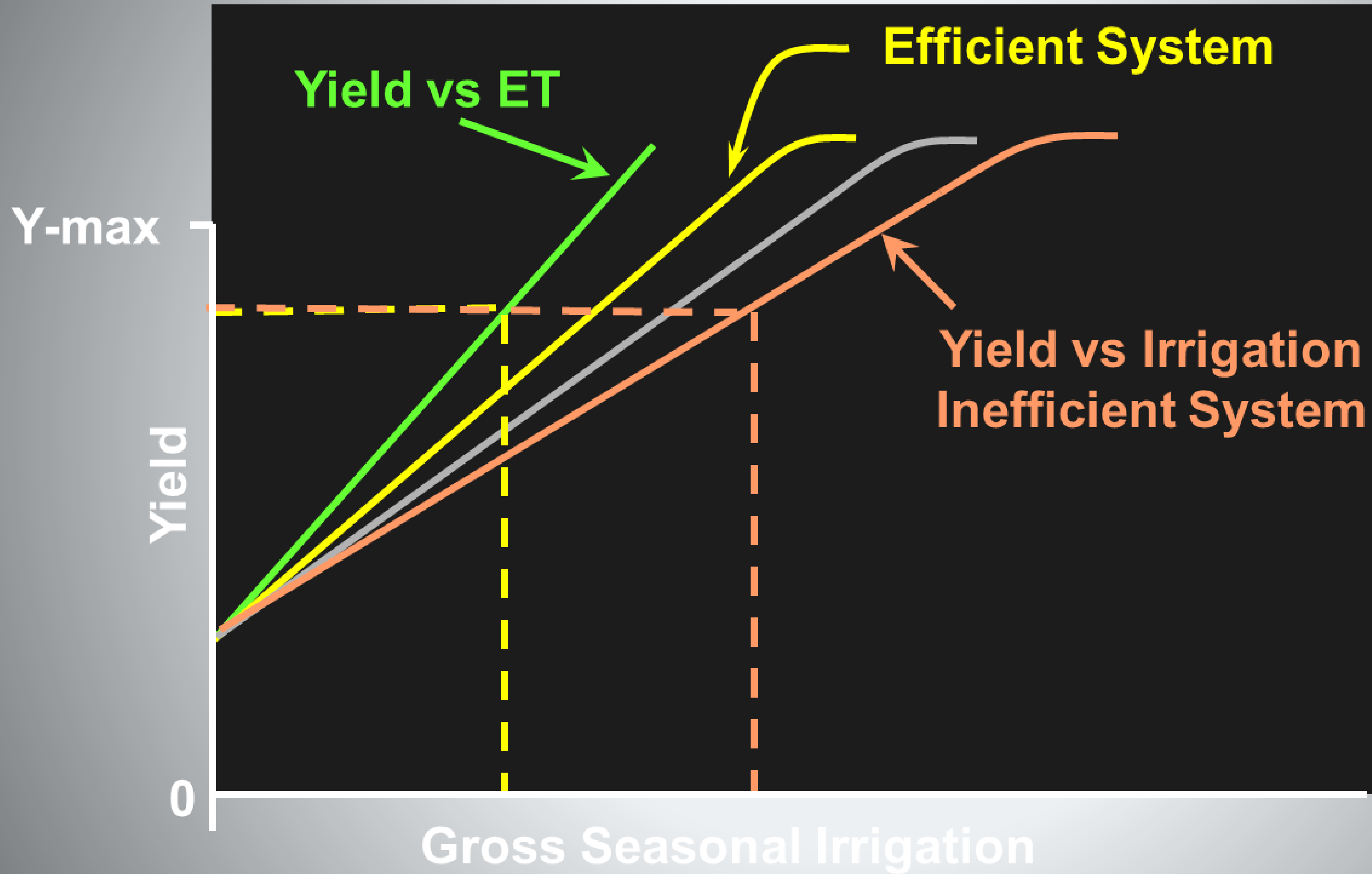


- Increase Water Use Efficiency
- Make best use of rainfall
- Application Timing
- Soil sensors for first application
- Schedule last irrigation



- Use Efficient Irrigation Method
- Maintain Irrigation Equipment
- Check Pressure Regulators and Nozzles
- Apply Water Uniformly

Yield vs Irrigation



Efficient Irrigation Application

- Properly designed sprinkler system
 - Nozzles selected – uniform application
 - Minimal runoff
- Apply larger irrigation amounts
 - 0.10 hangs up in canopy and evaporates
 - 0.5 inch application – 0.4 (80%) stored
 - 1.5 inch application – 1.4 (93%) stored

Uniform Application?



LIMITED CAPACITY?



Problem is likely due to matching of pump, well and power unit to center pivot needs.

Operating Pressure Does Not Match System Needs



PRESSURE LOSS
IN REGULATOR
IS ABOUT 5 PSI

NEED PRESSURE GAGE AT END OF LATERAL

- MEASURE PRESSURE AT END OF CENTER PIVOT PIPELINE AT HIGHEST POINT IN FIELD.
- PRESSURE ABOVE REGULATOR SHOULD BE AT LEAST 5 PSI ABOVE REGULATOR RATING

Uniform Application?

YIELD DECREASES LIKELY OTHER YEARS, JUST LESS VISIBLE THAN IN 2012

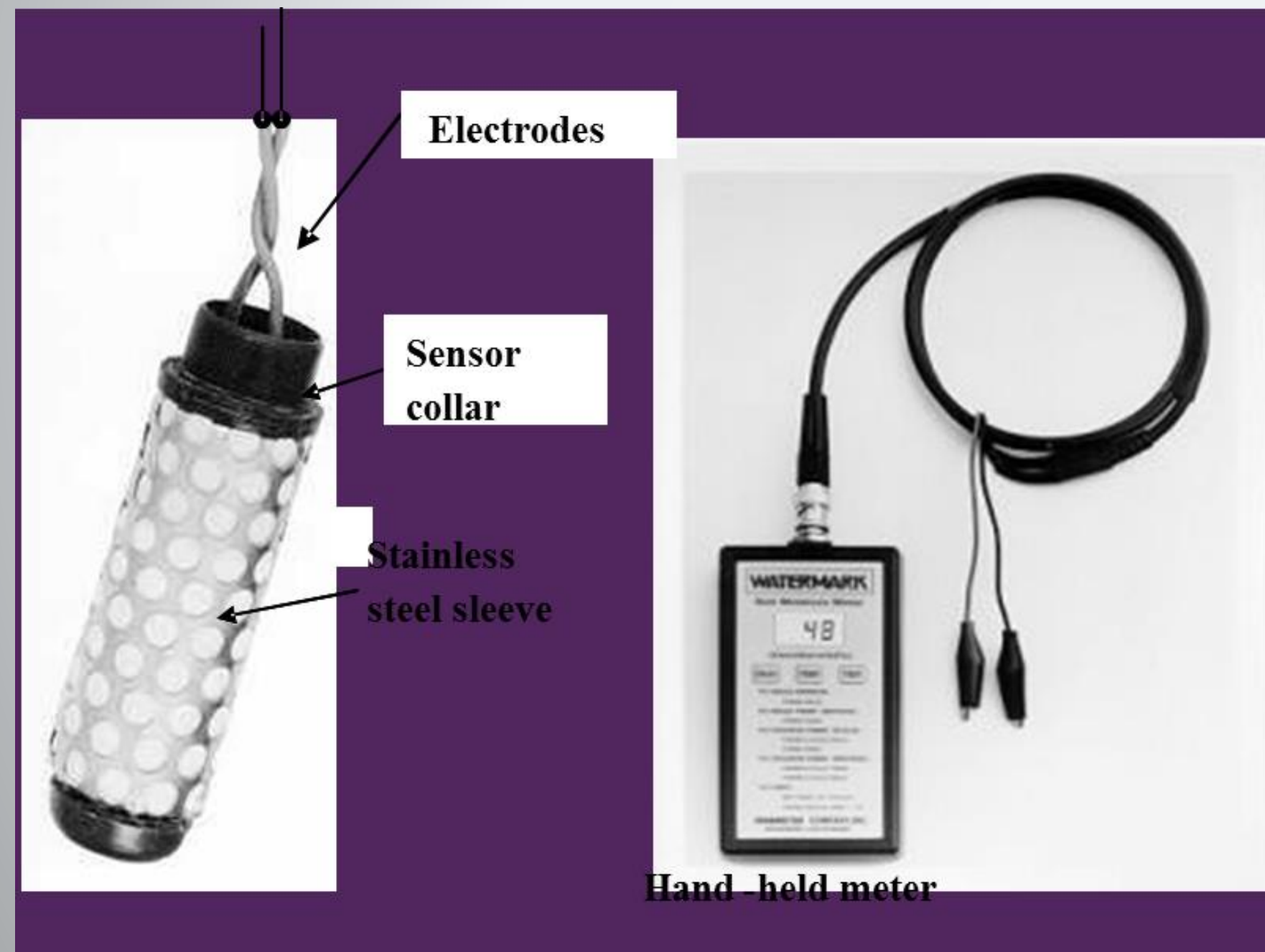
NEW NOZZLES AND REGULATORS COST APPROXIMATELY \$3,000

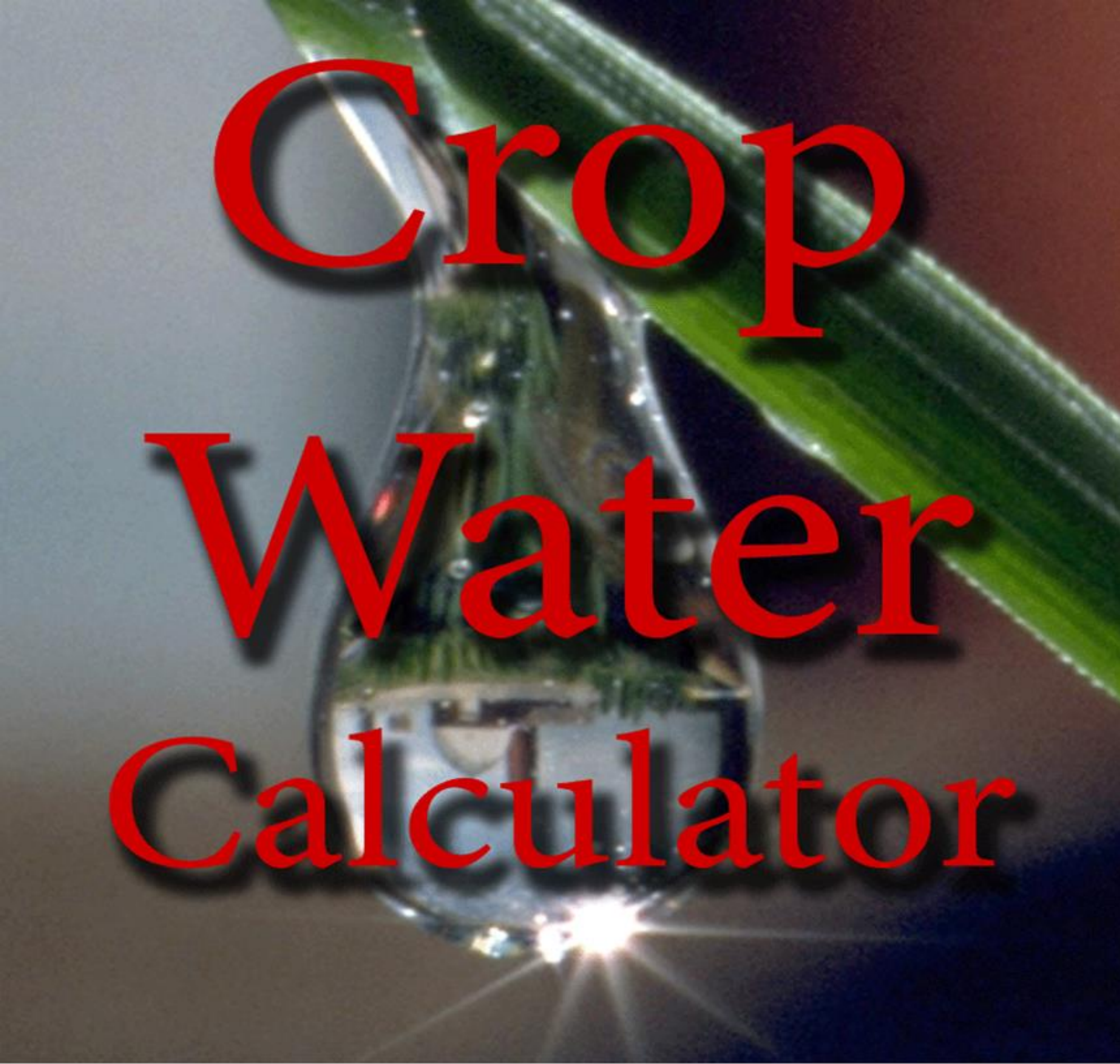
COST OF YIELD REDUCTION FOR POOR UNIFORMITY CAN BE MUCH LARGER

PROBLEMS NOT ALWAYS SPRINKLERS, PUMPING PROBLEMS COMMON

Monitor Soil Moisture

- Watermark Soil
- Moisture Sensors





Crop Water Calculator

UNIVERSITY OF
Nebraska
Lincoln[®] | EXTENSION



Crop Water App

- Free App
- Available for Apple and Android platforms
- Developed at the request of NAWMN
- Provides an easy way to estimate soil water status
- Will estimate water used as well as water available
- Log readings over time



Crop Water 4+

The University of Nebraska - Lincoln >

No Ratings

+ OPEN

Details

Reviews

Related

The screenshots show the app's data entry and calculation process. The first screen is titled 'Data Entry' and includes sections for 'FIELD INFORMATION' (with a date field set to 8/10/14), 'SOIL TEXTURE' (set to Silty clay loam), 'WATERMARK SENSOR' (with a number of sensors field set to 2), and 'ALLOWABLE WATER DEPLETION (%)' (with a slider set to 60%). The second screen shows the 'LAST IRRIGATION' section with crop type 'Corn' and growth stage 'RS - 1/2 Milk Line - Full Dent'. Below this is a 'Calculate' button and a 'Results for Silty clay loam' section showing 'Calculations Output' with values for water depleted (1.11 inches) and water available (0.89 inches). The third screen shows a list of field names: NAME1 (8/10/14), NAME22 (7/28/14), name22 (7/28/14), and name22 (6/9/14).

Description


The Crop Water App was developed at the request of Nebraska Agricultural Water Management Network (NAWMN) participants. This app provides an easy way to estimate soil water status based on Watermark

iPad 9:52 AM 30%

Data Entry

FIELD INFORMATION

Enter Field Name: 6/22/14

GPS Coordinates 

SOIL TEXTURE

Sandy loam

Available Water at 100% Capacity (in./ft.): 1.4'

WATERMARK SENSOR

Number of sensors:

2 3 4

Input Watermark Reading

1-foot depth 2-foot depth 3-foot depth 4-foot depth

ALLOWABLE WATER DEPLETION (%)


60% 50% 40% 30% 20%


As a rule of thumb, during the vegetative and early reproductive stages a 50% allowable water depletion is used to avoid yield loss. At crop maturity, a 60% allowable water depletion has been shown to not reduce yields.


DO YOU WANT TO ENTER LAST IRRIGATION INFO?

Yes No

Calculate

 Data Entry

 History

 Graphs

CropWater

- Enter Field Information
- Soil Texture
- Number of Sensors
- Allowable Water Depletion


CropWater

iPad 9:52 AM 30%

Data Entry

FIELD INFORMATION

East Quarter 6/22/14

GPS Coordinates 

SOIL TEXTURE

Sandy loam

Available Water at 100% Capacity (in./ft.): 1.4'

WATERMARK SENSOR

Number of sensors:

2 3 4

Input Watermark Reading

23 14 16 11


ALLOWABLE WATER DEPLETION (%)

60% 50% 40% 30% 20%

As a rule of thumb, during the vegetative and early reproductive stages a 50% allowable water depletion is used to avoid yield loss. At crop maturity, a 60% allowable water depletion has been shown to not reduce yields.

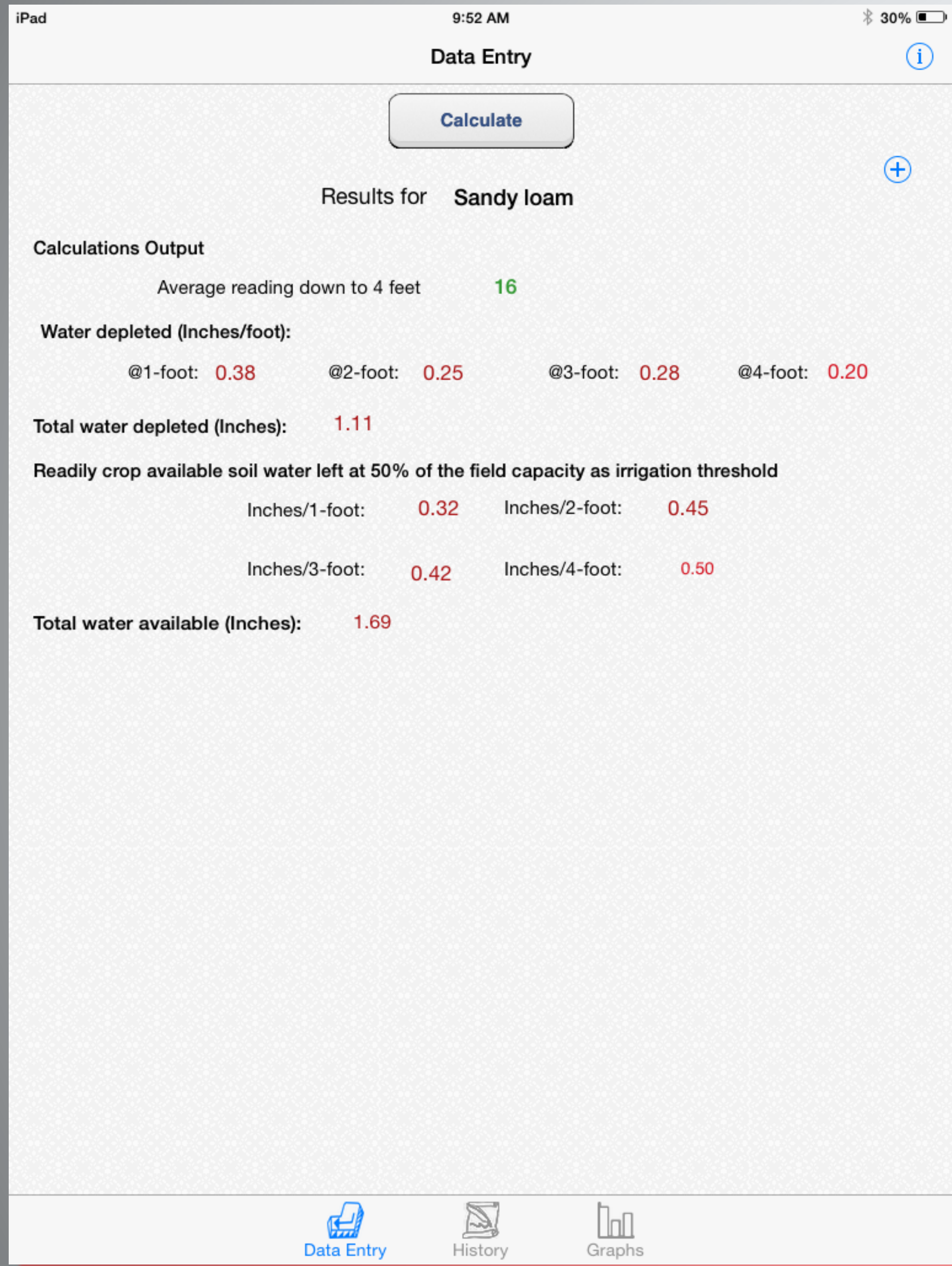
DO YOU WANT TO ENTER LAST IRRIGATION INFO?

Yes No

Calculate 

Data Entry History Graphs

- Data filled in
- Ability to push arrow button to add GPS coordinates
- Click on "Calculate" button



CropWater

- Calculate average reading down to 4 feet
- Water depleted in inches/foot
- Calculate water depleted in soil profile
- Also displays total water available

CropWater

iPad 9:53 AM 30%

Data Entry ⓘ

Calculate

Results for Sandy loam

Calculations Output

Average reading down to 4 feet 16

Water depleted (Inches/foot):

@1-foot: 0.38 @2-foot: 0.25 @3-foot: 0.28 @4-foot: 0.20

Total water depleted (Inches): 1.11

Readily crop available soil water left at 50% of the field capacity as irrigation threshold

Inches/1-foot: 0.32 Inches/2-foot: 0.45

Inches/3-foot: 0.40 Inches/4-foot: 0.50

Total water available (Inches):

Warning
Do you want to add this data to history?

Cancel OK

Data Entry History Graphs

iPad 9:56 AM 29%

Edit

EAST QUARTER

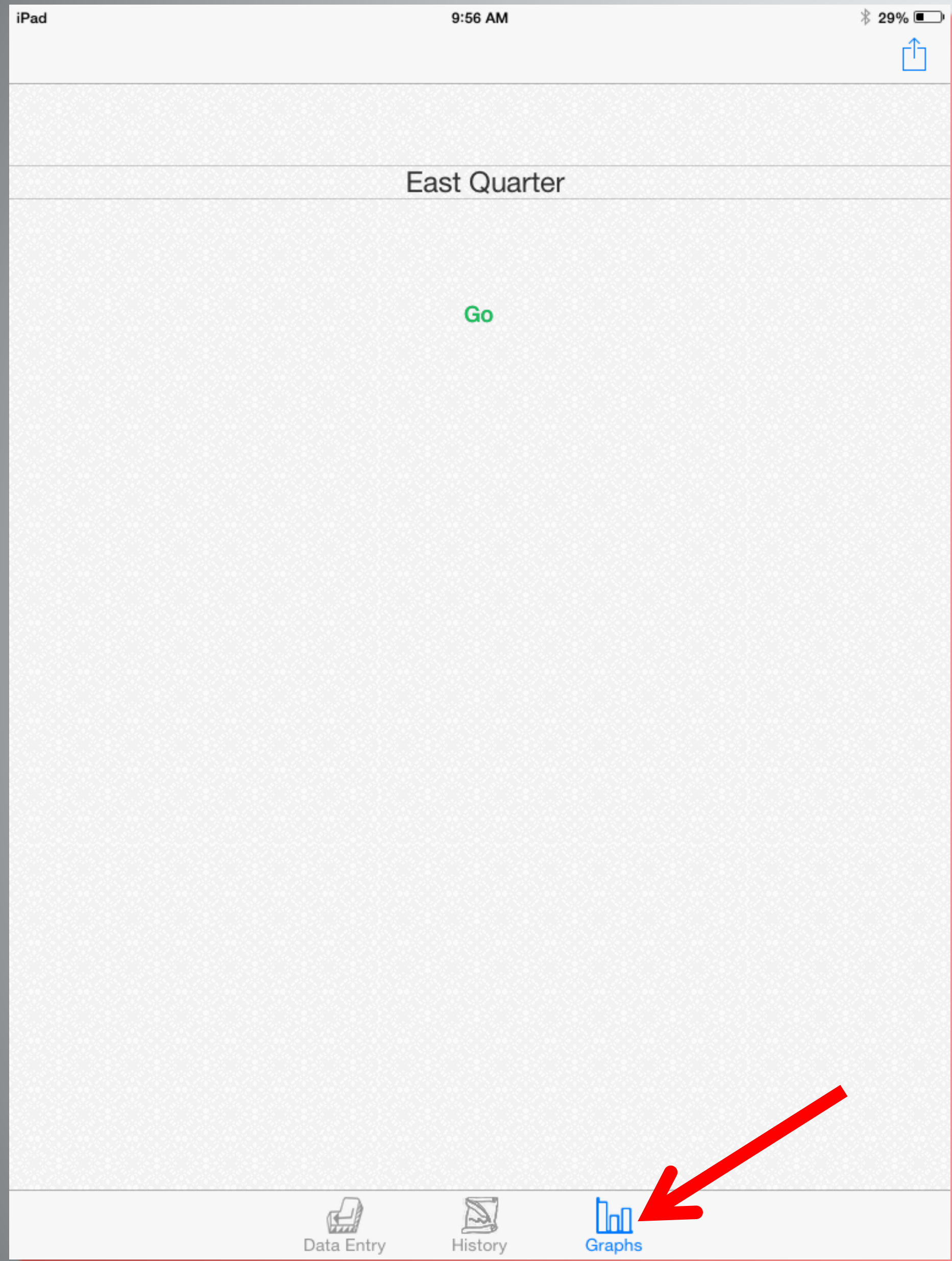
East Quarter 8/18/14 >

East Quarter 7/29/14 >

East Quarter 7/8/14 >

East Quarter 6/22/14 >

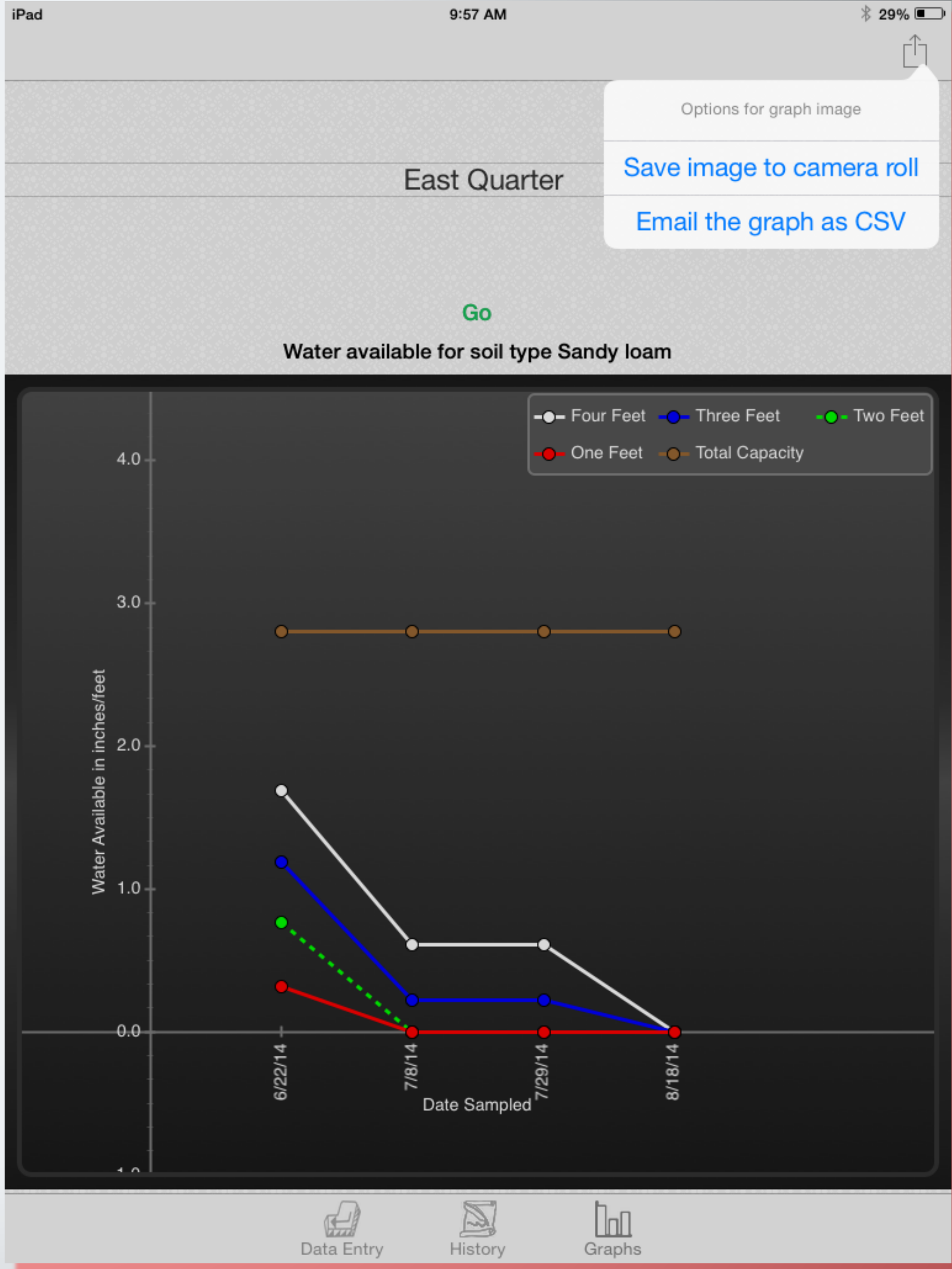
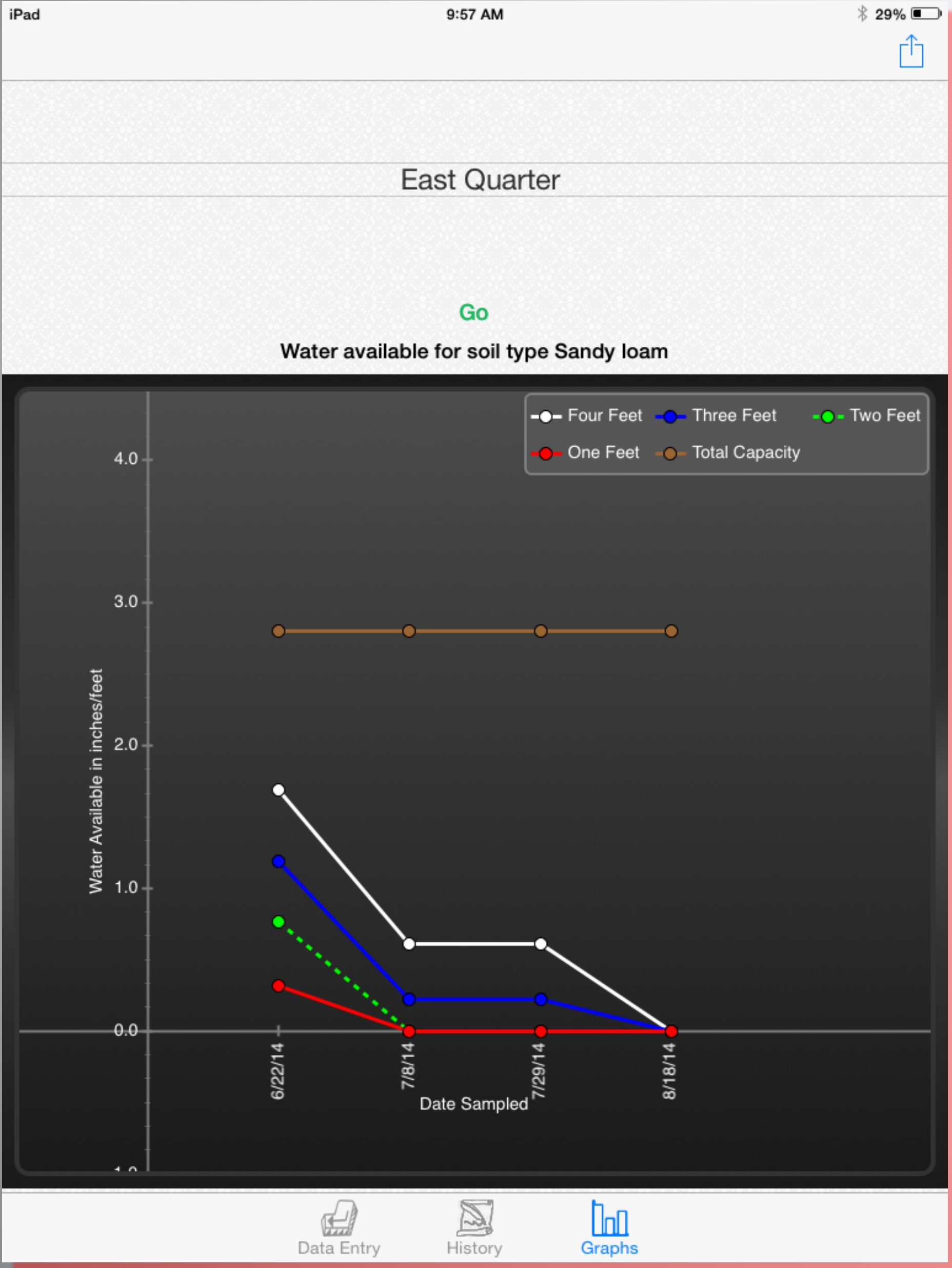
Data Entry History Graphs



CropWater

- Log the data that you input throughout the year

CropWater



Schedule the Last Irrigation

NEBGUIDE 1871, PREDICTING THE LAST IRRIGATION OF THE SEASON

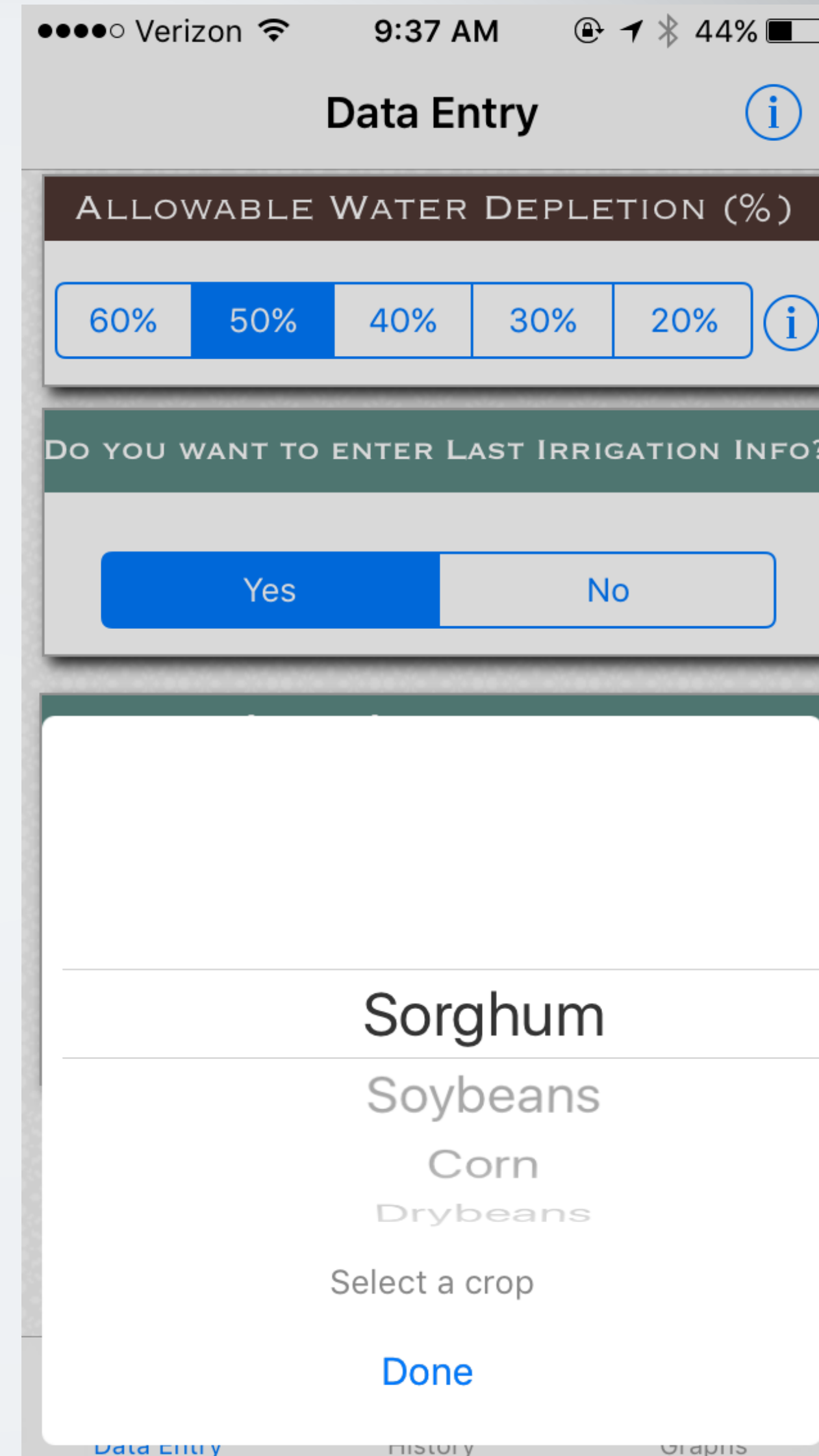
- * DRY DOWN PROFILE AT END OF SEASON
- * ALLOWS FOR STORAGE OF OFF-SEASON PRECIPITATION
- * CALCULATE HOW MUCH USEABLE WATER IN SOIL
- * COMPARE TO HOW MUCH CROP WILL USE TO MATURITY

Water/Days to Reach Maturity - Sorghum

Stage	Growth Stage	Days to Maturity	Water Use to Maturity
Stage 6	Half Bloom	34	9.0
Stage 7	Soft Dough	23	5.0
Stage 8	Hard Dough	12	2.0
Stage 9	Physiological Maturity	0	0

CropWater

- Schedule last irrigation



CropWater

Verizon 9:37 AM 44%

Data Entry

ALLOWABLE WATER DEPLETION (%)

60% 50% 40% 30% 20%

DO YOU WANT TO ENTER LAST IRRIGATION INFO?

Yes No

Stage 6 - Half Bloom
Stage 7 - Soft Dough
Stage 8 - Hard Dough
Stage 9 - Physiological Maturity

Select Crop Growth Stage

Done

Verizon 9:37 AM 44%

Data Entry

ALLOWABLE WATER DEPLETION (%)

60% 50% 40% 30% 20%

DO YOU WANT TO ENTER LAST IRRIGATION INFO?

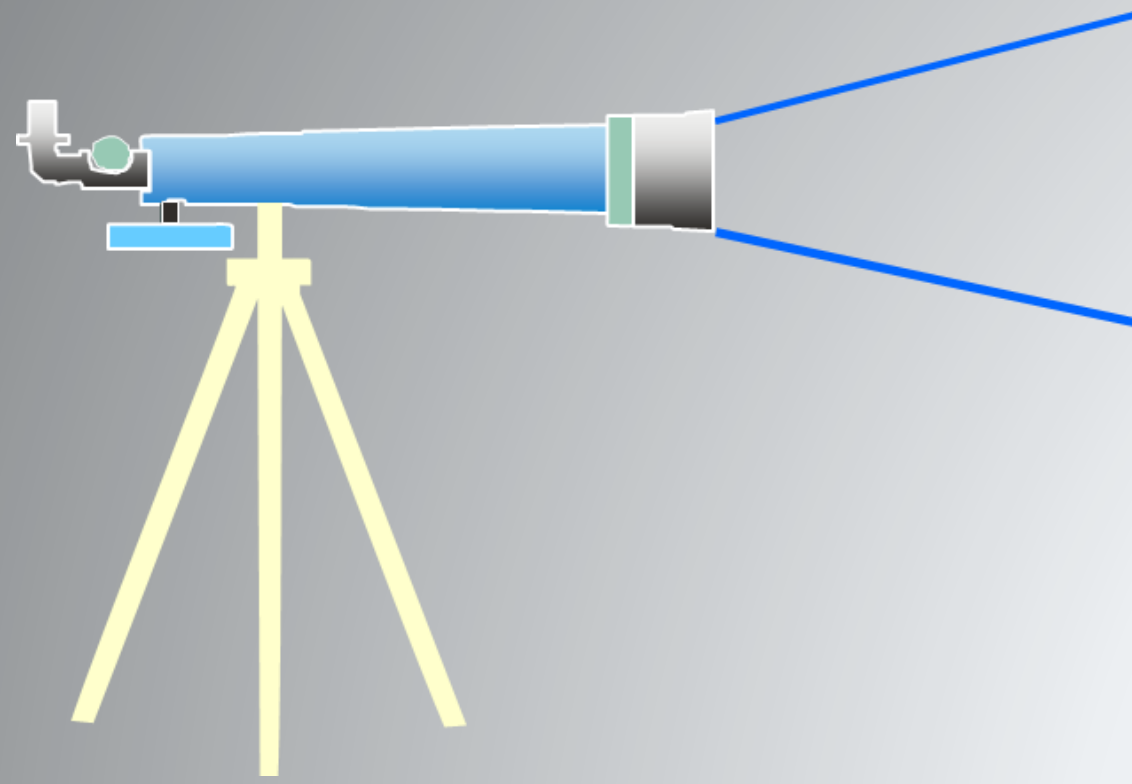
Yes No

LAST IRRIGATION

Sorghum	Stage 7 - Soft Dough
Approx. Days to Maturity:	23
Predicted Maturity Date:	2/13/...
Water requirement (In.):	5

Calculate

Data Entry History Graphs

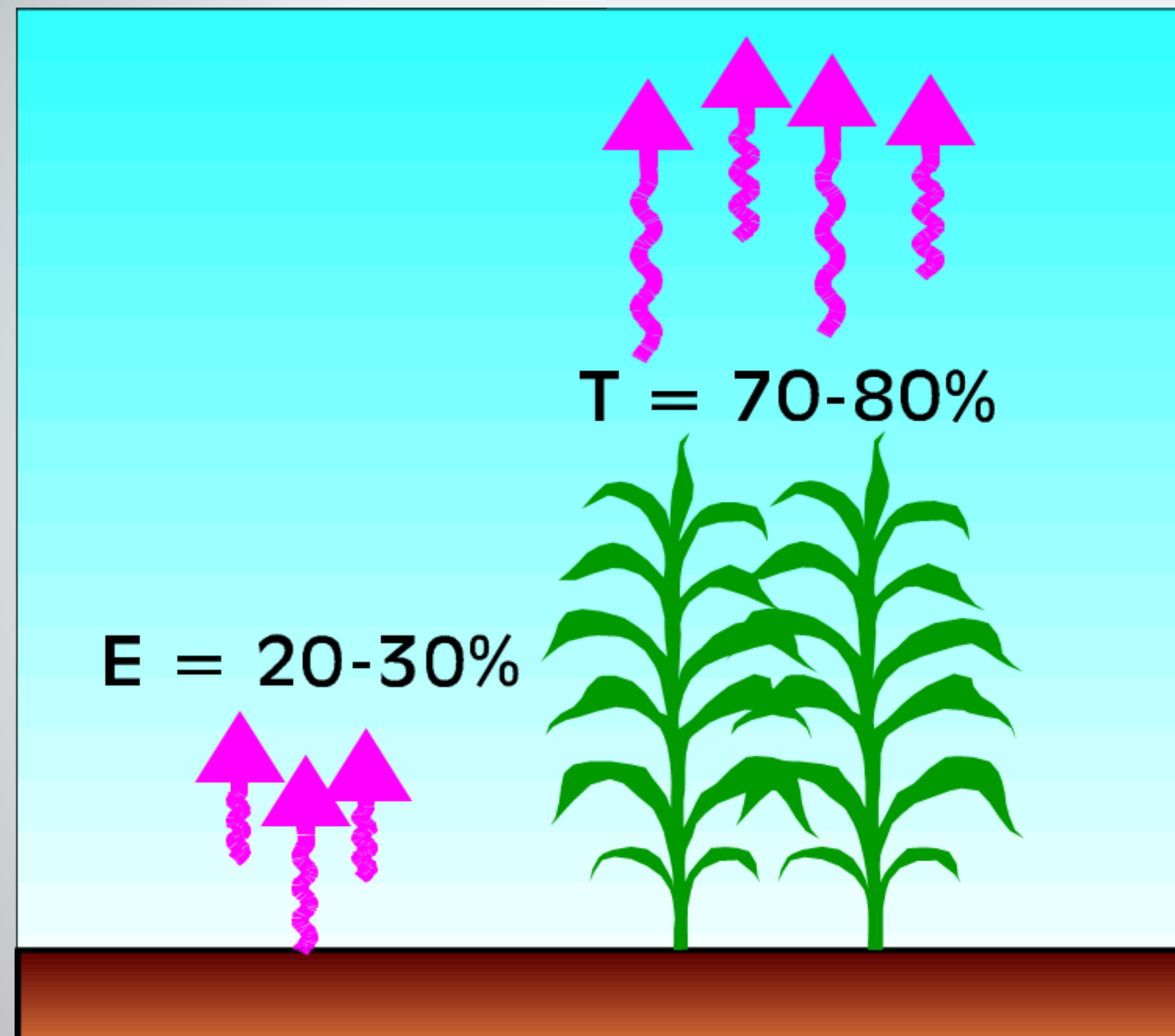


Water Conservation

REDUCE ET BY:

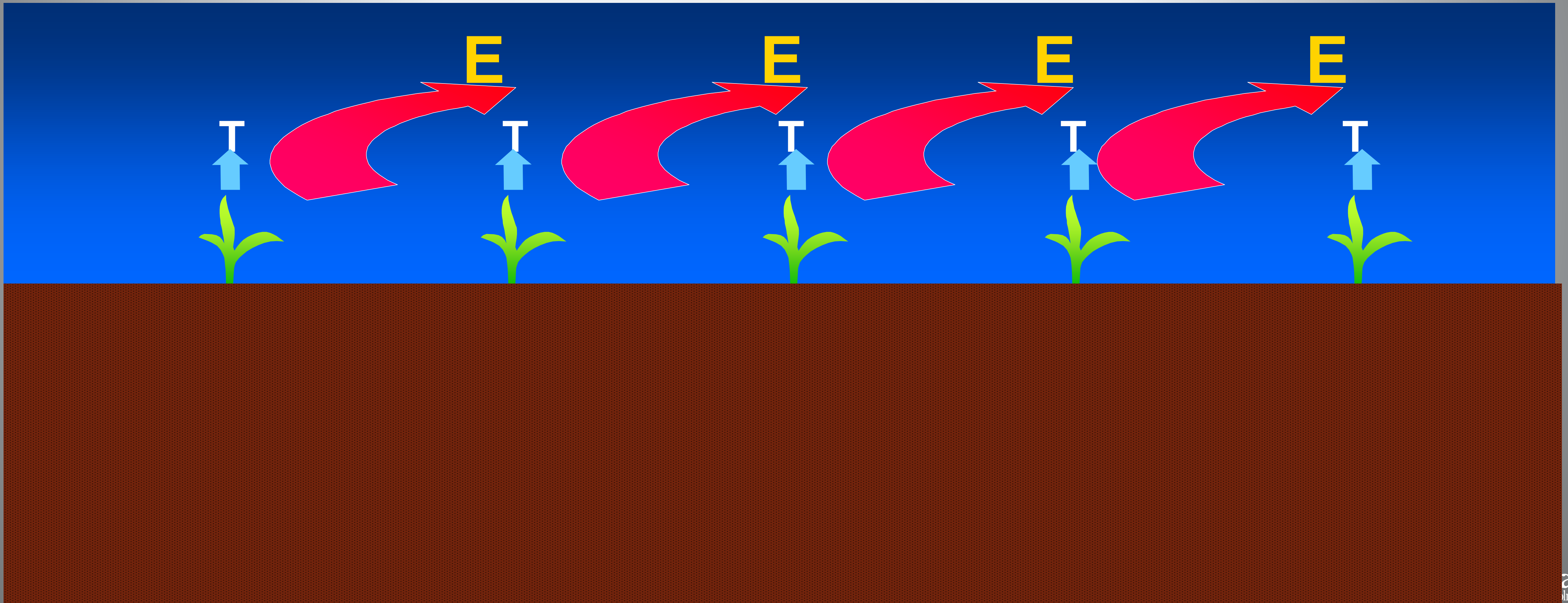
- *REDUCING TRANSPIRATION
- *REDUCING SOIL EVAPORATION

Evapotranspiration (ET)



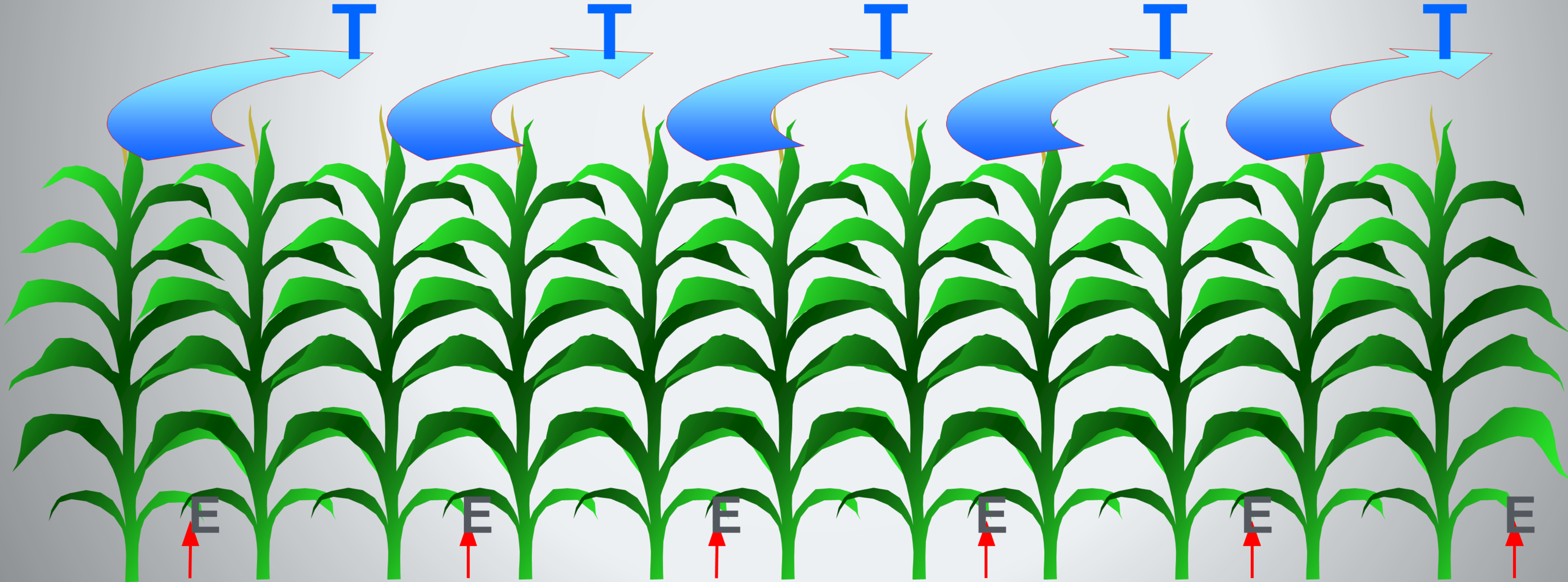
ET = EVAPORATION + TRANSPIRATION

When the crop is small,
almost all ET is EVAPORATION



WHEN THE CROP FULLY SHADES THE GROUND,

90 - 98% OF ET IS TRANSPIRATION



REDUCE SOIL EVAPORATION

NO-TILL SYSTEMS LEAVE RESIDUE COVER ON SOIL SURFACE
SHIELDS SURFACE FROM ENERGY FROM SUN
REDUCES AIR MOVEMENT ABOVE SOIL SURFACE

Effect of crop residue on evaporation and crop yield

REDUCED TILLAGE WITH MORE CROP RESIDUE CONSERVES WATER, BUT HOW MUCH WATER IS NOT CLEAR

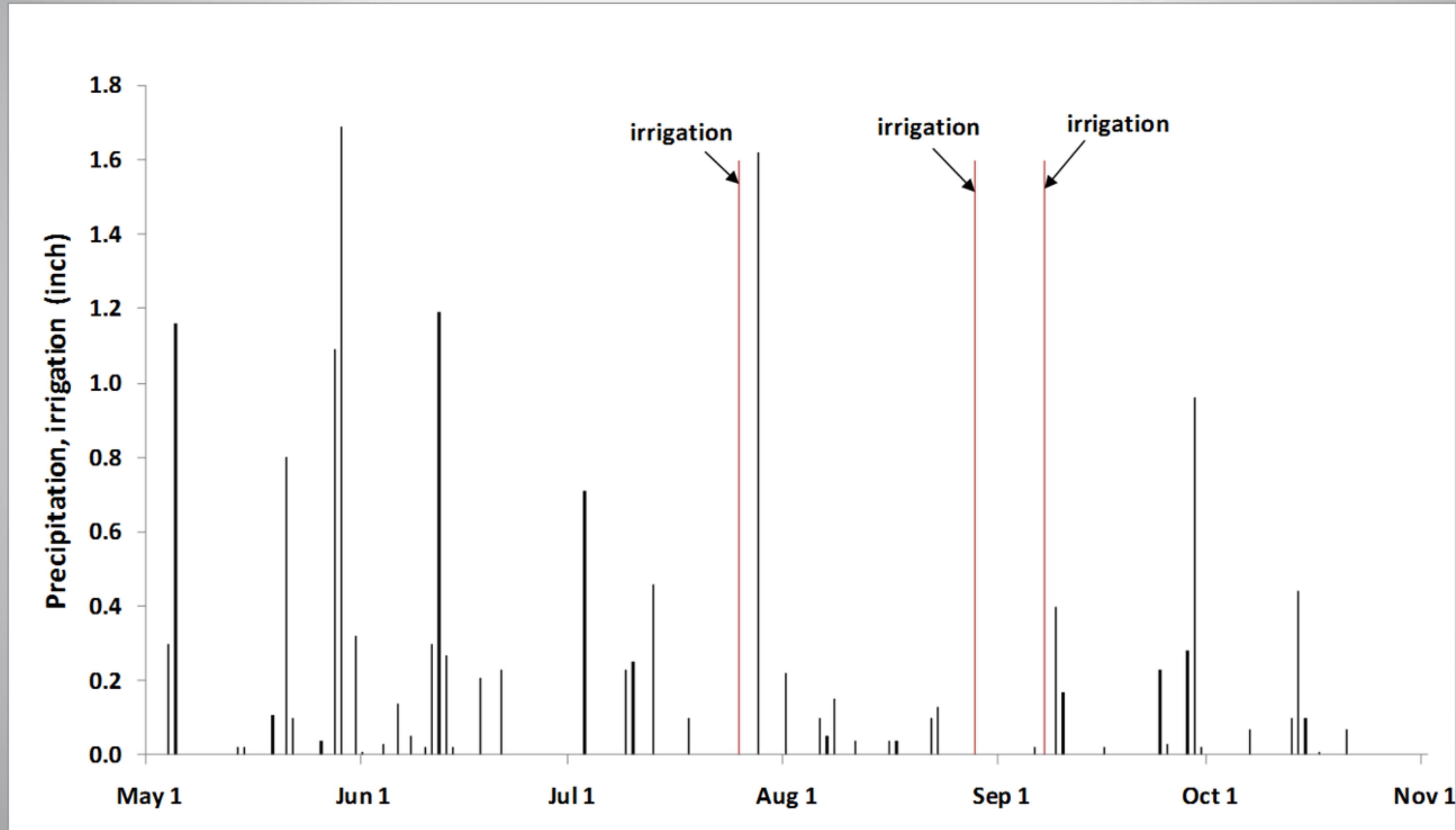


SIMON VON DONK, WCREC

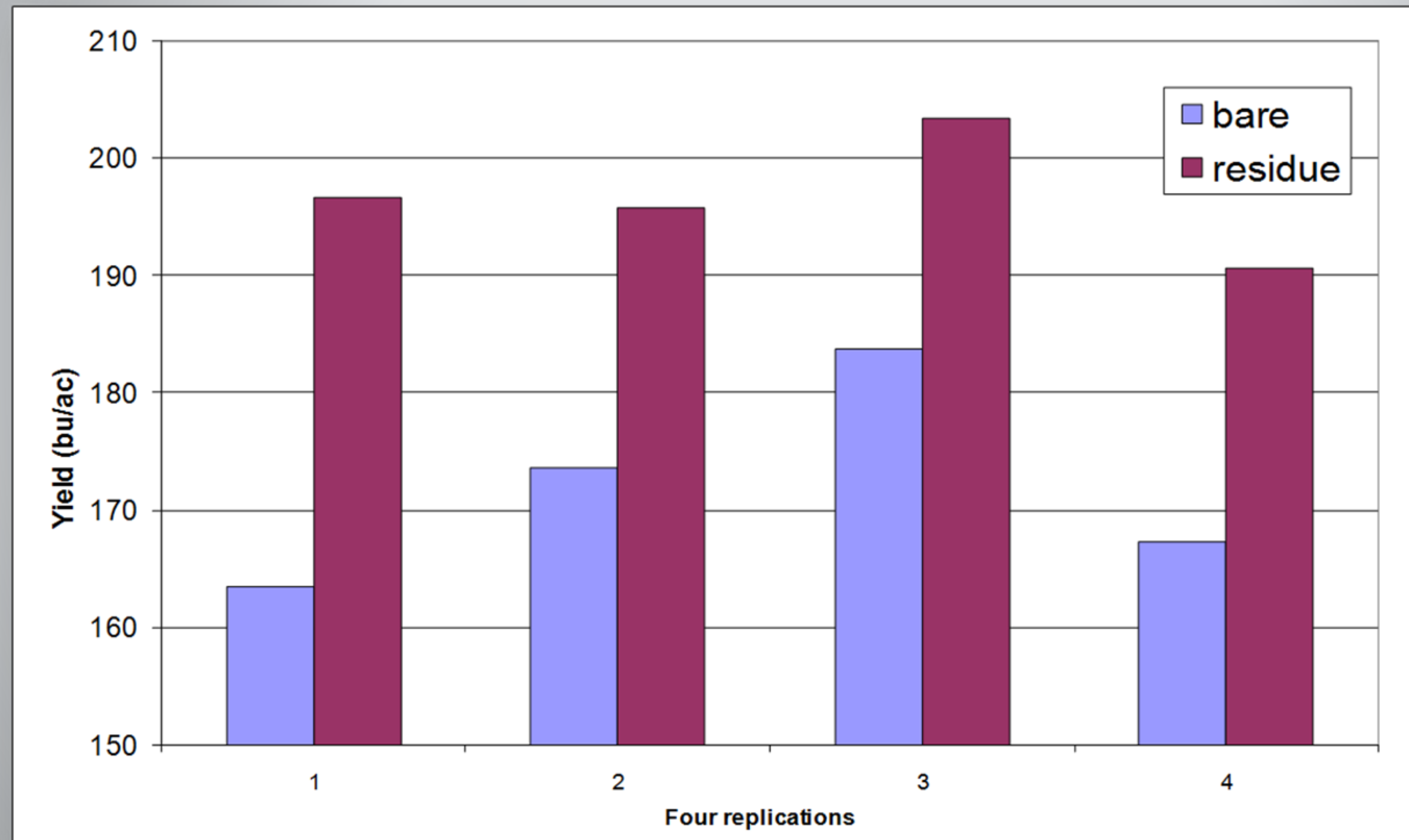
Effect of crop residue on evaporation and crop yield



Limited Irrigation, 2007



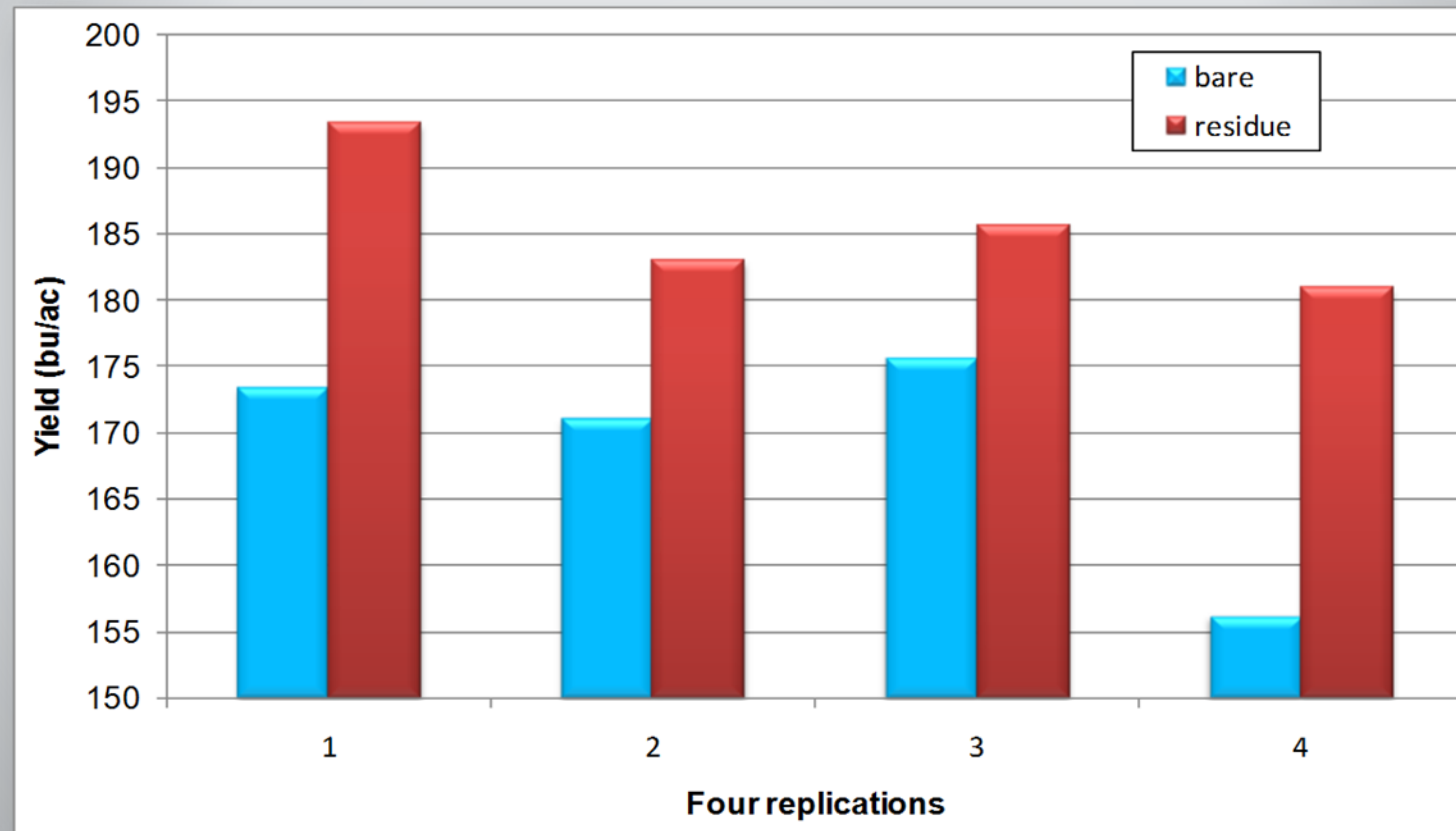
2007 CORN YIELD ON BARE SOIL (AVG. 172 BU/AC) AND RESIDUE-COVERED SOIL (AVG. 197 BU/AC) ON SMALL PLOTS AT NORTH PLATTE



THIS 25 BU/AC YIELD DIFFERENCE MAY BE INTERPRETED AS AN ADDITIONAL AMOUNT OF WATER OF 2.5-3.5 INCHES AVAILABLE TO THE CROP IN THE RESIDUE-COVERED PLOTS.

IT WOULD TAKE AN ADDITIONAL 2.5-3.5 INCHES OF WATER ON THE BARE-SOIL PLOTS TO REACH THE SAME YIELD AS OBTAINED IN THE RESIDUE-COVERED PLOTS.

2008 CORN YIELD ON BARE SOIL (AVG. 169 BU/AC) AND RESIDUE-COVERED SOIL (AVG. 186 BU/AC) ON SMALL PLOTS AT NORTH PLATTE.

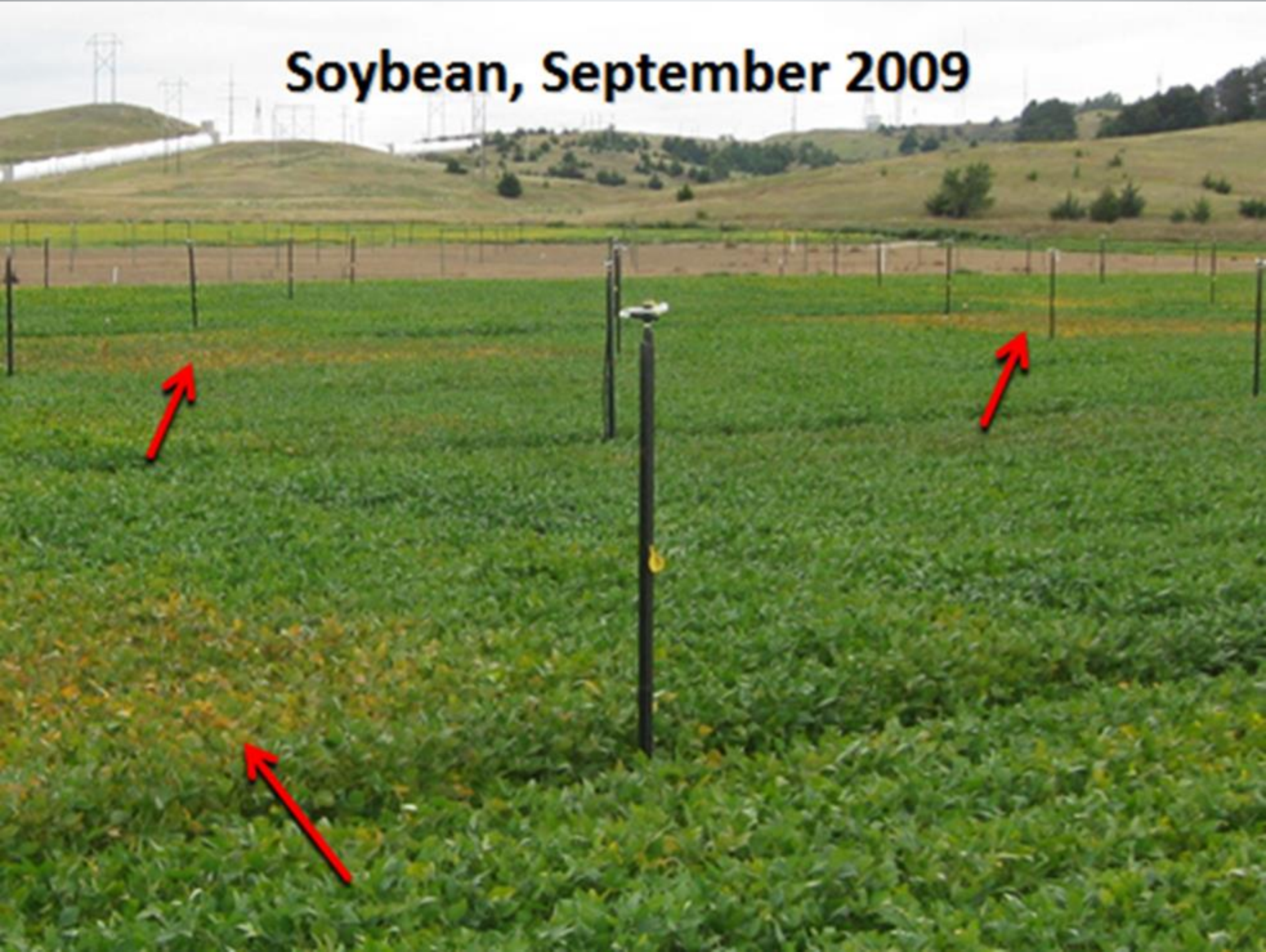


IT WOULD TAKE AN ADDITIONAL 1.5 – 2.5 INCHES OF WATER ON THE BARE-SOIL PLOTS TO REACH THE SAME YIELD AS OBTAINED IN THE RESIDUE-COVERED PLOTS.

ALSO, THE RESIDUE-COVERED PLOTS HELD MORE WATER TOWARDS THE END OF THE SEASON (1.5 INCHES MORE THAN BARE-SOIL PLOTS IN TOP 4 FT).

TOTAL OF 3-4 INCHES OF WATER SAVINGS.

Soybean, September 2009



Yield and soil water content: bare soil and residue-covered soil, 2007 - 2010

		Yields			Water savings		
		Residue	Bare	Diff.	Yield*	Soil**	Total
Year	Crop	Bu/ac	Bu/ac	Bu/ac	Inch	Inch	inch
2007	Corn	197	172	25	3.0	0	3.0
2008	Corn	186	169	17	2.0	1.5	3.5
2009	Soyb.	68	58	10	3.0	2.0	5.0
2010	Soyb.	61	53	8	2.5	0	2.5

**Additional irrigation water needed on the bare-soil plots to produce same yield as on residue-covered plots*

*** Additional soil water (in the top 4 ft of soil, at the end of the growing season) in the residue-covered plots compared to the bare-soil plots*

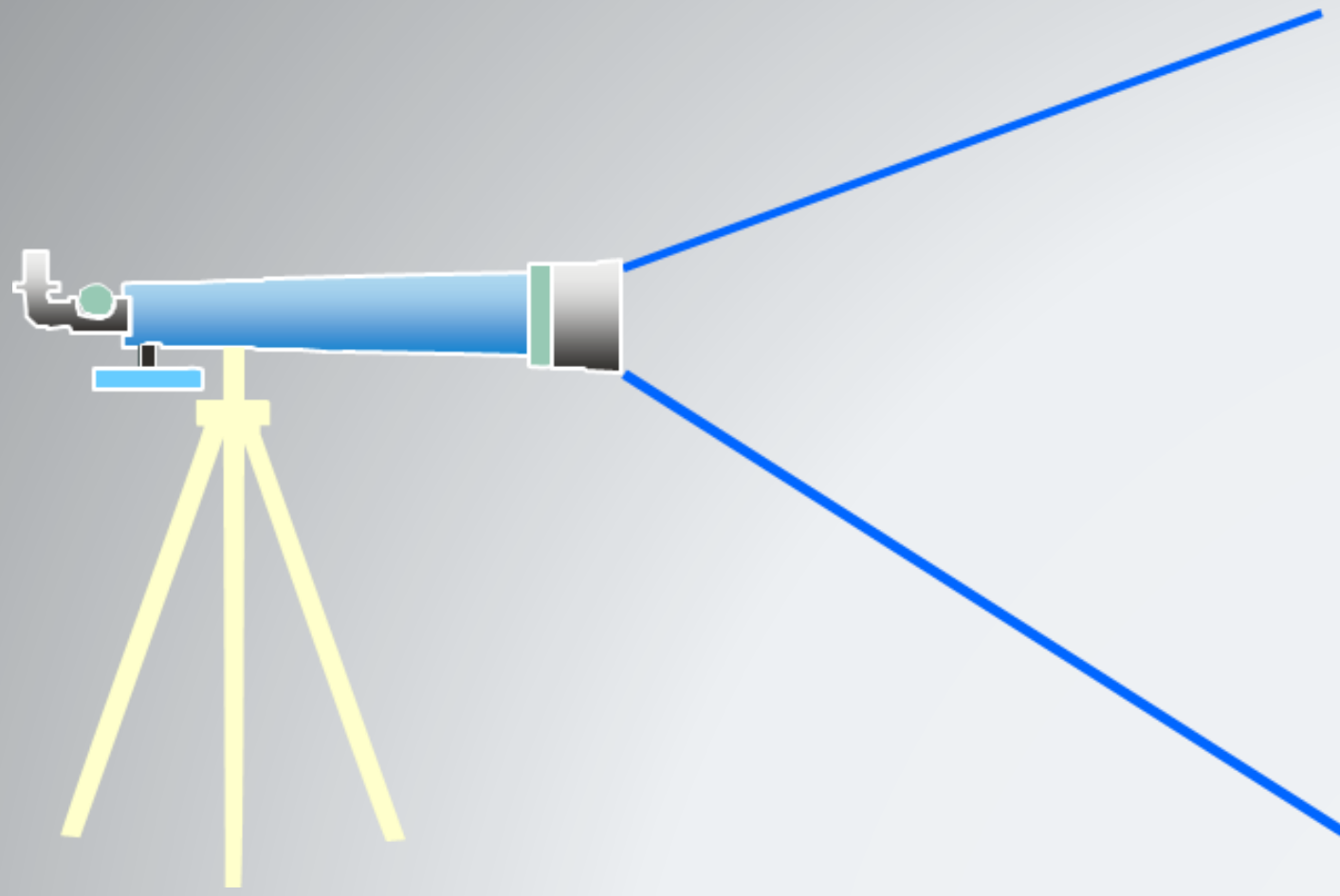
Residue Cover Increases Infiltration

- * PREVENTS SEALING OF SOIL SURFACE
- * MAINTAINS INFILTRATION RATE
- * SLOWS WATER MOVEMENT ACROSS SURFACE



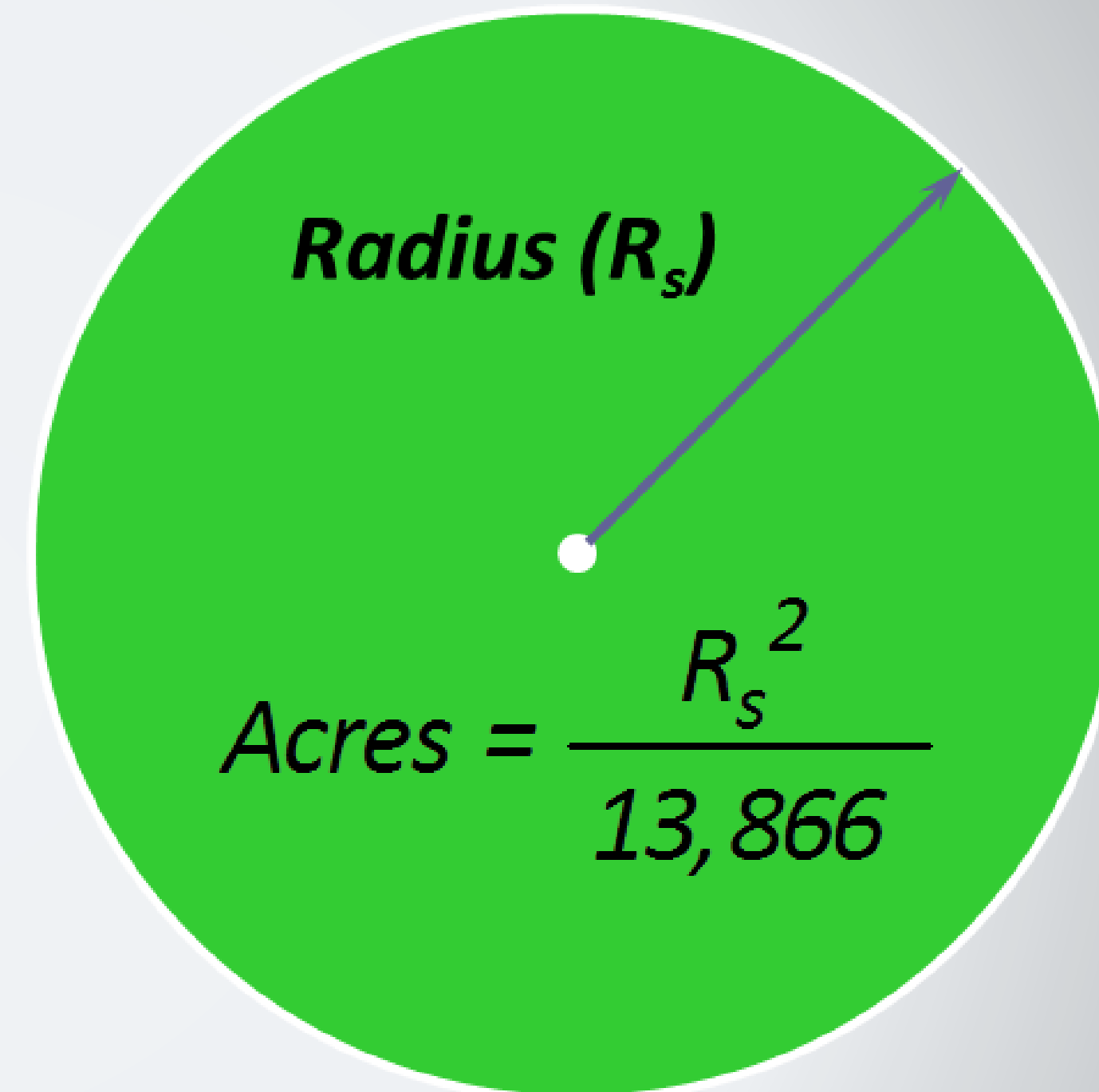






- * USE WATER CONSERVATION PRACTICES THAT REDUCE TRANSPIRATION AND MAINTAIN YIELD
- * LIMIT IRRIGATION DURING NON-CRITICAL GROWTH STAGES
- * GROW CROPS THAT REQUIRE LESS WATER
- * ADJUST POPULATION TO WATER AVAILABLE
- * USE APPROPRIATE CROP ROTATION

Gross System Capacity (C_g)



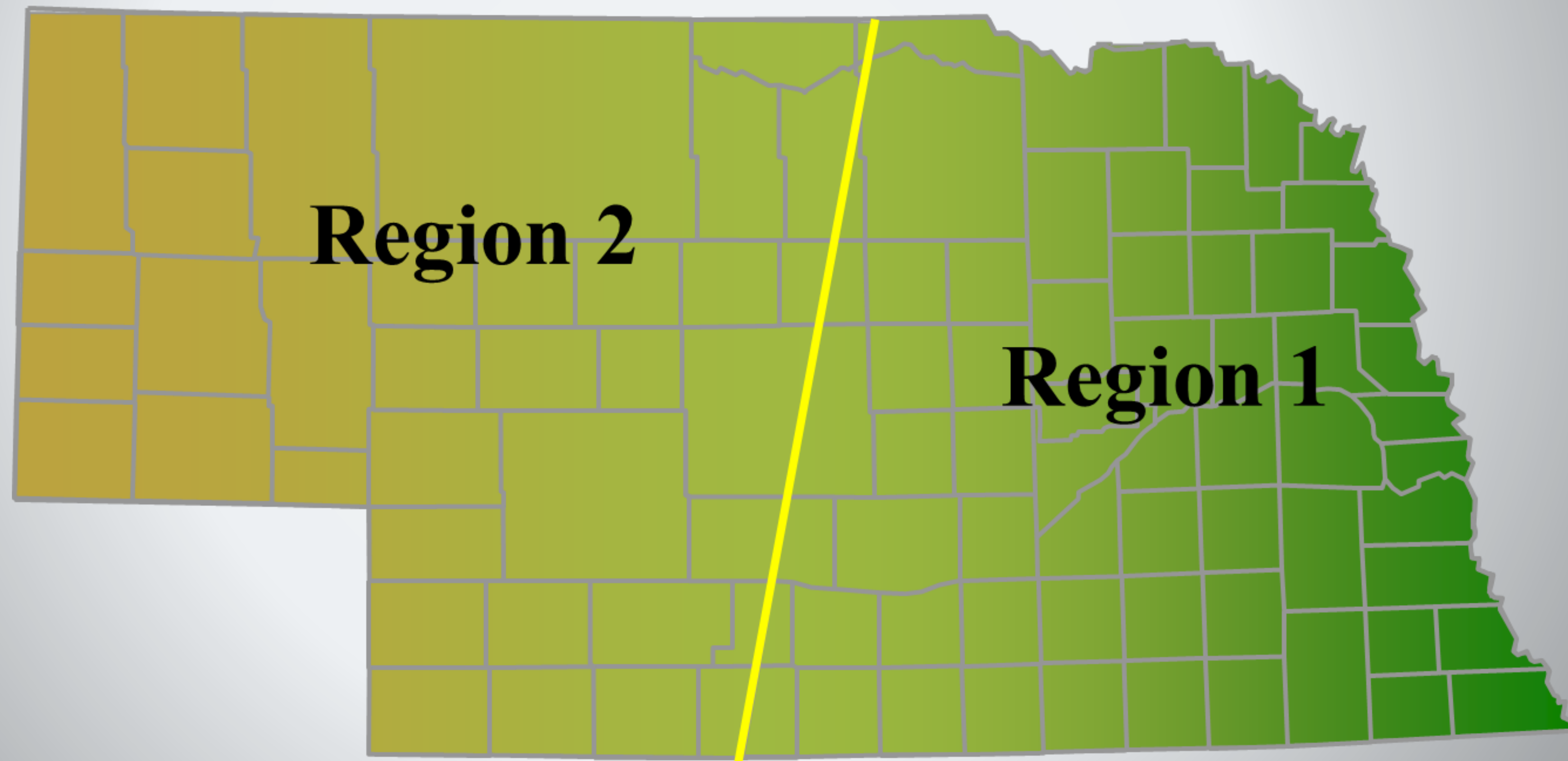
$$\text{System Capacity} = \frac{\text{System Flow Rate}}{\text{Field Area}}$$

= gpm / acre

$$C_g = \frac{750 \text{ gpm}}{125 \text{ acres}} = 6 \text{ gpm / acre}$$

Determine how much flow is needed for system

MINIMUM NET SYSTEM CAPACITY REGIONS



NEBRASKA NET SYSTEM CAPACITY RECOMMENDATIONS

NET CAPACITY (TO FULLY MEET NEEDS 9 OF 10 YEARS)

SOIL TEXTURE	AVAILABLE WATER (IN/FT)	REGION 1 (GPM/AC)	REGION 2 (GPM/AC)
SILT LOAM	2.5	3.9	4.6
SANDY CLAY LOAM	2.0	4.1	4.9
SILTY CLAY LOAM	2.0	4.2	5.1
SILTY CLAY	1.6	4.4	5.1
SANDY LOAM	1.4	4.5	5.2
LOAMY SAND	1.1	4.8	5.4
FINE SAND	1.0	5.0	5.9
PEAK ET		5.7	6.6

Pump Capacity Needed

EAST

PEAK - $5.7 \text{ GPM} * 130 \text{ AC} / 85\% = 871 \text{ GPM}$

SANDY LOAM - $4.5 \text{ GPM} * 130 \text{ AC} / 85\% = 688 \text{ GPM}$

SILT LOAM - $3.9 \text{ GPM} * 130 \text{ AC} / 85\% = 596 \text{ GPM}$

WEST

PEAK - $6.6 \text{ GPM} * 130 \text{ AC} / 85\% = 1,010 \text{ GPM}$

SANDY LOAM - $5.2 \text{ GPM} * 130 \text{ AC} / 85\% = 795 \text{ GPM}$

Know how much water you are applying

System Capacity, gpm/acre	System Flow Rate for Land Acres of:				Depth Applied per Day, inches/day	Depth Applied per Week, inches/week	Time to Apply one-inch, days
	120	130	160	240			
3.0	360	390	480	720	0.16	1.1	6.3
3.5	420	455	560	840	0.19	1.3	5.4
4.0	480	520	640	960	0.21	1.5	4.7
4.5	540	585	720	1080	0.24	1.7	4.2
5.0	600	650	800	1200	0.27	1.9	3.8
5.5	660	715	880	1320	0.29	2.0	3.4
6.0	720	780	960	1440	0.32	2.2	3.1
6.5	780	845	1040	1560	0.34	2.4	2.9
7.0	840	910	1120	1680	0.37	2.6	2.7
7.5	900	975	1200	1800	0.40	2.8	2.5
8.0	960	1040	1280	1920	0.42	3.0	2.4
8.5	1020	1105	1360	2040	0.45	3.2	2.2

Crop Response to Water Stress – Sensitive Stages

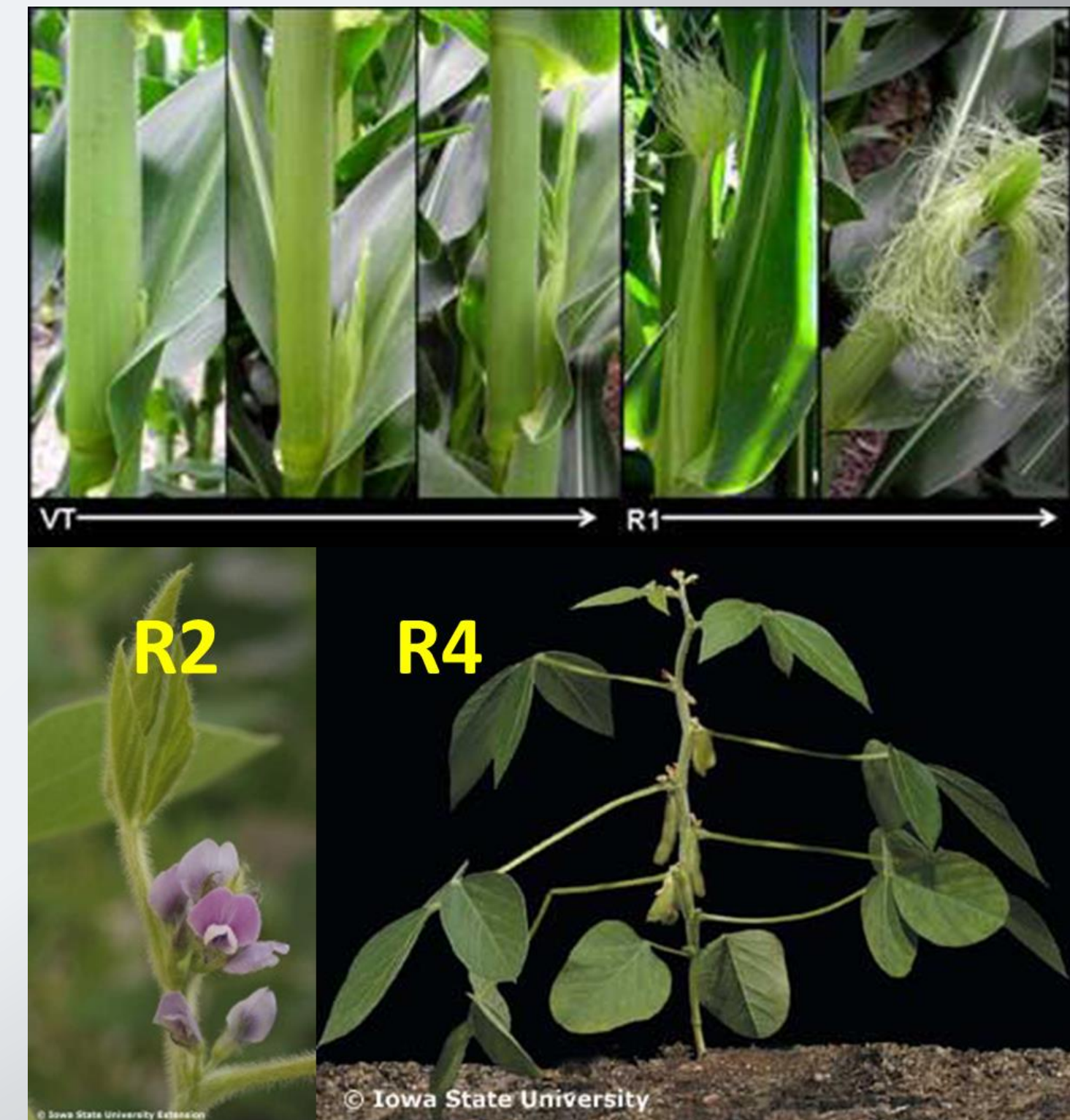
MOST SUSCEPTIBLE –TRANSITION FROM VEGETATIVE TO REPRODUCTIVE GROWTH OR FLOWERING TO FRUIT SET (EC 2007, CORN IRRIGATION MANAGEMENT UNDER WATER-LIMITING CONDITIONS).

CORN

(VT) TO BLISTER (R2) – MOST CRITICAL
PRIOR TO TASSELING – MID-CRITICAL
GRAIN FILL – LESS CRITICAL

SOYBEANS

FLOWERING AND FRUITING STAGE



Crop Response to Water Stress – Sensitive Stages

GRAIN SORGHUM

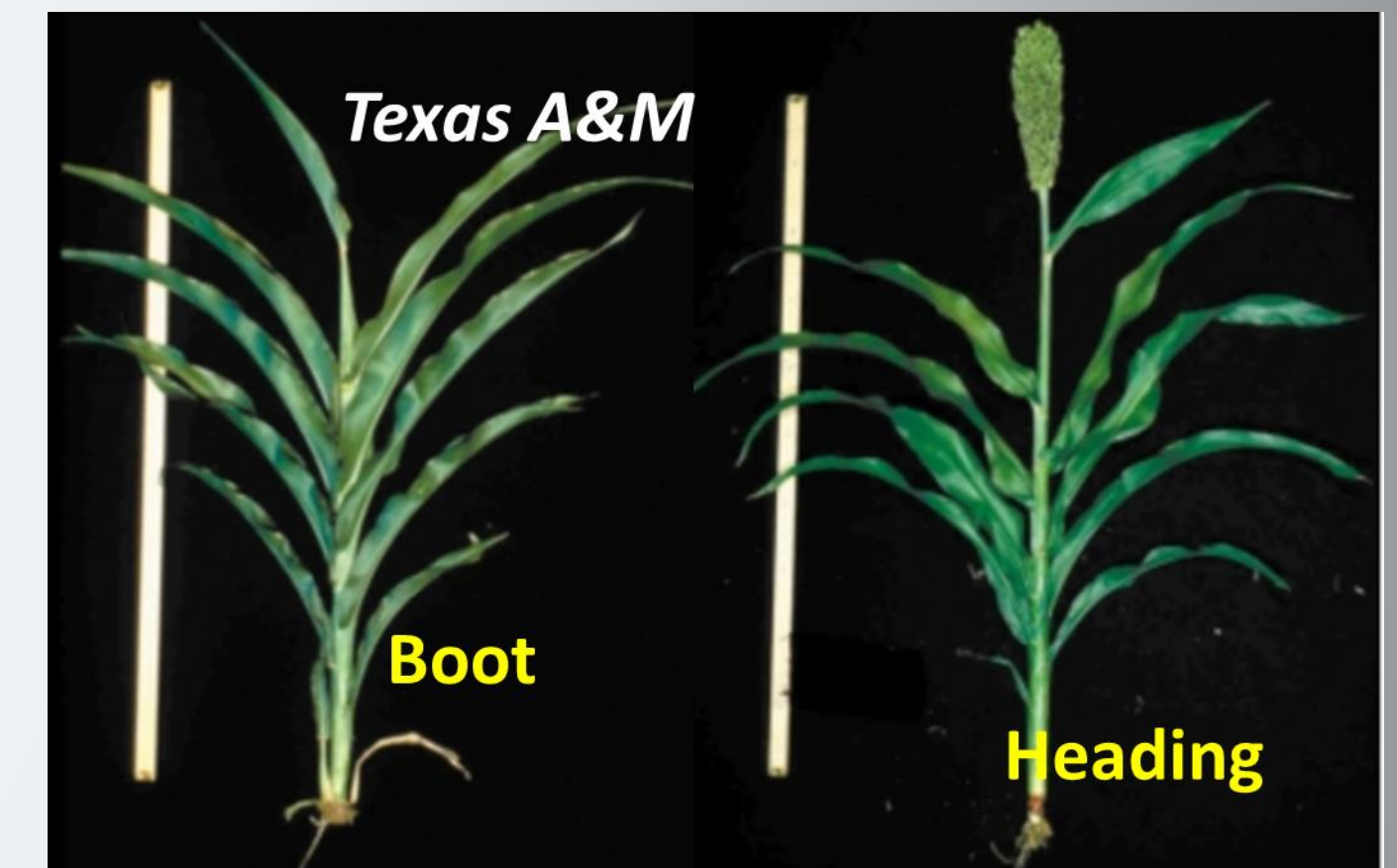
SECONDARY ROOTING & TILLERING TO BOOT – MOST CRITICAL
HEADING, FLOWERING AND GRAIN FORMATION – MID-CRITICAL
GRAIN FILL – LESS CRITICAL

WHEAT

BOOTING - HEADING & 2 WEEKS BEFORE POLLINATION

ALFALFA

FOLLOWING CUTTING



Boot stage -
Feekes 10.1



Beginning flower-
ing - Feekes 10.5.1

Limited Irrigation Strategies – How to Distribute Stress

DISTRIBUTE SEASONALLY AVAILABLE WATER WITH FIXED AMOUNTS THROUGHOUT SEASON INDEPENDENT OF CROP GROWTH STAGE
EXAMPLE: REPLACE OF 75% FULL IRRIGATION DEPTH EACH WATERING
GRADUAL PROGRESSION OF STRESS AS SOIL WATER IS MINED
DEGREE OF ULTIMATE STRESS DEPENDS ON RAIN AND SOIL

WITHHOLD WATER AT CROP GROWTH STAGES THAT ARE LESS SENSITIVE TO WATER STRESS
ACCOUNTS FOR SENSITIVE CROP GROWTH STAGES
USUALLY PRACTICED WHEN UNDER A WATER ALLOCATION
REQUIRES CAPACITY TO RELIEVE STRESS DURING CRITICAL STAGES

Limited Water Management Strategies

REDUCE IRRIGATION TO ENTIRE FIELD

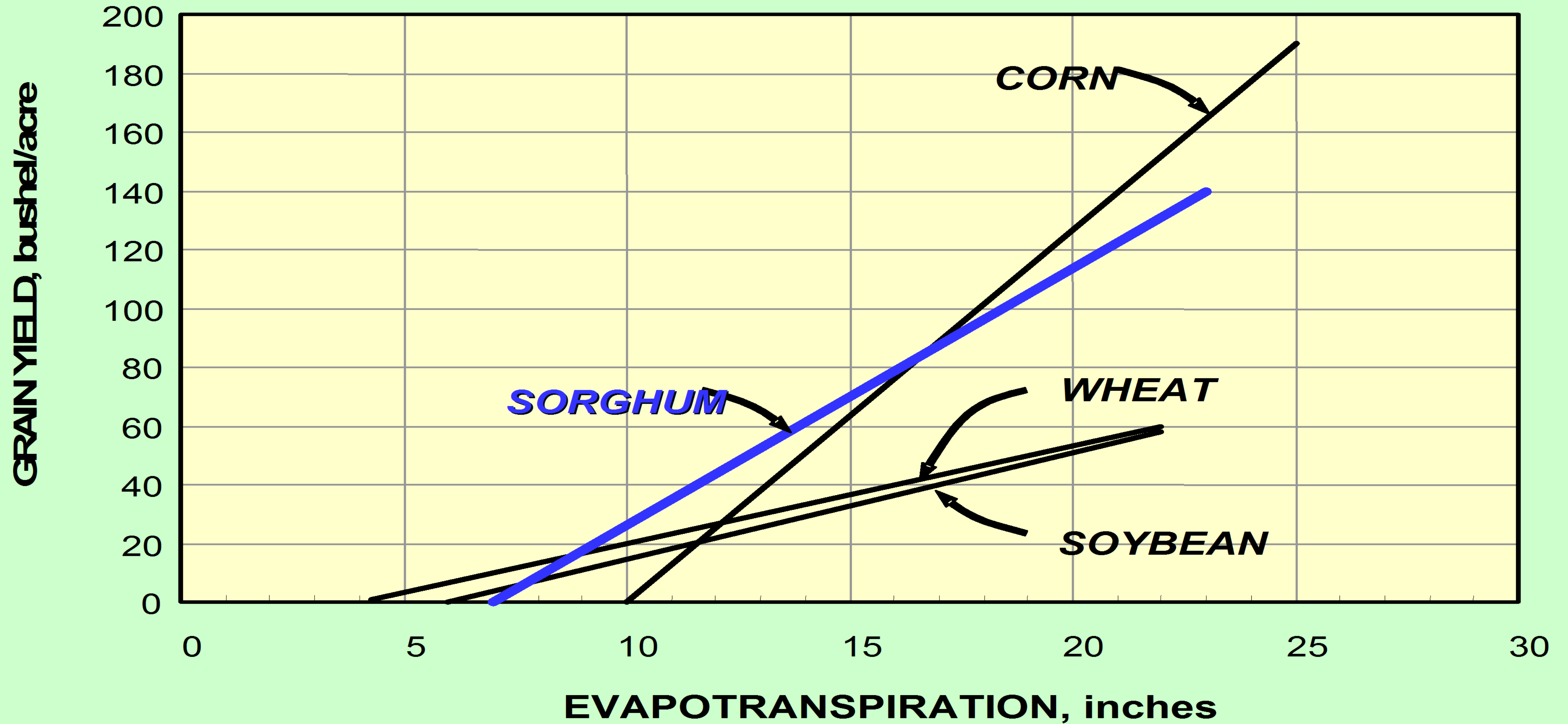
REDUCE IRRIGATED ACREAGE

IRRIGATE ONLY A PORTION OF LAND & REMAINDER IN DRYLAND
PRODUCTION

PLANT PART OF THE FIELD TO:

LOWER WATER USE CROPS THAT ARE MORE DROUGHT TOLERANT
AND ONLY IRRIGATE THEM IF WATER BECOMES AVAILABLE

PLANT PORTIONS OF FIELD TO CROPS WITH CRITICAL GROWTH
STAGES AT DIFFERENT TIMES OF YEAR TO AVOID CAPACITY
LIMITATIONS



SCHNEEKLOTH ET AL, 1991.

EXTENSION

Flow Meters



- Can also use the flow meter as a management tool.
- If flows are tracked over the course of several years, trends could be seen such as pump/power unit performance.

MeterCalc

Water Meter Calculator by UNL Extension 4+
Move Creative, L.L.C. >
No Ratings

[OPEN](#)

Details | Reviews | Related

Carrier 2:56 PM WATER METER CALCULATOR NORTH 40

INCHES PUMPED 2014	REMAINING ALLOCATION	REMAINING CAP 2014
1.1	43.9	13.9

ADD NEW READING >

PAST READINGS

42.262 ACRE IN PUMPED * 1.057 INCHES PER ACRE
35932
July 18, 2014 - 2:56 pm

0.42 ACRE IN PUMPED * 0.01 INCHES PER ACRE
24456
July 18, 2014 - 2:55 pm

Carrier 2:55 PM WATER METER CALCULATOR NORTH 40

METER READING

READING DATE
TODAY SELECT DATE

BEGINNING METER READING
24342 GALLONS X 100

ENDING METER READING
24456 GALLONS X 100

NEXT-SEE CALCULATIONS >

Carrier 2:55 PM WATER METER CALCULATOR NORTH 40

ADD FIELD

NORTH 40

SELECT METER TYPE
Dial Selection

GALLONS X 100 >

GALLONS X 1000 >

ACRE INCHES X .01 >

ACRE FEET X .001 >

ACRE FEET X .01 >

Carrier WATER

ALLOCATION

NO. YEARS IN AL
5

FIRST YEAR OF A
2012

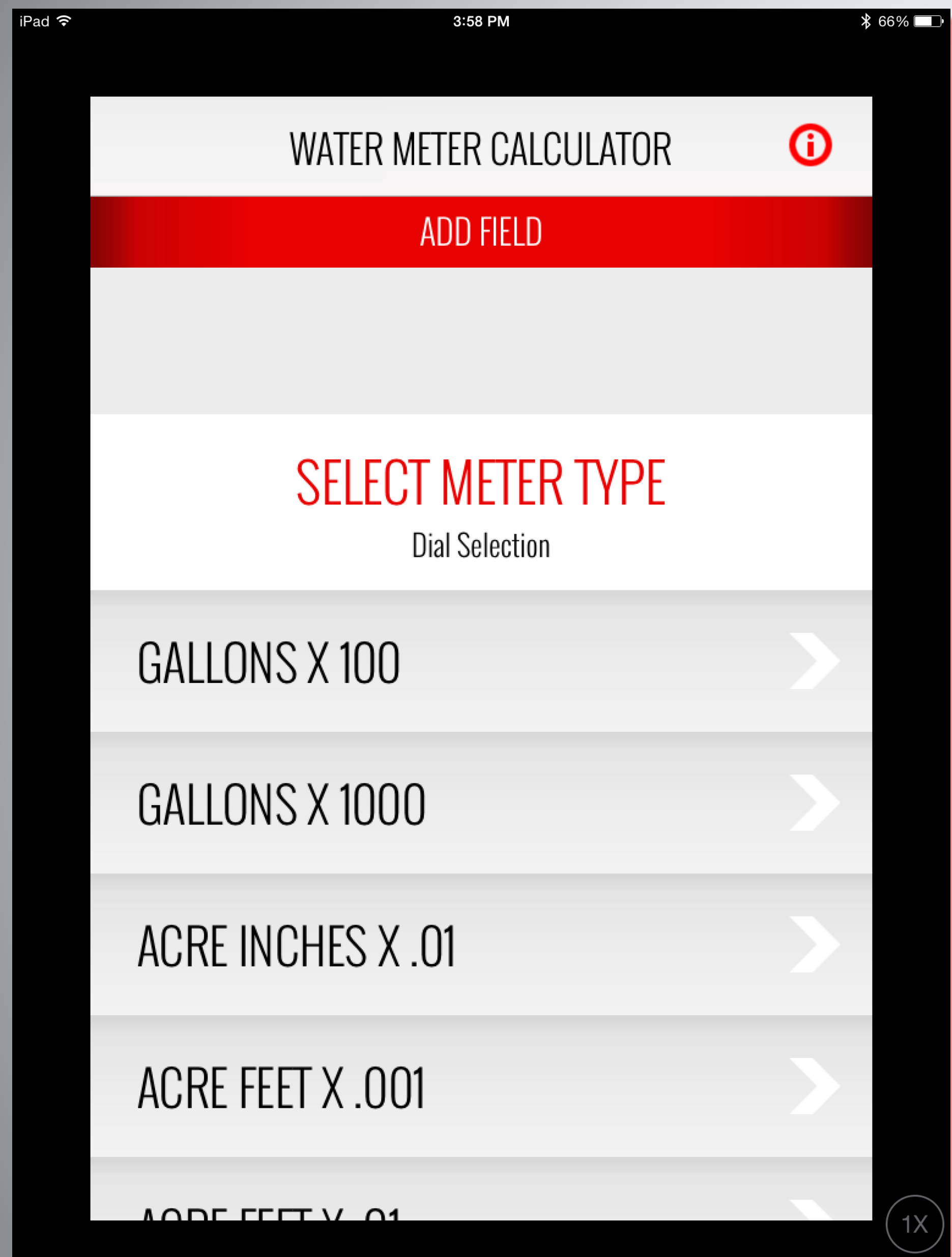
TOTAL ALLOCATI
45

DOES THIS FIELD
 YES

Description

The Water Meter Calculator by University of Nebraska-Lincoln Extension calculates the number of inches of water applied by irrigation over a given time and can even apply it to your yearly and multi-year allocation caps...

- Cost - \$3.99
- Available in Apple (iPhone only, iPad version coming soon) and Android platforms
- This app calculates the amount of water applied by irrigation over time.



MeterCalc

- Begin by selecting a meter type

MeterCalc

iPad 3:58 PM 66%

WATER METER CALCULATOR ⓘ

FIELD SETUP

IRRIGATED ACRES IN FIELD

130

METER MANUFACTURER

SENNINGER

METER SERIAL NUMBER

123456

DOES THIS FIELD HAVE AN ALLOCATION LIMIT

YES NO

1X

- Input field information
- Input meter information

MeterCalc

iPad 3:58 PM 66%

WATER METER CALCULATOR ⓘ

ISU

METER MANUFACTURER

SENNINGER

METER SERIAL NUMBER

123456

DOES THIS FIELD HAVE AN ALLOCATION LIMIT

YES NO

NEXT: ENTER METER READING >

1X

- Are you in a NRD that have allocations?

MeterCalc

iPad 3:59 PM 66%

WATER METER CALCULATOR ⓘ

METER READING

READING DATE

TODAY SELECT DATE

BEGINNING METER READING

24560 GALLONS X1000

ENDING METER READING

34780 GALLONS X1000

NEXT:SEE CALCULATIONS >

1X

- Enter your beginning and ending meter reading
- Click “Next” arrow to view calculations

MeterCalc

iPad 3:59 PM 66%

WATER METER CALCULATOR ⓘ

METER CALCULATIONS

DATE	READING RANGE
Oct. 01, 2014	24560 to 34780

ACRE INCHES PUMPED

376.4

INCHES PER ACRE

2.9

TOTAL INCHES PUMPED PER ACRE 2014

2.9

1X

- Acre inches pumped displayed
- Inches per acre displayed
- Total inches pumped during growing season displayed

MeterCalc

The screenshot shows the 'WATER METER CALCULATOR' app on a mobile device. The status bar at the top indicates Verizon 3G service, 9:54 AM, and 96% battery. The app title 'WATER METER CALCULATOR' is displayed in the navigation bar. Below the title is a red header bar. The main content area is white and contains the following information:

- METER CALCULATIONS** (Section Header)
- DATE**: Jan. 05, 2015
- READING RANGE**: 0 to 15864
- ACRE INCHES PUMPED**: 158.6
- INCHES PER ACRE**: 1.2
- TOTAL INCHES PUMPED PER ACRE 2015**: 1.2

At the bottom, a red bar contains the text 'NEXT:SEE CAP ALLOCATIONS' and a white right-pointing arrow.

- Calculates inches per acre and total for the year

Check Pumping Plant Efficiency

- Keep track of water pumped for season
- Keep track of energy consumed for season
- Compare to Nebraska Pumping Plant Criteria
 - Diesel – 12.5 whp-hr/gal
 - Gas – 8.86 whp-hr/gal
 - Propane – 6.89 whp-hr/gal
 - Natural Gas – 61.7 whp-hr/1000 ft³
 - Electricity – 0.885 whp-hr/kw-hr

Gallons of diesel to pump 1 acre-in

Lift	10 psi	20 psi	30 psi	40 psi	50 psi
0	0.21	0.42	0.63	0.84	1.05
25	0.44	0.65	0.86	1.07	1.28
50	0.67	0.88	1.09	1.30	1.51
75	0.89	1.11	1.32	1.53	1.74
100	1.12	1.33	1.54	1.75	1.97
125	1.35	1.56	1.77	1.98	2.19
150	1.58	1.79	2.00	2.21	2.42

Conversions for other Energy Sources

Energy Source	Units	Multiplier
Electricity	Kilowatt-hours	14.12
Propane	Gallons	1.814
Gasoline	Gallons	1.443
Natural Gas	1000 cubic feet	0.2026

For more information:

- Crop Watch Article – July 19, 2013,
Using your Irrigation Flow Meter for Better Decision
Making.
- Pumping Efficiency App available now.
- Android and iPad versions



IrrigatePump

- Cost - \$3.99
- Available in Apple and Android platforms
- Figure how well your pumping plant stacks up against the Nebraska Pumping Plant Criteria (NPC)
- Should be a reasonable target for most pumping plants



Irrigation Pumping Plant Efficiency Calculator by UNL Extension 4+

Move Creative, L.L.C. >

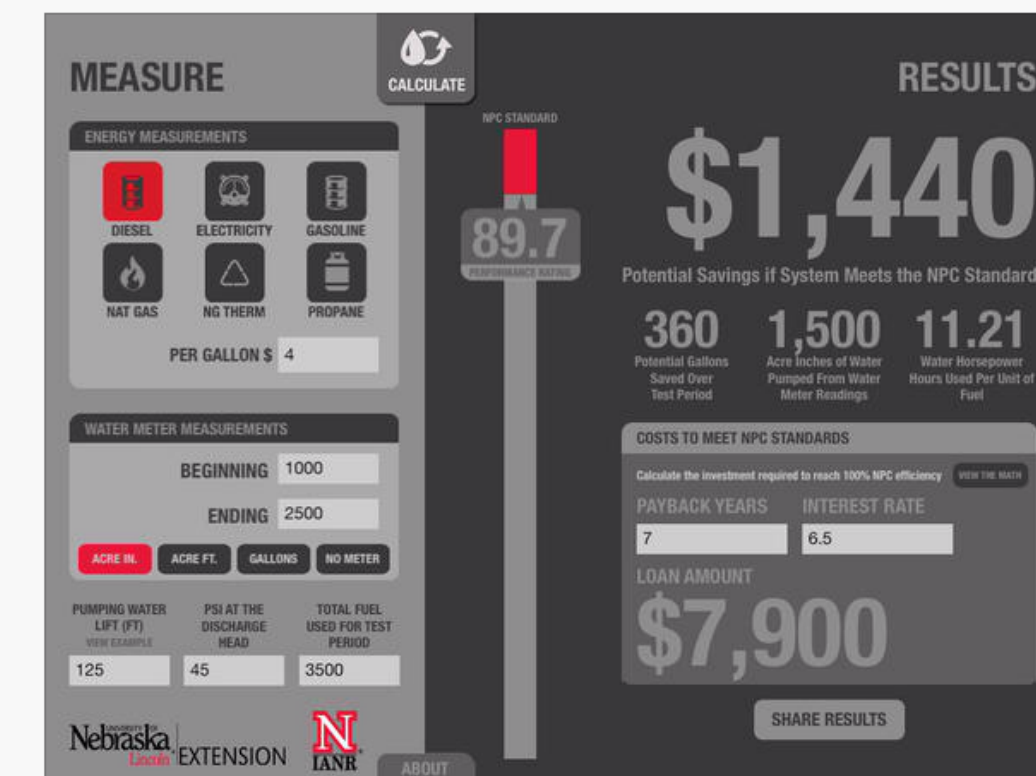
No Ratings

+ OPEN

Details

Reviews

Related



Description

Whether your pumping plant uses diesel, electricity, gasoline, natural gas, or propane, this app will help you calculate its efficiency and how much savings you could see by making upgrades to your system.

The content of this app is based upon the Nebraska Pumping Plant Performance Criteria (NPPPC) that is cited by irrigation design engineers worldwide (Scheusener and Sulek, 1959). Defining the original criteria invo... [more](#)

IrrigatePump

- App will allow you to:
- Input energy source
- Price/unit of energy
- Acres irrigated
- Water applied

The screenshot displays the IrrigatePump app interface, divided into 'MEASURE' and 'RESULTS' sections. The 'MEASURE' section includes 'ENERGY MEASUREMENTS' with options for Diesel, Electricity, Gasoline, Nat Gas, NG Therm, and Propane, and a 'PER GALLON \$' field set to 3.25. It also features 'WATER METER MEASUREMENTS' with 'ACRES IRRIGATED' (135) and 'GROSS INCH APPLIED' (6), and a unit selector (ACRE IN., ACRE FT., GALLONS, NO METER). 'PUMPING WATER LIFT (FT)' is 145, 'PSI AT THE DISCHARGE HEAD' is 45, and 'TOTAL FUEL USED FOR TEST PERIOD' is 2450. The 'RESULTS' section shows a 'CALCULATE' button, a bar chart for 'NPC STANDARD' with a 'PERFORMANCE RATING' of 75.3, and a large 'RESULTS' display of '\$1,971' representing 'Potential Savings if System Meets the NPC Standard'. Below this, three metrics are shown: '606 Potential Gallons Saved Over Test Period', '810 Acre Inches of Water Pumped From Water Meter Readings', and '9.41 Water Horsepower Hours Used Per Unit of Fuel'. A 'COSTS TO MEET NPC STANDARDS' section includes a 'VIEW THE MATH' button, 'PAYBACK YEARS' (7), 'INTEREST RATE' (4.5), and 'LOAN AMOUNT' (\$12K). A 'SHARE RESULTS' button is at the bottom right. Logos for the University of Nebraska Lincoln Extension and IANR are at the bottom left, and an 'ABOUT' button is at the bottom center.

Category	Value
Energy Source	DIESEL
Price/Unit	PER GALLON \$ 3.25
Acres Irrigated	135
Gross Inch Applied	6
Pumping Water Lift (ft)	145
PSI at Discharge Head	45
Total Fuel Used (gallons)	2450
Performance Rating	75.3
Potential Savings	\$1,971
Potential Gallons Saved	606
Acre Inches Pumped	810
Water Horsepower Hours	9.41
Payback Years	7
Interest Rate	4.5
Loan Amount	\$12K

IrrigatePump

- App will allow you to:
- Input well specifications
- Fuel used for test period

The screenshot displays the IrrigatePump app interface, divided into 'MEASURE' and 'RESULTS' sections. The 'MEASURE' section includes 'ENERGY MEASUREMENTS' with options for Diesel, Electricity, Gasoline, Nat Gas, NG Therm, and Propane. A 'PER KILOWATT HOUR \$' field is set to 0.065. 'WATER METER MEASUREMENTS' includes 'ACRES IRRIGATED' (130) and 'GROSS INCH APPLIED' (6). At the bottom, 'PUMPING WATER LIFT (FT)' is 125, 'PSI AT THE DISCHARGE HEAD' is 45, and 'TOTAL FUEL USED FOR TEST PERIOD' is 38760. The 'RESULTS' section shows a 'CALCULATE' button, a 'NPC STANDARD' bar chart, and a 'PERFORMANCE RATING' of 59.5. The primary result is '\$1,020' in potential savings. Other metrics include 16K potential kilowatt-hours saved, 780 acre inches of water pumped, and 0.53 water horsepower hours per unit of fuel. A 'COSTS TO MEET NPC STANDARDS' section shows a payback of 7 years at a 6.5% interest rate, with a loan amount of \$5,596. Logos for the University of Nebraska Lincoln Extension and IANR are visible at the bottom.

MEASURE

ENERGY MEASUREMENTS

DIESEL ELECTRICITY GASOLINE
NAT GAS NG THERM PROPANE

PER KILOWATT HOUR \$ 0.065

WATER METER MEASUREMENTS

ACRES IRRIGATED 130
GROSS INCH APPLIED 6

ACRE IN. ACRE FT. GALLONS NO METER

PUMPING WATER LIFT (FT) 125
PSI AT THE DISCHARGE HEAD 45
TOTAL FUEL USED FOR TEST PERIOD 38760

RESULTS

\$1,020
Potential Savings if System Meets the NPC Standard

16K Potential Kilowatt-Hours Saved Over Test Period
780 Acre Inches of Water Pumped From Water Meter Readings
0.53 Water Horsepower Hours Used Per Unit of Fuel

59.5
PERFORMANCE RATING

COSTS TO MEET NPC STANDARDS

Calculate the investment required to reach 100% NPC efficiency [VIEW THE MATH](#)

PAYBACK YEARS 7 INTEREST RATE 6.5

LOAN AMOUNT **\$5,596**

[SHARE RESULTS](#)

UNIVERSITY OF Nebraska Lincoln EXTENSION IANR

IrrigatePump

- Results:
- Click on the “Calculate” button to figure your performance rating
- Figures potential savings if you could bring the unit up to NPC standard
- Also figures payback years if repairs/improvements are made

MEASURE

ENERGY MEASUREMENTS

DIESEL	ELECTRICITY	GASOLINE
NAT GAS	NG THERM	PROPANE

PER KILOWATT HOUR \$ 0.065

WATER METER MEASUREMENTS

ACRES IRRIGATED 130

GROSS INCH APPLIED 6

ACRE IN. ACRE FT. GALLONS NO METER

PUMPING WATER LIFT (FT) 145

PSI AT THE DISCHARGE HEAD 45

TOTAL FUEL USED FOR TEST PERIOD 67897

RESULTS

\$2,783

Potential Savings if System Meets the NPC Standard

43K	780	0.33
Potential Kilowatt-Hours Saved Over Test Period	Acre Inches of Water Pumped From Water Meter Readings	Water Horsepower Hours Used Per Unit of Fuel

36.9

PERFORMANCE RATING

\$16K

LOAN AMOUNT

PAYBACK YEARS 7

INTEREST RATE 4.5

\$16K

COSTS TO MEET NPC STANDARDS

Calculate the investment required to reach 100% NPC efficiency [VIEW THE MATH](#)

[SHARE RESULTS](#)

Nebraska University of Lincoln EXTENSION IANR

Irrigation Water Use Efficiency

$$IWUE = \frac{\text{Irrigated Yield} - \text{Rainfed Yield}}{\text{Gross Irrigation Depth}}$$
$$= \frac{220 \text{ bu/acre} - 120 \text{ bu/acre}}{12 \text{ inches}} = 8.3 \text{ bushels / acre - inch}$$

Measure of Water Productivity for Management Practices

Attainable Water Use Efficiencies:

- ➔ Corn: 12 - 14 bushels/acre-inch
- ➔ Soybeans: 3 - 5 bushels/acre-inch
- ➔ Wheat: 4 - 6 bushels/acre-inch
- ➔ Sorghum: 8 – 10 bushels/acre-inch

Irrigation Water Use Efficiency

If Your IWUE Is Much Less Than Target Values:

- Monitor soil water to use precipitation or carryover soil water
- Leave room in soil profile to store irrigation/rainfall
- Schedule last irrigation to dry profile at end of season
- Improve application efficiency of system
- Use no-till systems to reduce evaporation and runoff
- Check application uniformity to maximize use of irrigation water

How to grow 200 bu sorghum with less water

THINK LIKE A RAINFED (DRYLAND, NON-IRRIGATED) PRODUCER

INCREASE APPLICATION EFFICIENCY

INCREASE WATER USE EFFICIENCY

LIMIT WATER EVAPORATION

REDUCE TRANSPIRATION

HYBRID SELECTION

WCREC

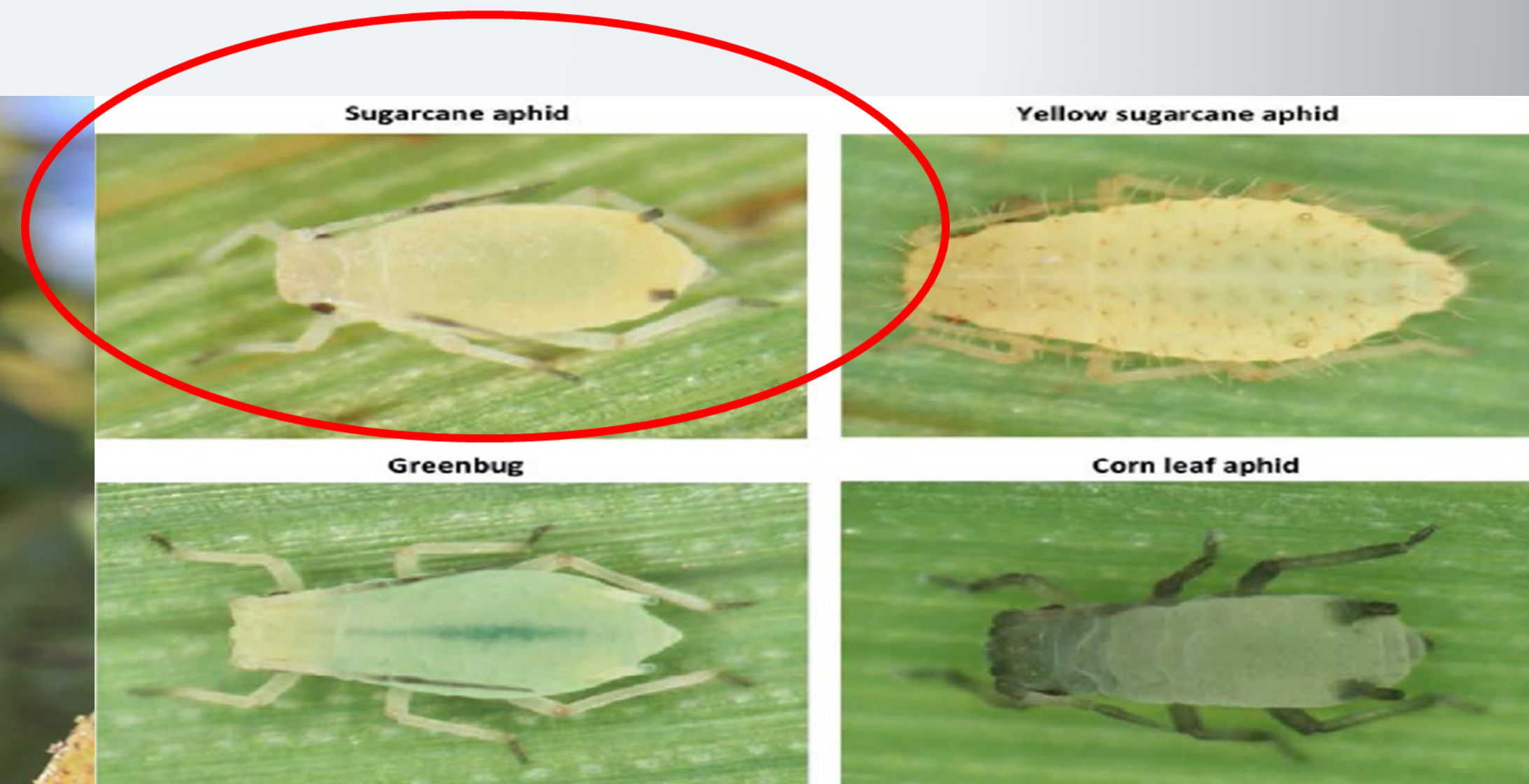
LIMITED RESEARCH ON SORGHUM PRODUCTION IN RECENT YEARS
NEW HIRES COULD CHANGE THAT...

Julie Peterson, entomologist



New Pest in Sorghum: Sugarcane Aphid

EXPANDED HOST RANGE FROM SUGARCANE TO SORGHUM
FORMS LARGE COLONIES ON SORGHUM LEAVES
LIGHT YELLOW APHID WITH BLACK LEG TIPS AND TAIL PIPES

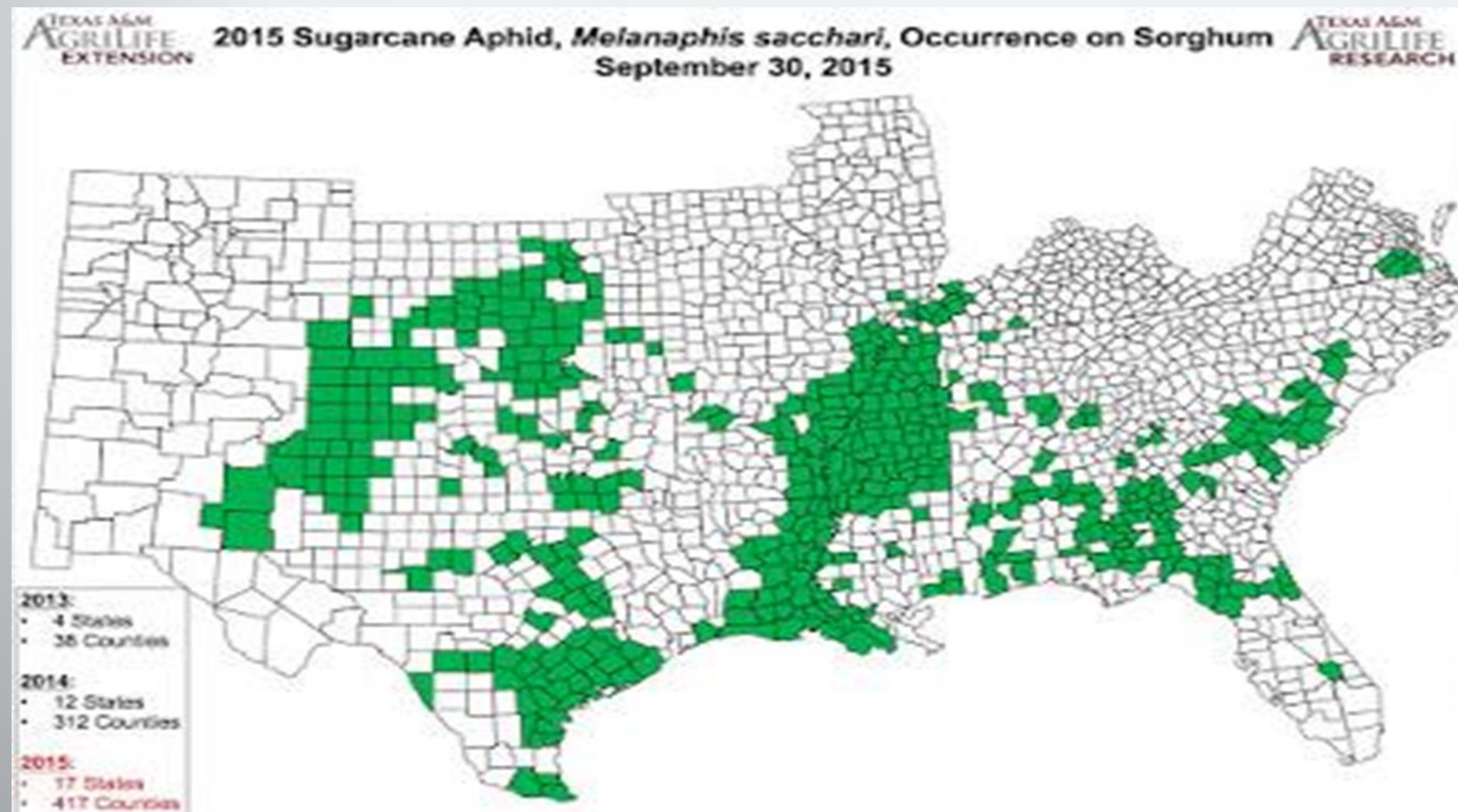


Quickly Approaching Nebraska

RAPID MOVEMENT NORTH & EAST SINCE 2013, FOUND IN KANSAS FOR 1ST TIME IN 2015

SO FAR NOT FOUND IN NE; IF PRESENT, VERY IMPORTANT TO DOCUMENT FOR SECTION 18 APPROVALS– FEW INSECTICIDES WILL CONTROL IT

PLEASE SUBMIT SAMPLES TO UNL PLANT & PEST DIAGNOSTIC CLINIC



Survey Program for Nebraska

- Preliminary surveys by Julie Peterson in 2015 in Hitchcock, Red Willow, Furnas & Lincoln counties found no sugarcane aphid
- More thorough surveys in 2016 are needed for early detection to:
 - Warn producers about this potentially damaging pest
 - Petition EPA for Section 18 approval for insecticide use
 - Conduct research on IPM for this insect to understand how to protect sorghum yields in Nebraska

Daran Rudnick, irrigation



Rodrigo Werle, cropping systems



Questions?

- chuck.burr@unl.edu