

Make the Most Out of Your Irrigation Water



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 K-State Southwest Research and Extension

Crop Talk
 18 February 2025

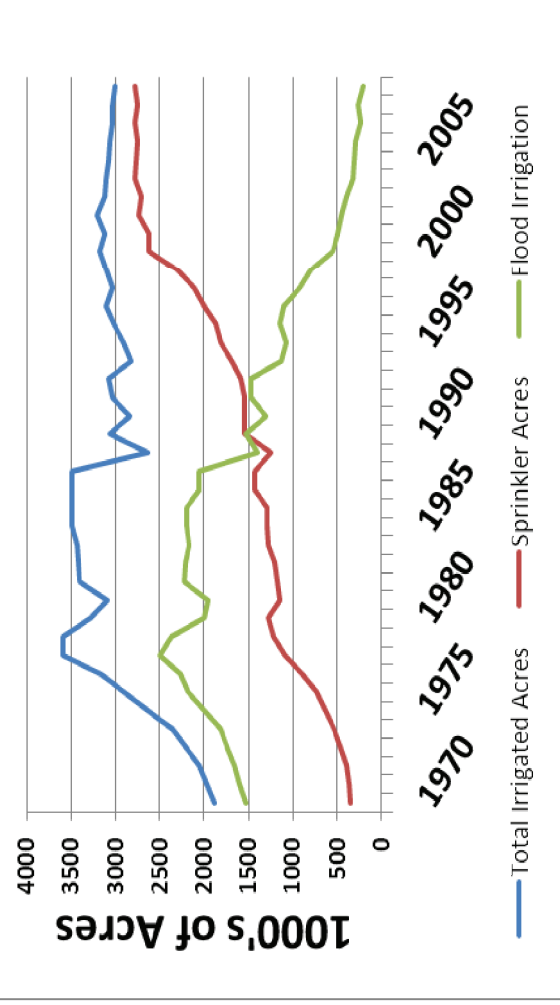
Overview

- Why Irrigate?
- Irrigation Management
- Planning Tools
- Scheduling Tools

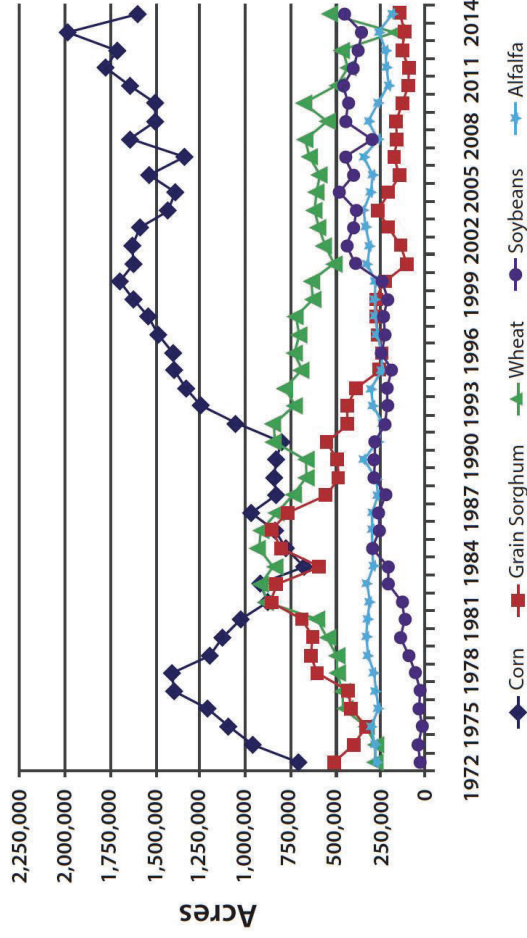
Kansas: 1989 – 2017 Irrigated Acres

Reporting Unit	1989		2012		2017		Change		% Change since 1989
	acres		acres		acres		in acres		
GMD 1	291,574		198,377		177,528		-114,046		-39.1
GMD 3	1,572,470		1,424,923		1,393,101		-179,369		-11.4
GMD 4	359,016		387,286		392,003		32,987		9.2
Rest of Region 1 (West)	106,915		109,220		113,022		6,107		5.7
Total of Region 1 (West)	2,329,975		2,119,806		2,075,654		-254,321		-10.9
GMD 2	94,683		136,543		150,786		56,103		59.3
GMD 5	429,133		456,746		458,119		28,986		6.8
Rest of Region 2 (Central)	192,664		248,916		273,152		80,488		41.8
Total of Region 2 (Central)	716,480		842,205		882,057		165,577		23.1
Total of Region 3 (East)	52,375		80,070		100,809		48,434		92.5
State	3,098,830		3,042,081		3,058,520		-40,310		-1.3

Total irrigated land area, sprinkler systems, and flood irrigation system in Kansas



Major Kansas Irrigated Crop Acreage



Why irrigate?

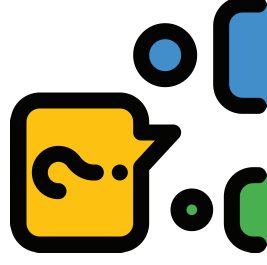
Why water the crops?

Why water plants?



Top reason why you irrigate

- Increase yield
- Improve soil health
- Reduce impact of drought
- Increase profit
- Improve grain/product quality
- Keep land value high



Why do we Irrigate???

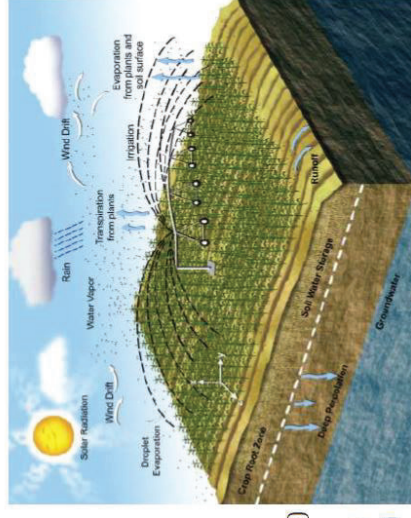
When precipitation and stored soil water in the crop root zone are insufficient to meet crop evapotranspiration (ET) demand, irrigation is required.

Insufficient Irrigation can reduce:

- Total Biomass
- Grain Yield
- Grain Quality
- Net Return (\$ per ha)

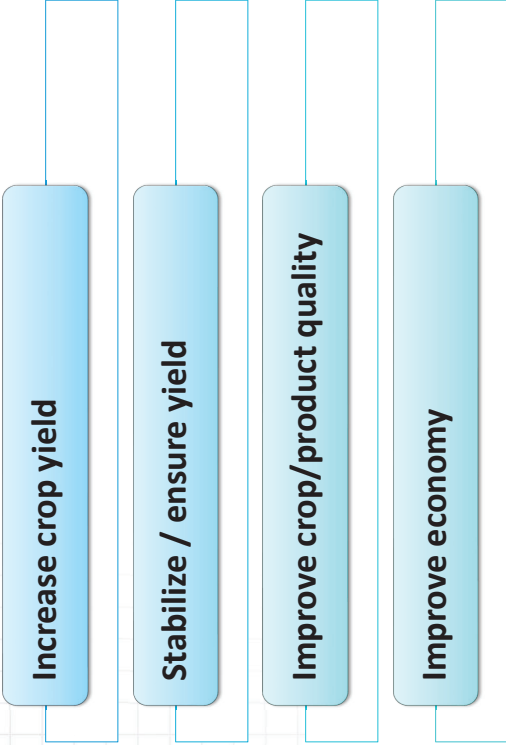
Excessive irrigation can result in:

- Runoff
- Soil Erosion
- Deep Percolation of Water (and Nutrients)
- Environmental Degradation
- Anaerobic Soil Conditions (Yield Penalty)
- Increased Pumping Cost (i.e., energy cost)



Source: Irmak (2009), Rudnick and Irmak (2015)

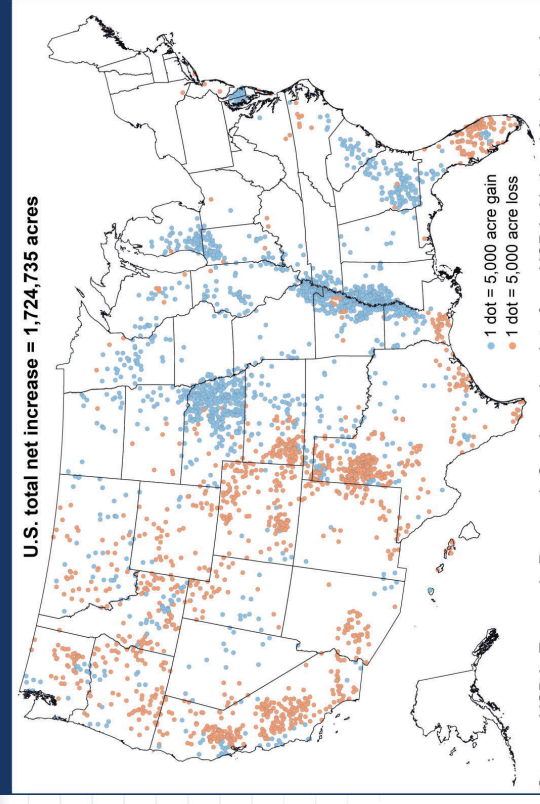
Reasons we irrigate



Kansas: 1989 – 2017 Irrigated Acres

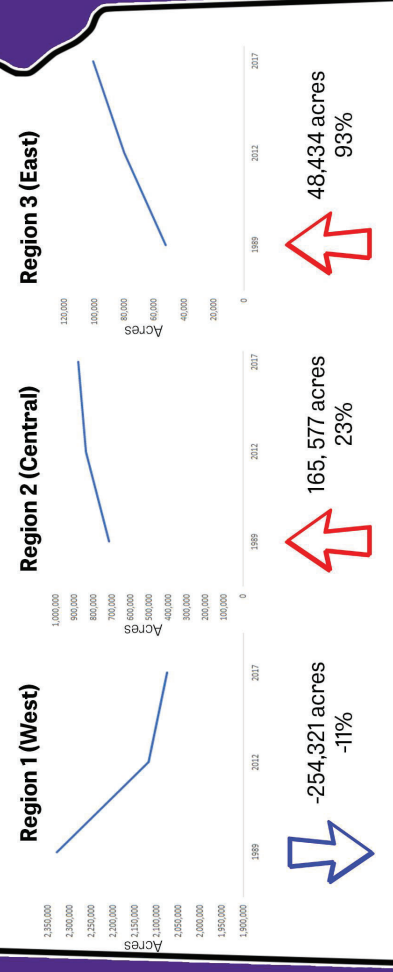
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Change in U.S. acres of irrigated agricultural land by county, 1997-2017



Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, 1997 and 2017 Census of Agriculture.

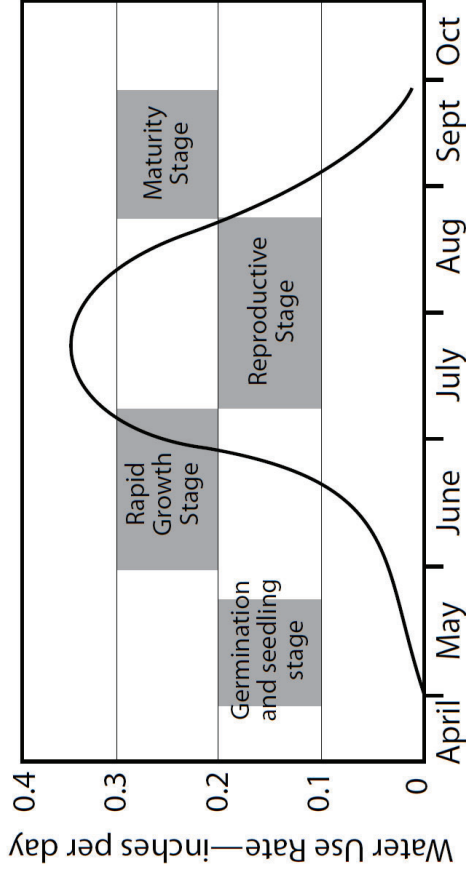
Kansas



Irrigation Reduces Risks from Rainfall Variability

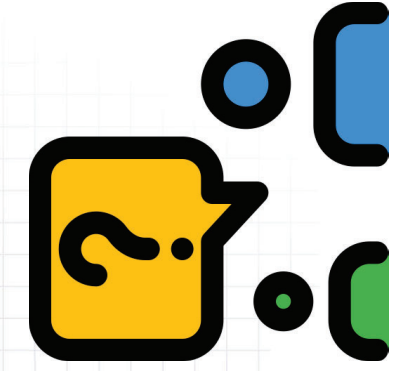
1989 - 2017 Irrigated Acres

Characteristic growth and water use pattern of corn



Precision Irrigation

Time of Irrigation Study at Scandia Exp. Farm	1991 Yield MT/ha	1991 Irrigation Date	1980-1991 MT/ha
No Irrigation	0.2	None	3.5
Tassel	7.8	7/8	8.9
Tassel + 1 week	9.3	7/8, 7/15	10.0
Tassel + 1 + 2 week	9.8	7/8, 7/15, 7/25	10.3
65% depletion	10.0	7/1, 7/23	10.8



KNOWLEDGE CHECK:
WHAT'S THE HIGHEST RECORDED YIELD FOR CORN (BU/AC) A FARMER GOT?

KEY ISSUES MEMBERSHIP STAY INFORMED GET INVOLVED TAKE ACTION

RECORDS BROKEN IN 2019 NCGA CORN YIELD CONTEST

DECEMBER 16, 2019

616 bu/ac

Natl. Avg. 167
Kansas, Irrgtd. 304

Strip, Min, Mulch, Ridge-Till Irrigated category, using Pioneer P1197YHR™

RECORDS BROKEN IN 2019 NCGA CORN YIELD CONTEST

This year, corn growers hit new highs in the National Corn Growers Association 2019 National Corn Yield Contest with David Hula of Charles City, Va. setting the highest yield on record at 616.1953 bushels per acre. Despite adverse growing conditions that impacted most farmers, improved seed varieties, advanced production techniques

YIELD GAP

Solar Radiation, Temperature,
Rainfall

Insects, Pests and
Diseases

Water
Mngt.

Nutrients

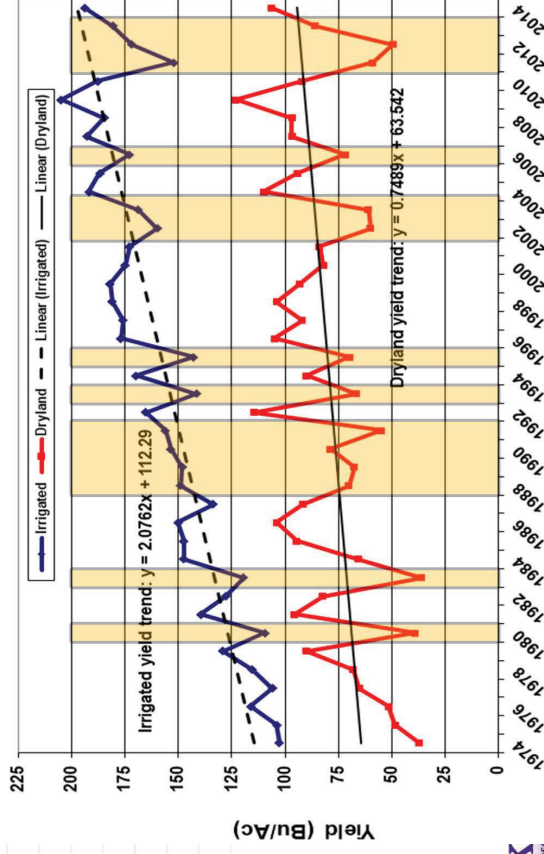
Seeding

Weeds

Why Irrigate?

Irrigation Stabilizes yield

Kansas Corn Yield Trend



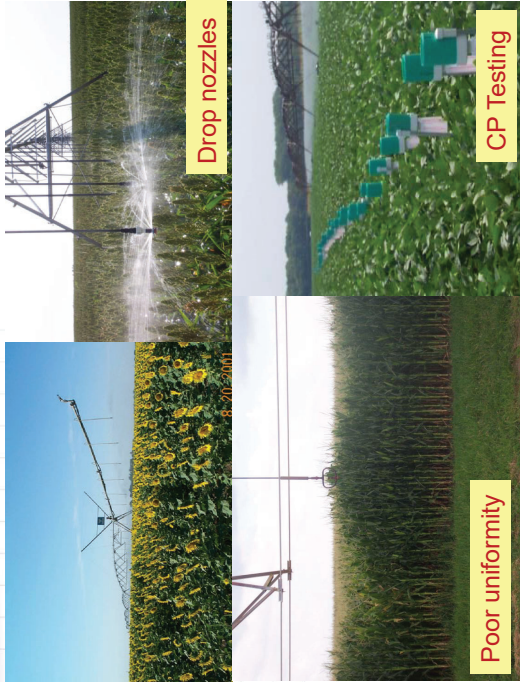
Seven Points to Consider

1. Keep irrigation system at optimum condition
2. Evaluate opportunities to be better
3. Apply water evenly in the field
4. Soak the water in where it is placed
5. Slow down pivot speed
6. Make better use of rainfall
7. Properly schedule your irrigation

1. MAKE SURE THAT YOUR IRRIGATION SYSTEM IS RUNNING AT ITS OPTIMUM CONDITION

- a. Do a baseline testing of well, pump and irrigation system
- b. Compare flow rate and pressure (psi) with Sprinkler Package Design
- c. Don't assume regulators perform as new
- d. Re-orifice package, adjust impellers, speed up pump engine, modify generator pulley as needed to get 480 Volts
- e. If the well can sustain the yield, reduce pivot flow rate to 5.4-6.7 gpm/acre (~0.27-0.33 in/day) for most row crop application

Off-season adjustments

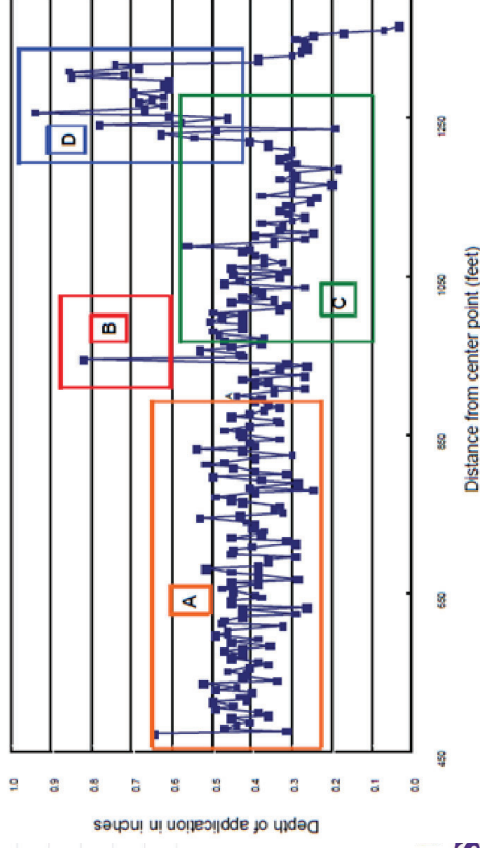


Check your irrigation systems for operation, maintenance and uniformity problems

Uniformity test result

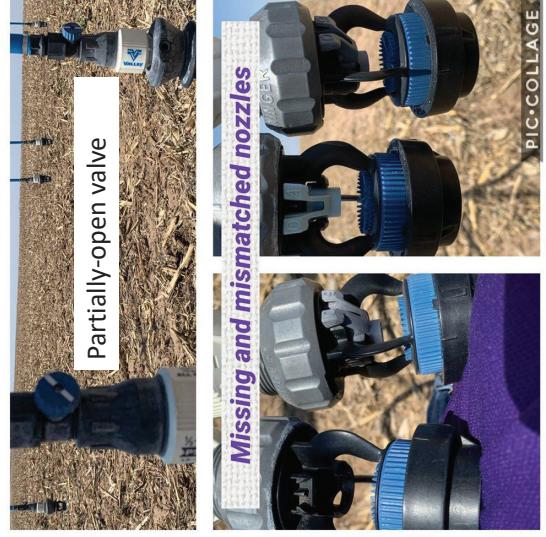
(Rogers et al. 2008).

Sprinkler Package Uniformity Test with End-gun 'ON'
Finney County, Kansas



At the Least, Walk Your System Before Irrigation System Starts

These are what I found in a recently renozzled pivot of a Water Tech Farm

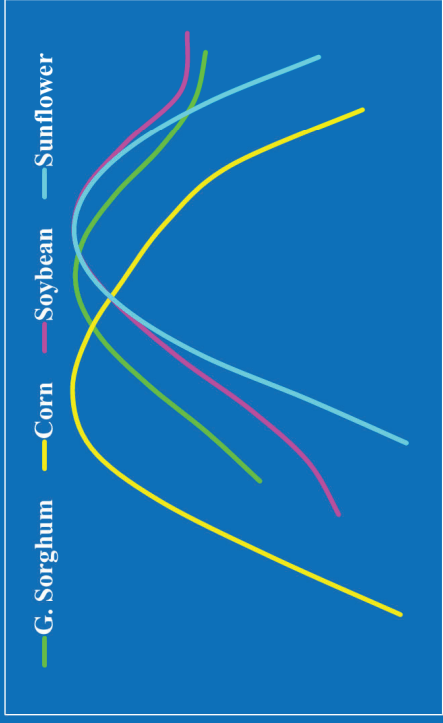


2. EVALUATE OPPORTUNITIES FOR BETTER WATER USE

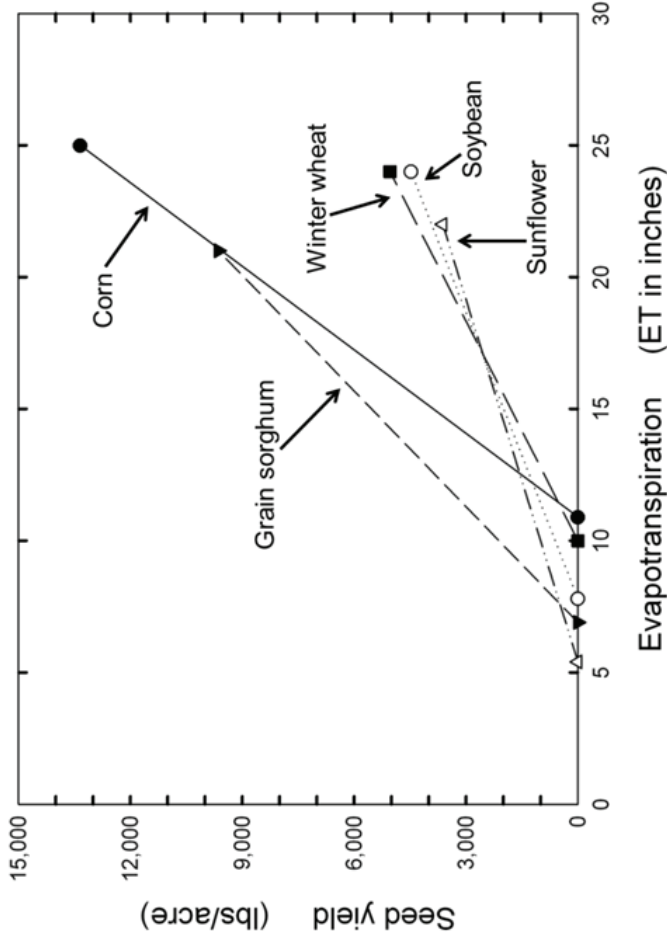
- Create All-Farm Water Use spreadsheet
- Group water use by crop
- Focus on yield per unit water used (bu/ac-in) or crop water use efficiency (WUE)

Peak Water Use Timing

Daily Water Use
(Fraction of Total)

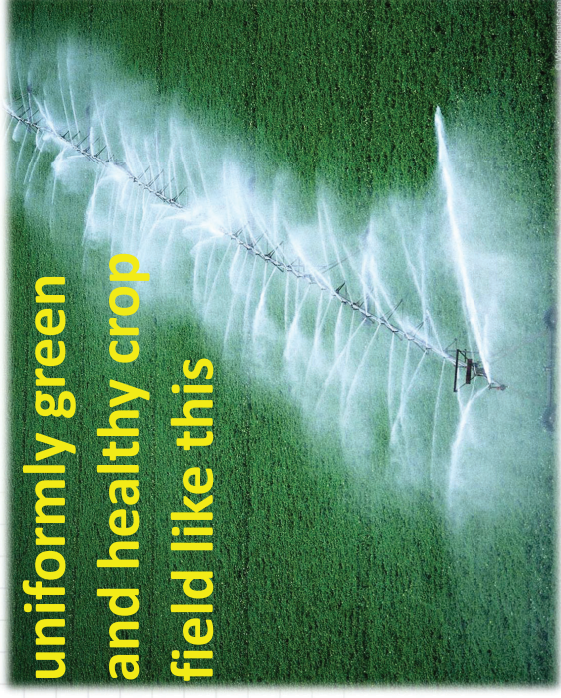


Crop Yield vs. ET Relationships



Ideally, maybe we would like to see

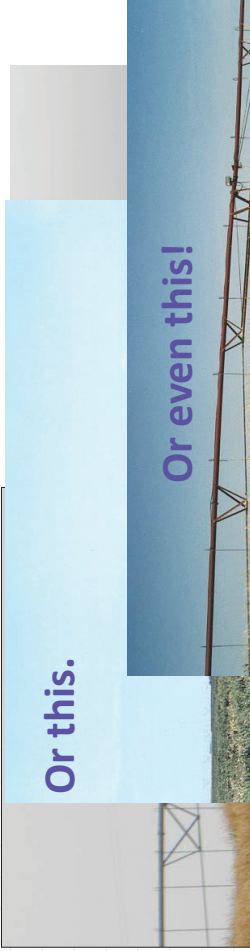
uniformly green
and healthy crop
field like this



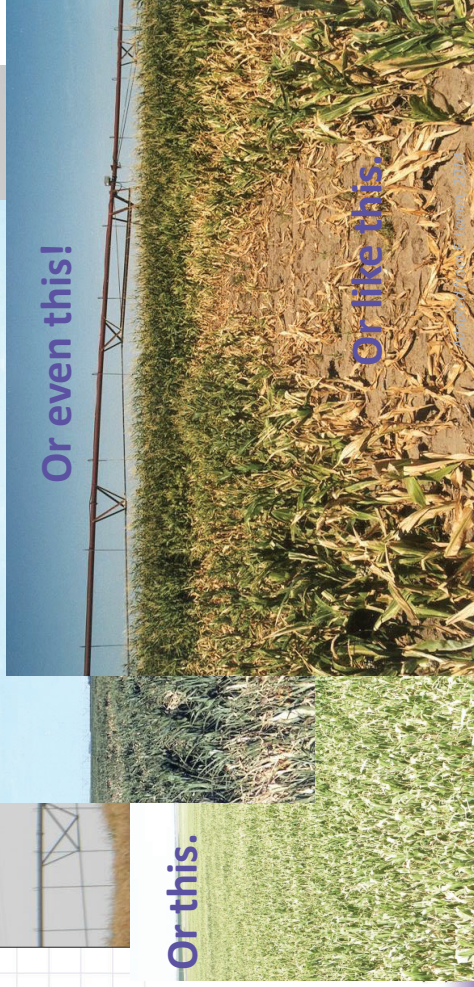
3. APPLY WATER EVENLY IN THE FIELD

- Maintain End Tower pressure 5 psi more than regulator setting
- Monitor center pivot end tower pressure (e.g. Ag Sense, FieldNet, Field Wise, etc.)
- Evaluate the seasonal graph of pressure and position (psi vs. angle 0-360)
- Use Aerial imagery to monitor for crop development and sprinkler patterns, soil challenges, fertility issues, runoff, excess rain, etc.
- Increase last 3 sprinkler flow rates on overhang to apply water more evenly after removing end-gun
- Close the drain hoses at the end of the tower when running, and add purge valve if needed
- Avoid using butterfly valve at pump discharge

But often, we saw irrigated fields like this



Or this.



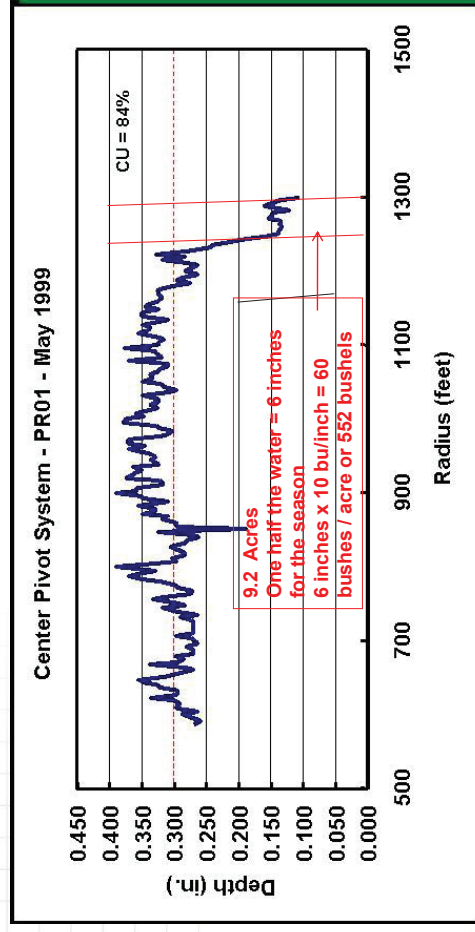
Or this.

Or like this.

- Use proper nozzle spacing (not more than twice corn row width)
- Use appropriate proper nozzle height (e.g., 2 or 7 ft, but not corn ear height)
- Use residue management
- Use circular rows

If runoff or uniformity problems continue, permanently raise nozzles above the crop canopy.

Center Pivot with un-installed nozzle and under sized orifices at outer edge.



IRRIGATION APPLICATION SYMMETRY

In the extreme drought years of 2000 to 2003 that occurred in the U. S. Central Great Plains, even small amounts of surface water movement affected sprinkler-irrigated corn production.



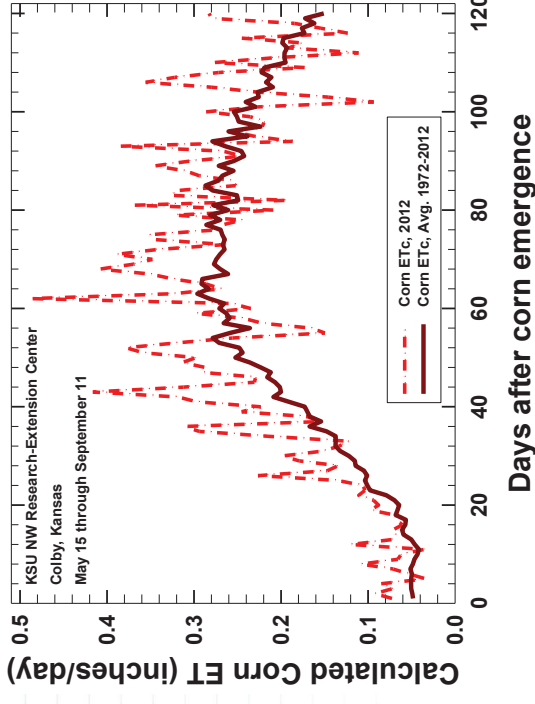
Large differences in corn plant height and ear size for in-canopy sprinkler application over a short 10-ft. distance (4 crop rows) as caused by small field microrelief differences and the resulting surface water movement during an extreme drought year, Colby, Kansas, 2002.

100% MAX

IRRIGATION MANAGEMENT



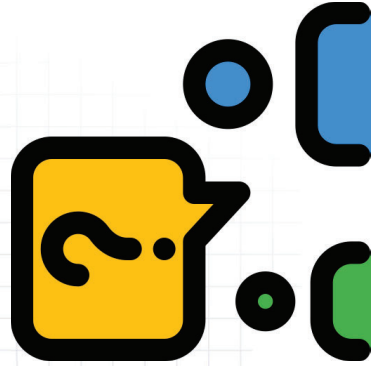
Not all days were created equal



Average daily corn ET (water use) at Colby, Kansas in 2012 was 16% greater than the long term average and on some days was nearly twice the average value.

Most regional irrigation systems are designed at less than 0.25 inches/day, and did not cope well at critical growth stages with such large increases in daily ET.

KNOWLEDGE CHECK: IF DROUGHT IS IMMINENT AND YOU CANNOT CATCH- UP WITH ET, DO YOU CONTINUE IRRIGATING THE WHOLE CIRCLE OR JUST FOCUS IT ON HALF THE CIRCLE?



4. SOAK IT IN WHERE IT IS PLACED

- Improve infiltration at soil surface
- Increase wetted footprint where you see runoff (e.g., overhead sprinklers = 80 ft. vs. bubblers = 3 ft. wetted diameter); Use moving plates and space drops closer together whenever possible
- Use other practices such as cover crops, green manure crops, and dammer-diking to reduce runoff
- Minimize big droplets-impact erosion at soil surface
- Use outrigger booms at towers and overhang to increase wetted footprint
- In many cases do not go below 10 psi regulators to maintain moderate droplet size
- Use truss rod hose clips to widen wetted footprint

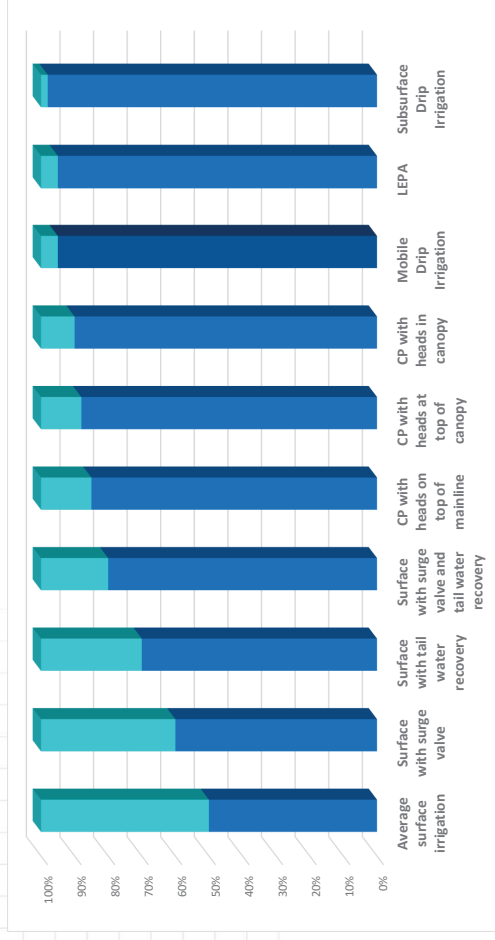
Off-season adjustments

- Increase irrigation system efficiency and/or uniformity



Each of these systems can be very efficient and uniform, but many producers find moving from left to right improves their own water management.

The Race for 100% Efficiency

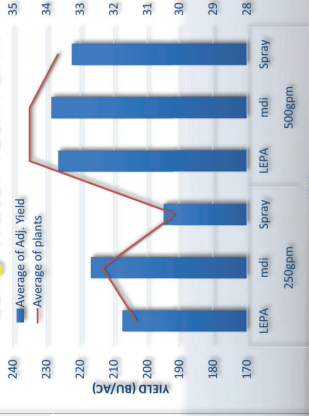


Water Tech Farms Data

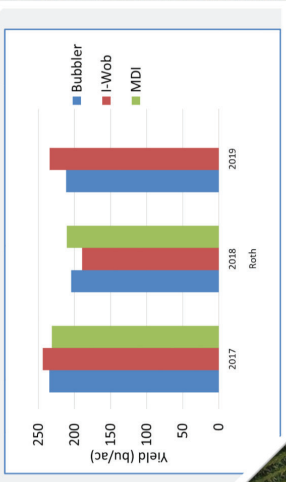
2018 ILS Farm Data

FIELD	TREATMENT	YIELD (Combine) (BU/AC)	YIELD (Hand) (BU/AC)	IRRGN APPLIED (IN)	WATER USE EFFICIENCY (BU/AC-IN)
NORTH 1G	ALL	234	244	13.1	18.6Z
	MDI (70%)	231	243	9.8	24.8
	MDI (80%)	249	237	11.2	21.2
SOUTH 15	SPRAY (100%)	232	259	14.0	18.5
	SPRAY	237	237	15.3	15.5

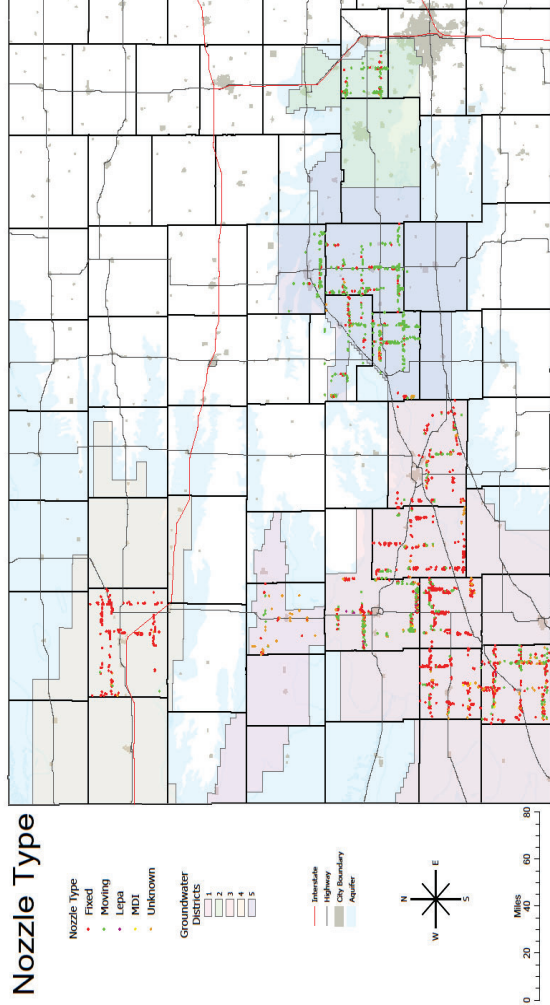
Long Water Tech Farm



Roth / GC Co. Farm



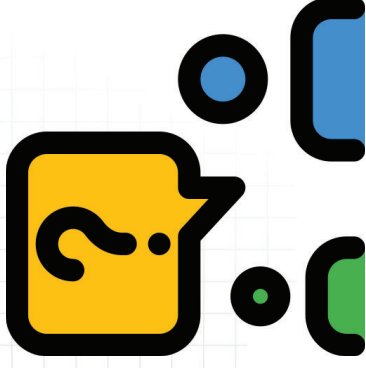
Center Pivot Survey



Irrigation System Capacity (GPM) Required to Supply 0.25 inches/day at Various Efficiency and Acreage

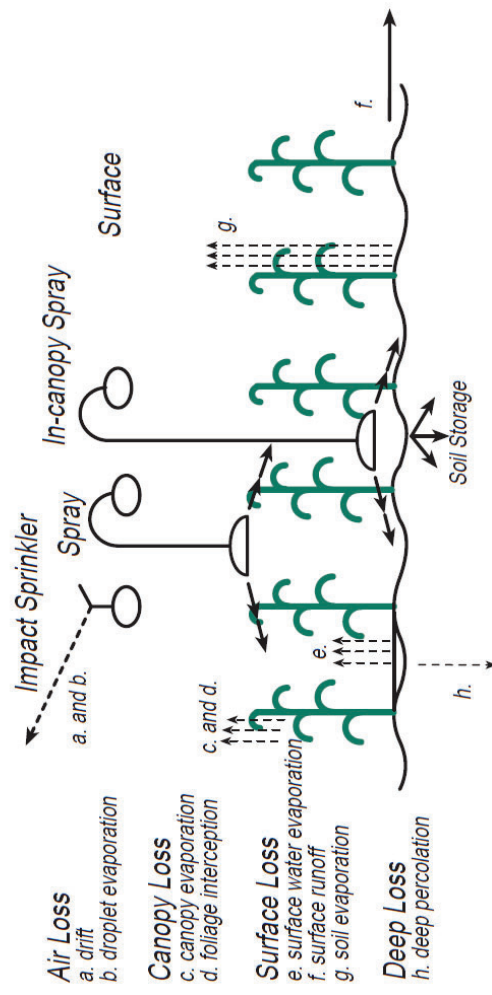
Irrigated System Efficiency	Acres Irrigated		
	1	128	160
100%	4.69	600	750
90%	5.21	667	833
80%	5.86	760	938
70%	6.70	857	1071
60%	7.81	1000	1250
50%	9.38	1200	1500

KNOWLEDGE CHECK:
IRRIGATION EFFICIENCY
IS A FIXED VALUE.
TRUE OR FALSE?



Myth: Irrigation efficiency is a fixed value

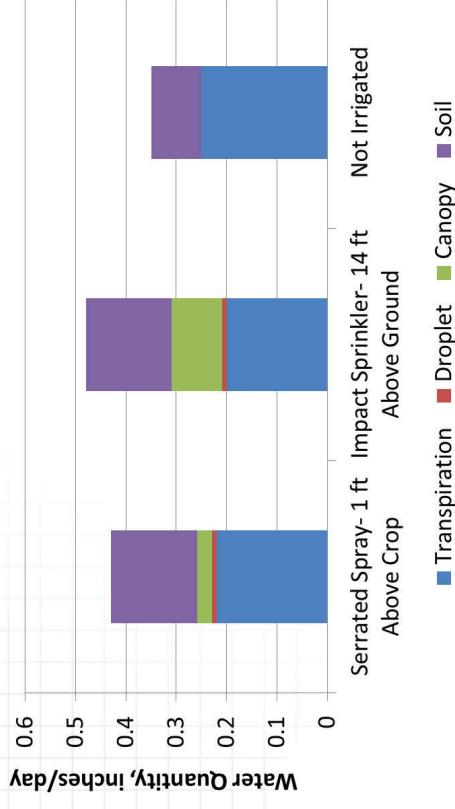
Center Pivot Sprinkler Package Potential Water Losses



5. SLOW PIVOT DOWN TO APPLY 0.8-1.2-IN. DEPTH IRRIGATIONS IF POSSIBLE UNLESS SIGNIFICANT RUNOFF OCCURS OR IN VERY SANDY SOILS

- a. Improve portion of irrigation water entering root zone (application efficiency) by reducing "Service Factor" (i.e. loss of E on ET; can be ~0.17 in.) per irrigation event
- b. Consider 3-4 days irrigation frequency, unless sandy soils, then 2-2.5 days

Evaporative Losses for Impact and Spray Devices



Wichita, KS: 1992, 90 F, 15 mph, dry Thompson, et al. (1997)

Example of effect of application depth on efficiency

Water Loss Component	1 inch applied	1 inch applied	0.75 inch applied	1.25 inch applied
Air evaporation and drift	0.02	0.02	0.02	0.02
Net canopy evaporation	0.08	0.08	0.08	0.08
Plant interception	0.07	0.07	0.07	0.07
Evaporation from the soil	Small	Small	Small	Small
Deep percolation	None	None	None	None
Run off	None	0.10	None	None
Total Water Loss	0.17	0.27	0.17	0.17
Efficiency %	83	73	77.3	86.4

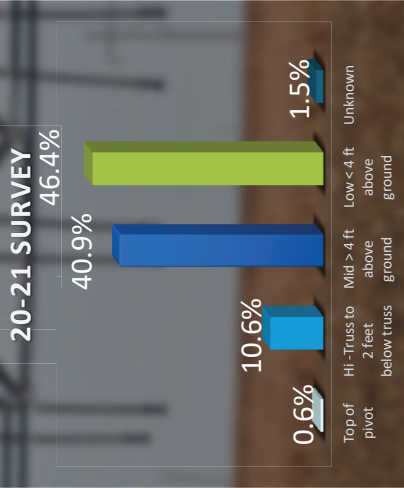
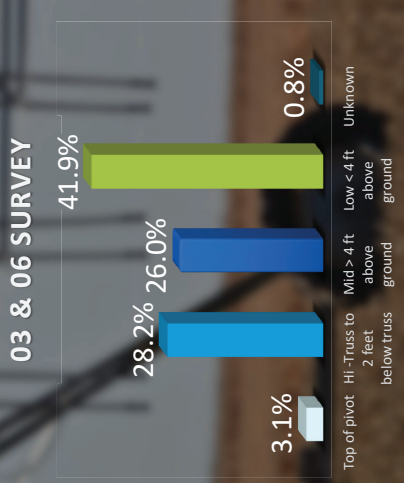
Any Service Fee*

Cooling, Heating,
Plumbing,
Electrical, Appliance

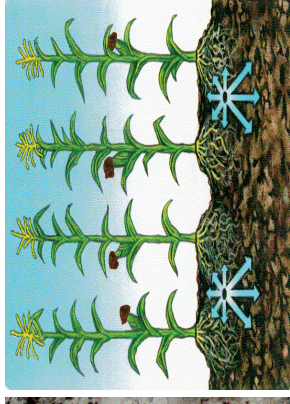
*Excludes service fees on Home Warranty or Bronze, Silver, or Gold Agreements. Not valid with any other offer.

0.17 in.
PER IRRGN
EVENT

Nozzle/Drop Height

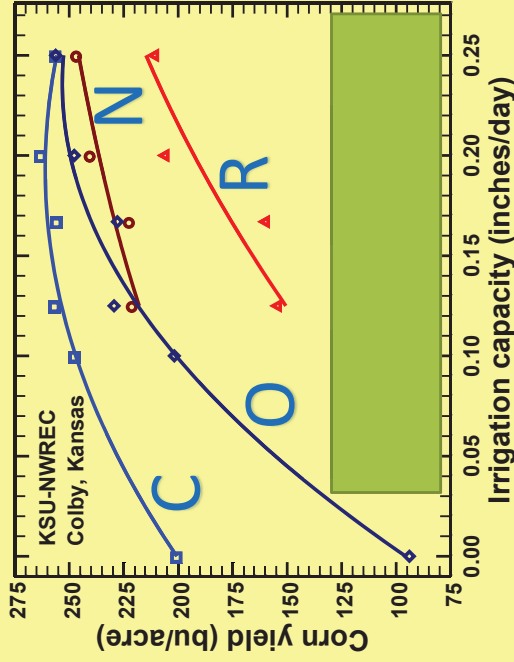


Subsurface drip irrigation (SDI) applies water below the soil surface to the crop root zone with small emission points (emitters) that are in a series of plastic lines typically spaced between alternate pairs of crop rows.



sdi

Does SDI really increase crop per drop?



There is growing evidence that subsurface drip irrigation (SDI) can stabilize yields at a greater level with less irrigation than **in-canopy sprinklers**.

SDI can be used for small, frequent, just-in-time irrigation applications directly to crop root system.

The primary ways that SDI could increase crop water productivity (WP), *More crop per drop* are:

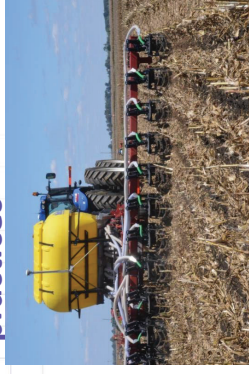
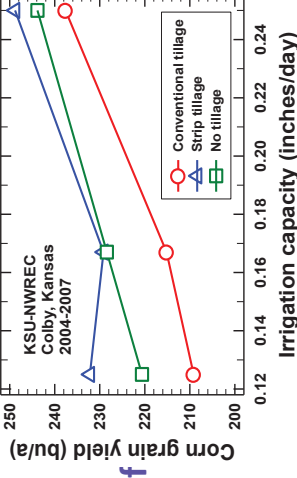
- Reduction and/or elimination of deep drainage, irrigation runoff, and soil water evaporation
- Improved infiltration, storage, and use of precipitation
- Improved in-field uniformity and targeting of plant root zone
- Improved crop health, growth, yield, and quality

6. MAKE BETTER USE OF RAINFALL

- Measure rain at field. Use tipping rain gauge with telemetry if possible
- After a rain event, re-establish moisture lag of 2-4 day irrigation cycle through progressive watering (i.e., move fast when starting then gradually slow down [in incremental pies] to finish the cycle)
- If conditions allow, hold off irrigation if high probability of rainfall is in the forecast

Off-season adjustments

Reduction of tillage increases yields.



Great adoption of strip tillage



Increasing adoption of reduced or no tillage planting

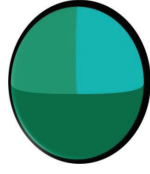
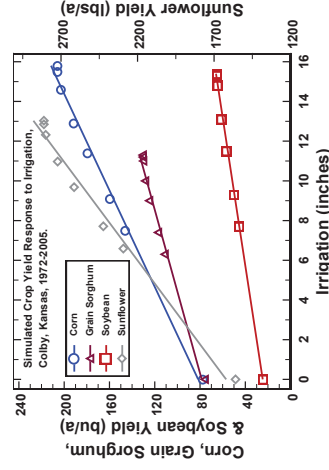
Adopted from F. Lamm, 2014

Off-season adjustments

- Increase irrigation efficiency and/or uniformity
- Adopt irrigation scheduling
- Improve management of precipitation and soil water through cultural practices
- Change crops or mixture of irrigated crops



Center pivot with multiple crops.



K-State software that helps with decisions

Irrigation Scheduling

21st century definition (Lamm, et al. 2014):

Process of delaying any unnecessary irrigation with the hope that the cropping season will end before the next irrigation is needed.

7. PROPERLY SCHEDULE YOUR IRRIGATION

- a. Use the same start/stop position near pivot road
- b. Use a checkbook budget like KanSched and Autonomous Pivot, to determine when to irrigate and how much
- c. Use Soil Moisture or Plant Based sensors with Telemetry to “close the loop”
 1. Install on “start” side of pivot start/stop position
 2. Install on soil type with lower water holding capacity, if prevalent

Irrigation Scheduling

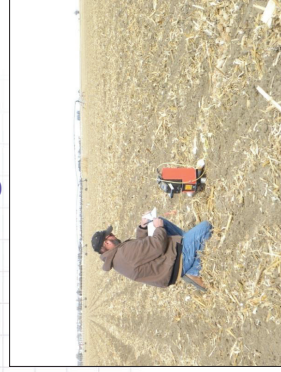
Definition:

Process of determining when to irrigate and how much water should be applied.

Let's call this a 20th century definition

Off-season adjustments

- Increase irrigation efficiency and/or uniformity
- Adopt irrigation scheduling



Monitoring available soil water

KanSched
Mobile Irrigation Lab

Lots of good science-based methods are available now



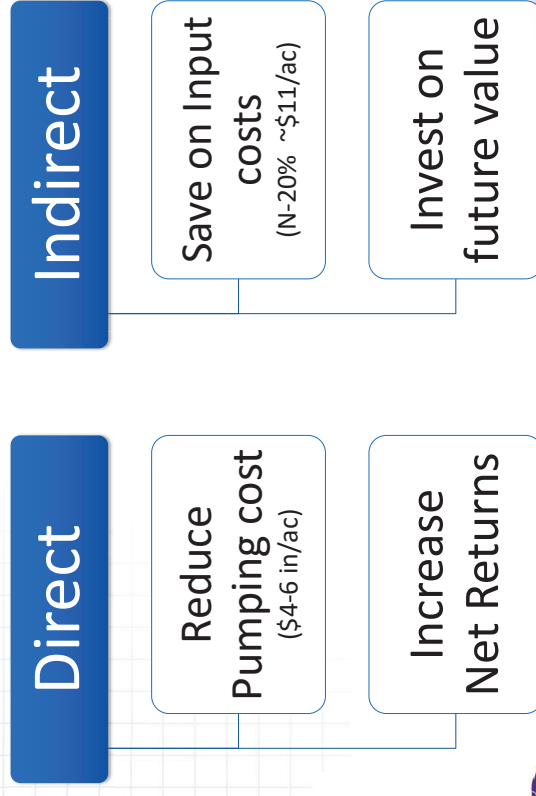
Infrared thermometers to monitor plant water stress

and more are on the way!!

We do need to improve adoption rates!!

Adapted from F. Lamm, 2014

THE VALUE OF SCHEDULING





KNOWLEDGE CHECK:
WHAT IS THE BEST
FEEDBACK TO SCHEDULE
YOUR IRRIGATION:
A) WEATHER-BASED
B) SOIL-BASED
C) PLANT-BASED
D) ANY TWO
E) ALL OF THE THREE

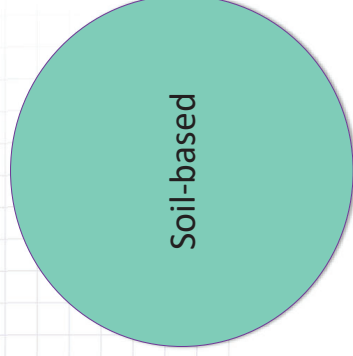


Irrigation Scheduling Tools



- KanSched
- ET Gauge/Atmometer
- Checkbook method
- DIEM - TX
- WISE - CO
- *K-State Mesonet*
- *FRET - NOAA*

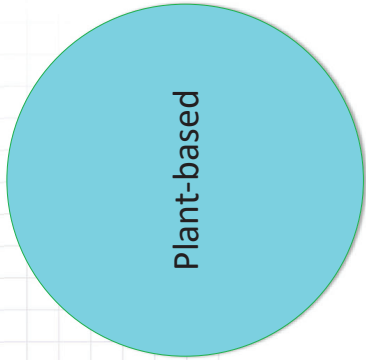
Irrigation Scheduling Tools



- Gravimetric
- Tensiometer
- Soil Water Potential
- Neutron count
- Electrical Resistance
- Electromagnetic
- Hand probe / feel

Irrigation Scheduling Tools

- Infrared / Thermal Camera
- Dendrometer
- Micro-tensiometer
- Osmotic/water potential
- NDVI/Aerial Imagery
- Visual



Plant-based

IRRIGATION SCHEDULING Starts by knowing what you have to manage



KanSched
Mobile Irrigation Lab

FIELD: SLAN2

Home Groups • Background Setup Budget Chart Notes Summary

Unmasquerade My account Log out

Growth Details

Stage: Emergence

Crop canopy exceeds 10% of the field

Crop canopy exceeds 70% of the field

Initial maturation of the crop

End of the growing season

Soil Layer Details

Soil Type: Loamy Sand

Percentage Profile: 100

Field Capacity: 0.18

Permanent Wilt: 0.07

Budget Details

Reference ET: 26.38 inches

Crop ET: 21.38 inches

Rain: 12.23 inches

Effective Rain: 6.06 inches

Gross Irrigation: 16.88 inches

Net Irrigation: 14.35 inches

Soil Water

From: To:

Legend: Permanent Wilt (orange line), Field Capacity (red line), MAD (blue line), Soil Water (green line), Rain (purple triangles), Irrigation (blue triangles)

Soil Details

Initial Root Depth: 6 inches

Maximum Root Depth: 32 inches

Yield: 215 bu/ac

Water Use Eff.: 11.6 bu/ac-in

Budget Details

Reference ET: 26.38 inches

Crop ET: 21.38 inches

Rain: 12.23 inches

Effective Rain: 6.06 inches

Gross Irrigation: 16.88 inches

Net Irrigation: 14.35 inches

Soil Details

Initial Soil Water: 80%

Initial Root Depth: 6 inches

Maximum Root Depth: 32 inches

Yield: 240 bu/ac

Water Use Eff.: 13.6 bu/ac-in

Budget Details

Reference ET: 26.15 inches

Crop ET: 20.80 inches

Rain: 22.43 inches

Effective Rain: 6.40 inches

Gross Irrigation: 17.70 inches

Net Irrigation: 15.05 inches

Advanced Details

MAD: 50%

Irrigation System Efficiency: 85%

Rainfall Discount: 0.00 inches

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FIELD: CSE10

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Growth Details

Stage: Emergence

Crop canopy exceeds 10% of the field

Crop canopy exceeds 70% of the field

Initial maturation of the crop

End of the growing season

Soil Layer Details

Soil Type: Fine Sandy Loam

Percentage Profile: 100

Field Capacity: 0.3

Permanent Wilt: 0.13

Budget Details

Reference ET: 26.15 inches

Crop ET: 20.80 inches

Rain: 22.43 inches

Effective Rain: 6.40 inches

Gross Irrigation: 17.70 inches

Net Irrigation: 15.05 inches

Soil Water

From: To:

Legend: Permanent Wilt (orange line), Field Capacity (red line), MAD (blue line), Soil Water (green line), Rain (purple triangles), Irrigation (blue triangles)

Soil Details

Initial Soil Water: 80%

Initial Root Depth: 6 inches

Maximum Root Depth: 32 inches

Yield: 240 bu/ac

Water Use Eff.: 13.6 bu/ac-in

Budget Details

Reference ET: 26.15 inches

Crop ET: 20.80 inches

Rain: 22.43 inches

Effective Rain: 6.40 inches

Gross Irrigation: 17.70 inches

Net Irrigation: 15.05 inches

Advanced Details

MAD: 50%

Irrigation System Efficiency: 85%

Rainfall Discount: 0.00 inches

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FIELD: DNUM2

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Growth Details

Stage: Emergence

- Crop canopy exceeds 10%
- Crop canopy exceeds 70%
- Initial maturation of the crop
- End of the growing season

Soil Layer Details

Soil Type: Fine Sandy Loam
 Percentage Profile: 100
 Field Capacity: 0.3
 Permanent Wilts: 0.13

Budget Details

Reference EIT: 25.85 Inches
 Crop ET: 20.61 Inches
 Rain: 14.63 Inches
 Effective Rain: 9.14 Inches
 Gross Irrigation: 11.84 Inches
 Net Irrigation: 10.06 Inches

Soil Details

Initial Soil Water: 90%
 Initial Root Depth: 6 Inches
 Maximum Root Depth: 32 Inches
 Yield: 181 bu/ac
 Water Use Eff.: 13.4 bu/ac-in

Advanced Details

MAD: 50%
 Irrigation System Efficiency: 85%
 Rainfall Discount: 0.00 Inches

Soil Water

Soil Water (Inches) vs. Date (05/28 to 09/03). Legend: Permanent Wilts (red), Field Capacity (orange), MAD (blue), Rain (green), Soil Water (purple).

Yield: 181 bu/ac
 Water Use Eff.: 13.4 bu/ac-in

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Soil Moisture Sensor Demonstration Videos

Up next

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Salih Taghvaiean, PhD
 Assistant Professor of Irrigation, Soils, and Water Quality

342 Views | 07/7/3:58

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OSIStandASNR
 Published on May 5, 2017

Salih Taghvaiean, PhD and Jonathan Amador, PhD discuss the soil moisture sensor demonstration.

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Up next:

- Sentek Sensors: OSIStandASNR, 144 Views
- Acclima and Campbell Scientific Sensors: OSIStandASNR, 172 Views
- Aquasys Sensors: OSIStandASNR, 328 Views
- Installing Soil Moisture Sensors: UNL CropWatch, 5.6K Views
- Heretau Sensors: OSIStandASNR, 211 Views
- Watermark sensor (with installation tube) & handmeter: OSIStandASNR, 4K Views

TIPS on selecting soil water sensor

OgallalaWater.org

Soil Moisture Monitoring

What are the available options in soil moisture monitoring?
 One way soil moisture can be determined is by weighing a soil sample and calculating the difference in weight to determine the moisture level. This is the gravimetric method, and it is the most accurate method for determining soil moisture. However, this method is labor-intensive and not practical for large-scale monitoring. Other methods for estimating soil moisture, such as neutron moderation, have been developed to estimate soil water levels. These technologies vary in their accuracy, cost, and ease of use. Some are more suitable for large-scale monitoring, while others are better suited for smaller-scale or research applications. (Burdette et al., 2017).

What are some recent improvements in soil moisture sensors? Considerable improvements have occurred recently in data processing, data storage, and sensor design. These improvements have led to the development of more accurate, reliable, and cost-effective sensors. Additionally, the integration of sensors with wireless communication technologies has enabled real-time data collection and analysis. (Burdette et al., 2017). Another notable advancement in soil moisture monitoring is the development of sensors that can measure soil moisture in real-time and provide immediate feedback to the user. These sensors are often used in precision agriculture to optimize irrigation and reduce water waste. (Burdette et al., 2017). 2019 | OgallalaWater.org Ogallala Water CAP Resource Guide Series 2019 | OgallalaWater.org Research and Extension

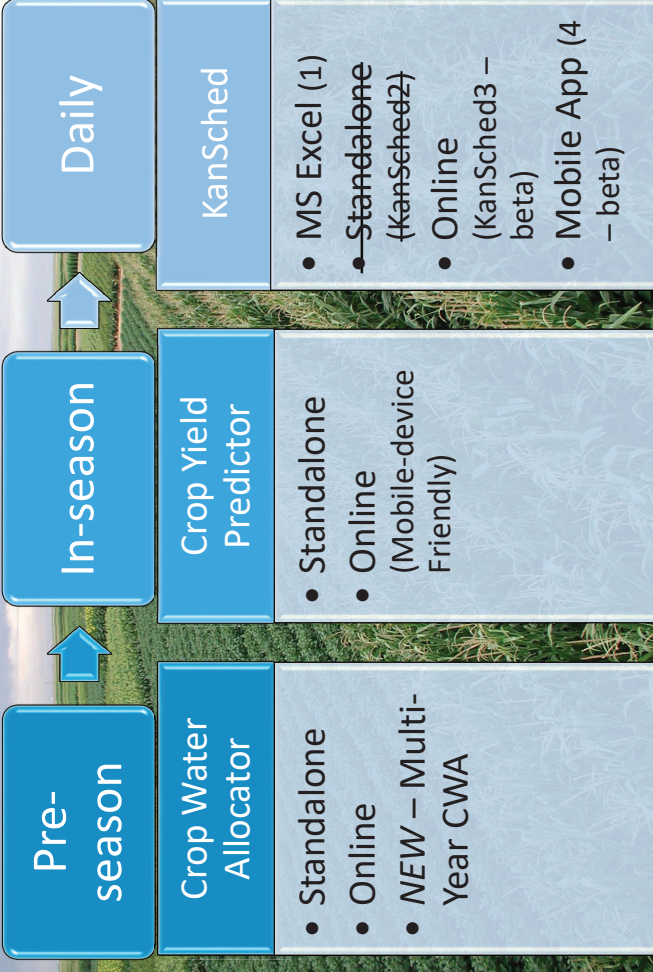
Seven Points to Consider

1. Keep irrigation system at optimum condition
2. Evaluate opportunities to be better
3. Apply water evenly in the field
4. Soak the water in where it is placed
5. Slow down pivot speed
6. Make better use of rainfall
7. Properly schedule your irrigation

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Suite of Management Tools



Mobile Irrigation Lab
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Home Resources Goals of the MIL Software Online Tools The MIL Team Contact Us

Welcome to the Mobile Irrigation Lab

Education
Applied Research
Technical Assistance
Management Support

Software Links

- Crop Water Allocator
- Crop Yield Predictor
- KanSched for Excel
- KanSched2
- SWREC ET Data
- INWREC ET Data
- FuelCost
- Subsurface Drip
- Irrigation Scheduling
- Pocket PC Software
- Quiz Master

Online Tools

- Crop Water Allocator
- Crop Yield Predictor
- KanSched3
- Compare Energy Costs
- FuelCost Online

WELCOME!

This web site provides information on the activities of the Mobile Irrigation Lab and to provide free software and media downloads, technical bulletins and links to other useful resources to assist in irrigation management and cropping system strategies.

Consider this your ONE-STOP SHOP for WATER and IRRIGATION MANAGEMENT NEEDS.

Featured Software!
MULTI-YEAR CROP WATER ALLOCATOR !!!

CLICK HERE

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CROP WATER ALLOCATOR

The Crop Water Allocator (CWA) is a tool to evaluate strategies to allocate limited irrigation on selected crops based on economic returns. It was developed by Kansas State University's Southwest Research-Extension Center, Department of Agronomy, Department of Biological and Agricultural Engineering, and Department of Agricultural Economics with programming support from Sprout Software. The project was funded in part by the Ogallala Aquifer Program, a consortium of the USDA Agricultural Research Service, Kansas State University, Texas AgriLife Research, Texas AgriLife Extension Service, Texas Tech University, and West Texas A&M University.

Neither the programmers nor Kansas State University are to be held responsible for the information generated from this program.

Start

Close

Field and Location Information

Acres: 130
Annual Rainfall: 18 inches
Land Split: 100
Multiple Year Run:
Total Water Allocation: 60 inches

Irrigation Information

Discharge Rate: 475 GPM
Pumping Lift: 200 ft
Efficiency: 90 %
Fuel: \$2.35 /gal
Repairs & Maint: 0.33 per ac-in

Field and Location Information

Soil type: Silt Loam
Applied Irrigation: 18 inches
Total Years: 5 years
Allow Non-irrigation:

Irrigation Costs Subtotal
\$6.36/ac-in
*not including labor costs

Calculate

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Price per unit:

Crop	Price per unit	Unit
Alfalfa	0.50	/lb.
Corn	3.72	\$/bu.
Sorghum	3.13	\$/bu.
Soybean	7.81	\$/bu.
Sunflower	0.2	\$/lb.
Wheat	4.11	\$/bu.
(fallow)		

Maximum Yield / Acre

Crop	Maximum Yield / Acre
Corn	220 bushels
Sorghum	140 bushels
Soybean	65 bushels
Sunflower	3500 pounds
Wheat	70 bushels
(fallow)	

General Input Costs

Item	Rate	Unit
Nitrogen	1.35	lb/ac
Phosphorus	0.45	lb/ac
Seed	3.00	seeds/ac
Herbicide	51.00	/acre
Insecticide	19.07	/acre
Subtotal	70.07	/acre

Harvesting Costs

Item	Rate	Unit
Base Charge	29.82	/acre
Extra charge for yields exceeding 69 bushels	0.21	/bu.
Hauling	0.21	/bu.
Subtotal	59.30	/acre

Price Maximum per unit:

Crop	Price Maximum per unit	Unit
Alfalfa	0.50	/lb.
Corn	3.72	\$/bu.
Sorghum	3.13	\$/bu.
Soybean	7.81	\$/bu.
Sunflower	0.2	\$/lb.
Wheat	4.11	\$/bu.
(fallow)		

Rank Year Acres

Rank	Year	Acres	Crop	Yield / Acre	Irrig. applied inches	Op. Costs \$/acre	Returns \$/acre	Annual Net RTN \$/acre	Multi-year Ave. Net RTN \$/acre
1	1	130.0	Corn	202.1 bu.	14.0	693	752	\$59	
2	1	30.0	Corn	176.1 bu.	11.0	600	655	\$55	
3	1	30.0	Corn	176.1 bu.	11.0	600	655	\$55	+56
4	1	30.0	Corn	176.1 bu.	11.0	600	655	\$55	
5	1	30.0	Corn	176.1 bu.	11.0	600	655	\$55	
1	2	130.0	Corn	202.1 bu.	14.0	693	752	\$59	
2	2	30.0	Corn	176.1 bu.	11.0	600	655	\$55	
3	2	30.0	Corn	176.1 bu.	11.0	600	655	\$55	+39
4	2	30.0	Corn	176.1 bu.	11.0	600	655	\$55	
5	2	30.0	Corn	176.1 bu.	11.0	600	655	\$55	
1	3	130.0	Wheat	61.5 bu.	9.0	627	353	\$-45	
1	3	30.0	Corn	202.1 bu.	14.0	693	752	\$59	
2	3	30.0	Corn	176.1 bu.	11.0	600	655	\$55	
3	3	30.0	Corn	176.1 bu.	11.0	600	655	\$55	+37
4	3	30.0	Corn	176.1 bu.	11.0	600	655	\$55	
5	3	30.0	Corn	176.1 bu.	11.0	600	655	\$55	
1	4	130.0	Sorghum	124.6 bu.	11.0	424	390	\$-34	
2	4	30.0	Sorghum	119.9 bu.	10.0	411	375	\$-35	
3	4	30.0	Corn	202.1 bu.	14.0	693	752	\$59	
4	4	30.0	Corn	176.1 bu.	11.0	600	655	\$55	
5	4	30.0	Corn	176.1 bu.	11.0	600	655	\$55	+21

Acknowledgment

- Kansas Water Office
- USDA OAP
- Kansas Water Office
- *Private industry:* Dragon-line, Netafim, Servitech, Monsanto, and more
- Kansas Corn Commission
- K-State Global Food System
- USDA NRCS Conservation Innovation Grant
- USDA-NIFA





THANK YOU

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