



# **2013 Cropping Strategies: Split-Pivot Systems to Reduce and Spread Immediate Water Demand**

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# Contents of this PowerPoint



- Key Pointers for Irrigation
- Split Pivot Scenarios for the Texas South Plains
  - Purpose of split pivots—minimize water demand of a full circle
  - Suggestions for managing scenarios (planting date, maturity of hybrid, time of peak water requirement for cotton/sorghum, corn/sorghum, cotton/sunflower, peanut/sorghum)
- Irrigation tips for cotton and grain sorghum

## Nitrates in Irrigation Water: An Asset for Crop Production

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Naturally occurring nitrogen in the form of nitrate in irrigation water helps meet crop N requirements and reduces fertilizer cost for crop production. This nitrogen may be expressed as  $\text{NO}_3$ ,  $\text{NO}_3\text{-N}$ , or nitrate-nitrogen—all actual nitrogen. This nitrogen is free and is readily available to the crop. It should be credited 100 percent toward crop needs if applied just before or during crop growth.

This N in irrigation water can:

- Supply varying amounts of timely N during the growing season;
- Be available to the crop immediately;
- Reduce the amount of N fertilizer the producer must buy;
- Be credited toward crop nitrogen needs as a sound economic and agronomic practice;
- Reduce excess nitrates from entering groundwater from percolation or runoff.

### Nitrate content in Texas irrigation waters

Though some waters used for irrigation in Texas contain 20 to 50 ppm nitrate-N, most average 3 to 10 parts per million (ppm) nitrate-N (Fig. 1). Regions that tend to have irrigation water with higher nitrate-N include:

- South of San Antonio
- East of Midland-Odessa and north through most of the Texas South Plains

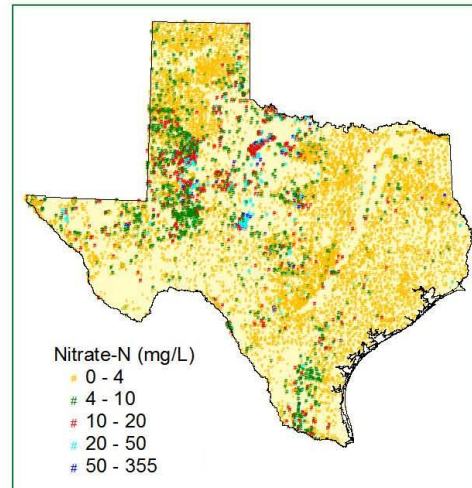


Figure 1. Distribution of  $\text{NO}_3\text{-N}$  in groundwater in Texas (Texas Water Development Board Data)

- Several areas in the Texas Rolling Plains aquifers, especially the Seymour Aquifer—the highest median nitrate-N among major aquifers in Texas

### Federal Drinking Water Standards

The public health drinking water standard set by the U.S. Environmental Protection Agency is expressed as 10 ppm  $\text{NO}_3\text{-N}$  or 10 mg/ml  $\text{NO}_3\text{-N}$ . A person who endures prolonged consumption of

# New from TX AgriLife

- Should  $\text{NO}_3\text{-N}$  in irrigation water be credited to crop requirement?
- Yes—fully!
- 7 ppm  $\text{NO}_3\text{-N}$  X 10" irrig. = 16 lbs. N/ac
- At \$0.60/lb., then \$9.60/acre
  - 0.3 bales of cotton
  - 800 lbs. of grain sorghum
  - 13 bushels of wheat

- “An irrigation lateral near Hereford, Texas. The field shown is now in alfalfa. Irrigation water comes from wells ranging in depth from 50 to 200 feet. An unlimited supply of water seems assured. Electric-powered and butane-powered pumps in this area usually have capacities of 1000 to 1500 gallons of water per minute. 50,000 acres of land in the county are now irrigated by this method with no measurable effect on the water level.”

12/18/1944



# Contributors



- Cotton irrigation, Jim Bordovsky (slides 20-26)
- Extension Agents: Kerry Siders (IPM, Hockley-Cochran); Monti Vandiver (IPM, Parmer-Bailey); Mark Brown (Ag., Lubbock)

# Key Pointers for Irrigation



# Cropping With Less Water



- Irrigating less vs. irrigating more efficiently—  
Over the past 20 years what we have accomplished is most likely the latter
- Texas Seed Trade Association newsletter reporting, Feb. 9, 2012: “Due to the new requirements of measuring and reporting irrigation water use it looks plain that most growers **use less water** than they believed and are better stewards of the resource than is commonly believed.” (HPWD staff).



# Remember Some Basics

- "A shiny steel shank is often a farmer's worst enemy."



M.B., Lubbock Co.

This represents tillage  
and moisture loss



# Three Rules for Moisture

**Catch it!**

**Keep it!**

**Reap it!**

- Not just for rainfall
- Applies to irrigation, too.



# Do you need to re-evaluate pre-plant irrigation?



- Water use efficiency of preplant irrigation is often very low, especially when using **spray mode** in contrast to LEPA drag socks with furrow dikes.
  - Efficiency may be as little as 20%, especially for early spring applications
  - Wetting the **entire** surface of the soil greatly diminishes efficiency

# Should You Be Using LEPA?



- Research documents well the advantages of increased water use efficiency
- Once the crop is established, at some point we can/should switch from spray used to establish the stand to low-set water application (especially drag hoses, also splash pads, etc.)
  - Sometimes we might need to switch back to nozzles for a period of time

# Should You Be Using LEPA?



- LEPA will wet about 40% of the soil surface, and none of the foliage—more water to the root zone.
  - Less evaporation from the soil
  - Water movement into the soil at least twice as far







# What About Furrow Diking?



- An “Old” technique
  - “Oh, furrow diking is so 1960s!...”
  - But less useful (and less needed) if you are using conservation tillage/no-till
- Benefits are well documented in research
- Practice may be considered a nuisance, but it is still recommended
- Benefit some years more than others
  - Up to 150 lbs./A lint, 1,000 lbs./A sorghum in best years of benefit

# Irrigation Scheduling?

- Potential evapotranspiration?
  - Unfortunately the Texas AgriLife High Plains PET network was closed to the public due to lack of funding
- AquaSpy, other equipment
- Texas Alliance for Water Conservation irrigation tool, <http://tawcsolutions.org/>



# Overestimating Irrigation Capacity



- This gets us in trouble in years that have even 'average' rainfall...
- ...and we are too hopeful, too optimistic; and we delay much-needed decisions: *it's just got to rain soon!*

# Implications of Forthcoming Pumping Limits



- Think now, how will you farm with a 15" limit?—This might not be an issue for you if you don't have a lot of water anyway (or you are in an irrigation district that has not imposed limits).
- How to manage the contiguous acres provision, to get above 15"/year.
  - Should we even grow anything that requires this amount of annual irrigation?

# Implications of Forthcoming Pumping Limits



- Banking your 6" of water for use in future dry years (again, if this applies to you)
- What about required water meters and reporting water use? Does that seem intrusive?
  - Most producers who have used water meters have in fact found they are using less water than they thought AND the meters have proved to be a useful management tool.

# Minimum Irrigation GPM‡

Crop	Minimal	Good
Corn	3-4	4.5
Peanut	---	5.0
Alfalfa	5	7 to 8
Cotton	?	?
Grain Sorghum	?	?

*‡Mid- to late-season gallons per minute, not in May; this  
Allows for decrease in pumping capacity through season.*

# Range of Planting Dates

## (Lower South Plains)

Crop	Early‡	Late
Grain Sorghum	4/20	7/5 (medium) 7/15 (early)
Sunflower	4/10	Tier I, July 15 Tier II, July 22
Guar	5/10?	7/1
Sesame	5/10?	7/1
Black-eyed Pea	5/10?	7/10
Sorghum/sudan	4/15	Good, by early July Late forage, ~8/1

# Range of Planting Dates

## (Central South Plains†)

Crop	Early‡	Late
Grain Sorghum	4/25	6/30 (medium) 7/10 (early)
Sunflower	4/10	Tier I, July 10 Tier II, July 17
Guar	5/10?	7/1
Sesame	5/10?	7/1
Black-eyed Pea	5/10?	7/10
Sorghum/sudan	4/20	Good by early July; Late forage, ~8/1

†For 'Late' dates, use 5 days earlier for north/northwest South Plains, 5 days later for lower South Plains; ‡Relies on warm soils & favorable 7 to 10 day forecast.

# Range of Planting Dates

## (Northern South Plains)

Crop	Early‡	Late
Grain Sorghum	4/30	6/25 (medium) 7/5 (early)
Sunflower	4/15	Tier I, July 5 Tier II, July 12
Guar	5/10?	7/1
Sesame	5/10?	7/1
Black-eyed Pea	5/10?	7/5
Sorghum/sudan	~4/25	Good, by early July Late forage, ~8/1

‡Relies on warm soils & favorable 7 to 10 day forecast.



# Crop Water Use Patterns & Optimum Timing

- When water is limited, there are better times to get a bang for your irrigation buck?
- When do you get better potential yield response?
- If you can irrigate cotton, sorghum, sunflower say 4", when is the best time to do it (provided you can get to that point)?

# Split-Pivot Irrigation Scenarios



# Split Pivot Scenarios



- Pairing two irrigated crops
- What strategies can you consider?
- One crop is your main focus, the other may be managed in such a way that it 'goes dryland' if needed.

# Cotton/Sorghum, Split Pivot



- Two-crop/two planting date/split pivot scenarios
  - Early cotton, late June sorghum
  - Early sorghum, delayed cotton
  - Early sorghum, late sorghum same pivot
- The goal is to minimize or even eliminate the overlap of peak irrigation
  - Much if not most of the time you are only watering a half circle
- Check with Extension (Troastle) for an explanation of possible scenarios for your farm

# Cotton/Sorghum, Split Pivot



- Farmer consideration--splitting pivot with different crops requiring water at different times to reduce total irrigated acres at one time
- Which crop has main emphasis?
  - Cotton production, give it all you can?
  - Sorghum—you signed a pounds contract?—you have to spread your crop loss/low yield risk to ensure delivery of pounds of grain

# Shifts in Projected Dates



- A specific planting date for either cotton or grain sorghum does not mean cut-out or flowering will occur on a certain day or within a few days
- Heat unit accumulation drives physiological growth—it is potentially driven faster by heat
  - The same hybrid planted in late April will probably take 5-7 days longer to reach half bloom vs. plantings in June
  - But grain filling and maturation will likely then be quicker for the early planted grain sorghum

# Shifts in Projected Dates



- Early cool fall temps. can greatly slow growth
- It is not worth sickly or slow emergence on cotton or sorghum if it means you need to wait 5 days to early plant
  - The potential damage in a start in cold conditions is a greater risk than if irrigation or heat during flowering hit crop later
  - If temperatures are reasonable is there a major cold front in the next 5-7 days?



# ***Soil Temperatures & Fall Cool***

- Crops that can extend the production season and spread irrigation needs by planting early in cooler soils or matures better under cool and even frost conditions, can expand the window of opportunities for split-pivot irrigation scenarios
  - Early planting in cool soils: corn, sunflower (50°F minimum; cotton & grain sorghum, 62-65°F minimum)
  - Mature in cool/frost conditions: sunflower (28°F)
- Want to expand cropping season or minimize overlap irrigation more than these scenarios?  
**PLANT WHEAT**

# **Scurry/Howard/Dawson/Lynn/Terry**

## **Early Cotton, Late GS**



- Half pivot with cotton, planted ~May 5
  - Peak water use early July to mid-August
  - Physiological cut out (5 NAWF) by ~August 10?
  - Greatly reduce irrigation ~Aug. 20 if soil moisture is available, A&M data suggests little additional irrigation benefit esp. if some rain is received
- Consider medium maturity sorghum, ~4,500 lbs./A yield goal (6-8" irrigation)
  - about September 5
  - Back up 65-67 days (from 9/5)—plant ~July 1

# **Scurry/Howard/Dawson/Lynn/Terry**

## **Early Cotton, Late GS**



- Result: cotton is up to 3 weeks past cutout prior to sorghum flowering (~Sept. 5), and lower moisture requirement
- Sorghum enters peak water demand ~7 days after cotton cut out when cotton irrigation is greatly reduced
  - Sorghum maturity near October 10-15 with added potential of Sept. rainfall assisting yield
- Concentrate water to cotton early with 1-2 possible key waterings to sorghum prior to flowering (panicle differentiation, early boot)

# **Scurry/Howard/Dawson/Lynn/Terry**

## **Early GS, Delayed Cotton**



- Half pivot with medium-early sorghum, planted ~April 25
  - Medium-early hybrid, flower by June 25-30—peak water use is declining as cotton water needs rise rapidly
  - Maturity about first week of August with mid/late-August harvest
- Cotton planting delayed to May 15th
  - Physiological cut out ~Aug. 20<sup>th</sup>
  - Little overlap in peak irrigation needs
  - How strong is your water?

# Split Pivot Sorghum—2 Plantings

Dawson/Lynn/Terry Co., **Medium** Maturity



<u>Timing</u>	<u>Planting Date</u>	<u>Flower- ing</u>	<u>Maturity</u>	<u>Maximum Water Use</u>
Early	April 25	July 1-5	Aug. 5-10	6/15 to 7/10
Late	June 30	Sept. 5	Oct. 10-15	8/20 to 9/15

# **Hockley/Lubbock/Crosby/Floyd/Hale**

## **Early Cotton, Late GS**



- Half pivot with cotton, planted ~May 5
  - Peak water use early July to mid-late August
  - Physiological cut out (5 NAWF) around Aug. 15?
  - Reduce irrigation ~Aug. 25 if moisture is available, A&M data suggests little additional irrigation benefit esp. if some rain is received
- Consider medium-early maturity sorghum, ~4,500 lbs./A yield goal (6-8" irrigation)
  - "Schedule" flowering about September 1
  - Back up 60-62 days (from 9/1)—plant ~7/1

# Hockley/Lubbock/Crosby/Floyd/Hale

## Early Cotton, Late GS




- **Result:** cotton is up to 2 weeks past cutout and higher moisture requirement prior to sorghum flowering (~Sept. 1)
- Sorghum enters peak water demand about time of cotton cut out but before end of cotton irrigation
  - Sorghum maturity near October 5-10 with added potential of Sept. rainfall assisting yield
- Concentrate water to cotton early with 1-2 possible key waterings to sorghum prior to flowering (panicle differentiation, early boot)



# **Hockley/Lubbock/Crosby/Floyd/Hale**

## **Early GS, Delayed Cotton**



- Half pivot with medium-early sorghum, planted ~April 25 (watch soil temps. if cool)
  - Medium-early hybrid, flower by ~July 1—peak water use is declining as cotton water needs rise rapidly
  - Maturity about August 5<sup>th</sup> & harvest begins ~Aug. 20
- Cotton planting delayed to May 15
  - Physiological cut out ~Aug. 25<sup>th</sup>
  - Little overlap in peak irrigation needs
  - How strong is your water?

# Split Pivot Sorghum—2 Plantings

Hockley/LBB/Crosby/Floyd/Hale, **Medium** Maturity

<u>Timing</u>	<u>Planting Date</u>	<u>Flower- ing</u>	<u>Maturity</u>	<u>Maximum Water Use</u>
Early	4/25- 5/1	6/30- 7/7	Aug. 5-15	6/20 to 7/15
Late	June 25	~Sept. 1	~Oct. 5-10	8/15 to 9/10

# **Parmer/Castro/Bailey/Lamb/Cochran**

## **Early Cotton, Late G.S.**



- This is harder to separate irrigation of the two crops than to the south and east
- Half pivot cotton, planted ~May 10
  - Plant cotton earlier if you safely can due to soil temp.
  - Peak water use early July to late August
  - Cut out (5 NAWF) about August 20-25<sup>th</sup>?
- Consider medium-early maturity sorghum, ~5,000 lbs./A yield goal (6-8 irrigation)
  - “Schedule” flowering by ~Sept. 1st
  - Back up 60-62 days (from 9/1)—plant by June 30<sup>th</sup> (the cut-off for a medium-early maturity)

# **Parmer/Castro/Bailey/Lamb/Cochran**

## **Sorghum/Cotton**



- Result: cotton is about 1 week past cutout before sorghum flowering (~Sept. 1)
- Cotton cutout about 0-7 days after peak sorghum water demand begins
  - Sorghum maturity near October 5-10 (this is close to early frosts) with potential of Sept. rainfall assisting yield
- Concentrate water to cotton early with 2 possible key waterings to sorghum prior to flowering (panicle differentiation, boot)

# **Parmer/Castro/Bailey/Lamb/Cochran Early G.S. vs. May 10 Cotton**



- More separation in water use than late sorghum?
- Half pivot with sorghum, planted ~May 1
  - Medium-early hybrid, flower by ~July 4
  - Peak sorghum water demand reduces after July 10
- Can't advocate delaying cotton
- Half pivot cotton, planted ~May 10
  - Peak water use early July to late August
  - Cut out (5 NAWF) about August 20-25<sup>th</sup>?

# **Parmer/Castro/Bailey/Lamb**

## **Early Corn, Late Grain Sorghum**

- Half pivot 108- to 115-day relative maturity corn, planted ~April 15
  - Compare heat units requirements for specific hybrids
  - Peak water use ~V10 and especially from silking to past milk (through ~July 25); maintain good soil water to near ½ starch line
  - Don't cut the corn short...
- Consider medium maturity sorghum, ~5,000 lbs./A yield goal (6-8" of irrigation)
  - "Schedule" flowering by ~Sept. 1st
  - Back up 65-67 days (from 9/1)—plant by June 20-25<sup>th</sup> (the cut-off for a medium-early maturity is 6/25)

# **Parmer/Castro/Bailey/Lamb**

## **Early Corn, Late Grain Sorghum**

- Result: half circle of corn is essentially fully irrigated, but for grain sorghum
  - One watering to establish stand (late June)
  - Before corn is finished, a possible second water ~4 weeks after planting in advance of growing point differentiation (increase spikelet & seeds per spikelet set)
- Grain sorghum maturity by ~Oct. 10 (this is close to early freezes) with potential of Sept. rainfall assisting yield
  - Modest population for grain sorghum to better prepare the crop to wait until after corn irrigation is completed

# Corn & Sorghum Scenarios



- Merging the corn and sorghum cropping systems
- Assume corn is primary crop; sorghum should **complement** corn, and not detract from corn's irrigation requirement
  - This affords you opportunity to grow 60 acres (if pivot is split in half) of well-irrigated corn where your management skill is fully in play vs. having your hands tied trying to irrigate 120 acres of corn
- Remember that corn has more flexibility in these scenarios as there are a better choice of hybrid maturities
- We do not recommend any sorghum scenario with longer than medium maturity
  - Pioneer 84G62, 84P80, other companies' medium-longs have greater yield potential but a) these increase overlap of irrigation & water demand, b) are a reduced fit to limited irrigation



# Split Pivot Corn—2 Planting Dates

Northwest Texas South Plains

Early Planting, **110-day** Maturity/Late Planting **100-Day** Maturity

<u>Planting Timing</u>	<u>Planting Date</u>	<u>Silking</u>	<u>Maturity</u>	<u>Maximum Water Use</u>
Early	April 15	~July 1	~Aug. 5	6/15 to 7/15
Late	June 20	Aug. 25	Oct. 1-5	8/10 to 9/10

- **Critical irrigation** for corn is at its peak requirement from about 2 weeks before pollen shed and silking to 2 weeks after.
- This scenario does a good job of minimizing overlap of peak water requirements though both crops require lower irrigation levels late July-early August.

# Split Pivot Sorghum—2 Plantings

Parmer/Castro/Bailey/Lamb/Cochran, **Medium-Early** Maturity

<u>Timing</u>	<u>Planting Date</u>	<u>Flower- ing</u>	<u>Maturity</u>	<u>Maximum Water Use</u>
Early	May 1	July 1-5	Aug. 5-10	6/20 to 7/10
Late	June 25	Aug. 25	Oct. 1-5	8/10 to 9/1

# Peanut/Sorghum Scenario

Gaines/Yoakum/Terry Counties


- Half pivot with **Runner or Virginia peanuts** and grain sorghum
  - You can not diminish water to peanuts!
  - Peak peanut water use early July to early/mid September
  - Recommended crop rotation min. 1 year peanut in 3
  - Preferable to let each sorghum and peanut rotate with cotton but not each other
- Consider medium-early maturity sorghum, 4,000 lbs./A yield goal, and planting late April
  - Flower by end of June, peak water use decline early July—if you water at all (choose lower seed drop)
  - Some sorghum water sharing with peanut needed

# **Peanut/Sorghum** (Gaines, Terry Cos.)



- Result: sorghum is at or past flowering (~June 30) before peanut enters peak water demand
- Concentrate water to peanut after July 1 with only 1 possible additional watering to sorghum, esp. if soil water is banked
  - Sorghum maturity by ~August 5

# Peanut/Sorghum Scenario



- Dilemma for early sorghum and runner peanut:
- You are watering the sorghum at the possible expense of peanut unless rainfall is good
- Hold water off sorghum (other than establishment) until you have profile moisture for peanut (irrigated to peanut ground or rainfall received)
  - At no time would you want to re-direct moisture to sorghum if profile moisture in peanut needs to be replaced.

# Possible Early Peanut/ Late Sorghum



- ~May 1 Valencia peanut maturing in 127-130 days to digging
  - Must dig to avoid loss of large pods
  - Most remaining irrigation could go to sorghum by about Sept. 1
- Consider medium-early maturity sorghum
  - “Schedule” flowering about September 10 (lower South Plains)
  - Back up 60-62 days (from 9/10)—plant by end of first week of July (7/10 cut-off for medium early)

# Other Peanut Options



- Sunflower can better spread the water use by planting two weeks sooner to 10 days later than grain sorghum
- To optimize irrigation use in peanuts, wheat is the best rotation, and the stubble should be key for protection of seeding cotton or peanut the next year. The grass rotation is excellent for both.

# Sunflower Irrig. on Split Pivot



- Farmer consideration: splitting pivot with different crops requiring water at different times—or very limited but timely irrigation to the 'complementary crop, e.g. sunflower or grain sorghum, to reduce total irrigated acres at one time
- Which crop has main emphasis?
  - Cotton production, give it all you can?
  - Corn—you signed a pounds contract?
  - Sunflower—widest range of planting dates




# Sunflower Irrig. on Split Pivot

- Two-crop/two planting date/split pivot scenarios
  - Early cotton, late June/early July sunflower
  - Early sunflower, delayed cotton
  - Corn & Sunflower
  - Sunflower offers more flexibility than grain sorghum
- The goal is to minimize or even eliminate the overlap of peak irrigation
  - Much if not most of the time you are only watering a half circle
- Check with Extension (Troastle) for an explanation of possible scenarios for your farm

# Central/Lower TX South Plains


## Early Cotton, Late Sunflower



- Half pivot with cotton, planted ~May 5
  - Peak water use early July to mid-August
  - Physiological cut out (5 NAWF) by ~August 10-15?
  - Significantly reduce irrigation ~Aug. 25 if soil moisture is available, Texas AgriLife data suggests much reduced irrigation benefit esp. if modest rain is received
- Sunflower @ 1,500 lbs./A yield goal,
  - “Schedule” flowering about September 10-15
  - Back up 55-60 days (from 9/10)—plant ~July 10

# **Central/Lower TX South Plains**

## **Early Cotton, Late Sunflower**



- Result: cotton is now at reduced moisture requirement and 3 weeks or more past cutout prior to sunflower bloom (~Sept. 10)
- Sunflower enters peak water demand 1-2 weeks after cotton cut out when cotton irrigation is significantly reduced
  - Sunflower maturity near October 15 (two weeks before average first freeze) with added potential of Sept. rainfall assisting yield
- Concentrate water to cotton early with 1-2 possible key waterings to sunflower prior to flowering (esp. buds ~0.5-1.0")

# Central/Lower TX South Plains

## Early Sunflower, Delayed Cotton



- Half pivot with sunflower, planted ~April 15
  - Flower in ~60 days by June 15—peak water need lasts about two more weeks to ~July 1 (petal drop)
  - Maturity about July 20 & harvest begins in early August
  - This crop is essentially finished before cotton requires peak water in early July
- Cotton planting delayed to May 15<sup>th</sup> (or the last irrigated cotton you plant)
  - Physiological cut out ~Aug. 20-25<sup>th</sup>
  - Little overlap in peak irrigation needs
  - How strong is your water?

# Grain Sorghum & Sunflower



- Split pivot scenarios with sunflower and grain sorghum are highly flexible as sunflower has a very wide range of planting dates and is less affected by cool fall weather
  - Suggested sunflower planting, lower South Plains, April 10-July 15
  - Northwest South Plains, April 20-July 10

# More Flexibility, Less Risk if Main Crop is Planted First



- If you plant your “companion” crop early, you could regret watering it too much if the year turns out dry
- If companion crop is planted later, you are in the driver’s seat on your decision making—you can keep the water on the primary crop 100% if needed.
  - If sorghum, a seeding rate that can get by if minimally watered

# Factors in Decision Making

- The role or 'attractiveness' of certain crop insurance products
- Ag loans & financing—Net return dollars are the bottom line, but sometimes the loan process may be tilted toward cotton and other high dollar/high cost crops



# Moving Forward—Less Water



- Technology
- Superior hybrids and varieties—can you slightly reduce maturity and preserve yield?
- Irrigation timing
- NOT irrigating and using water for higher value situation



# **Irrigation Tips for Cotton & Grain Sorghum**



# Cotton Irrigation Summary

**Jim Bordovsky, TX AgriLife Research, Halfway**



- Cotton growth periods:
  - Vegetative (planting to very early bloom)
  - Reproductive (early bloom to just past peak bloom)
  - Maturation (after peak bloom to initial boll maturity)

# Fill in Approx. Calendar Dates



- Vegetative—When does 'early bloom' typically occur for your fields and your varieties?
  - For discussion purposes, about July 5?
- Peak bloom—When does this occur for you, in general?
  - For discussion purposes, about August 1?

# **Cotton Irrigation Summary**

**Jim Bordovsky, TX AgriLife Research, Halfway**



- Declining Ogallala aquifer—availability can change dramatically during a season
- Dealing with lack of rainfall
- Shortages of water during critical growth stages
- Loss of wells due to mechanical failure
- Limited irrigation volumes imposed by regulatory mandates before the end of the growing season

# Trostle Comments



- We don't have as much water now as 10 & 20 years ago, so pre-plant irrigation is less an option
- And with less irrigation available, we are concerned if we use much of it outside of the time (early) of maximum benefit.
- Early use in many crops leads to rank, less productive growth

# **Cotton Irrigation Summary**

**Jim Bordovsky, TX AgriLife Research, Halfway**



- When available water can't meet the needs of crop demand, irrigation community has generally recommended and producers have followed the practice of 'banking water' to partially fill soil profile before planting or during early plant growth

# **Cotton Irrigation Summary**

**Jim Bordovsky, TX AgriLife Research, Halfway**



- While a full profile is very desirable for cotton and other crops, and pre-plant irrigation is absolutely necessary in some years, our work indicates that under potential water constraints, the strategy of filling the profile by irrigation may need to change or at least be altered.

# Banking Water ≠ Germination Water



- Watering ahead of time to have a planting zone is different, and you will use spray mode to achieve this if needed.



# Cotton Irrigation Summary

Jim Bordovsky, TX AgriLife Research, Halfway



- High wind, high air temp., low humidity combine to make it difficult to retain early applied water in the soil until cotton (or other crops) really need it in July and August during bloom and boll growth
- In addition, early season water applications can be lost via evaporation or excessive plant growth
- This all represents non-productive water

# Cotton Irrigation Summary

Jim Bordovsky, TX AgriLife Research, Halfway



- South Plains data from wet (2010) and dry years (2011!):
- Storing water in the soil profile in excess of cotton plant's evapotranspiration during June was ineffective
- Best time to water?...

# Cotton Irrigation Summary

Jim Bordovsky, TX AgriLife Research, Halfway



## ■ Results to date:

- Ensure adequate irrigation available in the reproductive( # ) and early maturation periods of cotton development (about 7/5 to 8/15)
- Water applications during this stage of growth resulted in > 100 lbs./A cotton fiber growth per 1" of irrigation
- About 20 lbs./A or less cotton production per acre-inch during spring and vegetative 'water banking' irrigation application period

# Other Crops & Water Use

- **Corn**—Peak water use about 2 weeks before and two weeks after pollen shed
- **Cotton**—early July to cut-out (5 NAWF), usually mid or late August
  - Do you irrigate too much after Cut-out?
- **Sunflower**—2 weeks before to 2 weeks after bloom (a distinct cutoff, petal drop)
- **Peanut**—Ensuring pegging, late water vs. early water



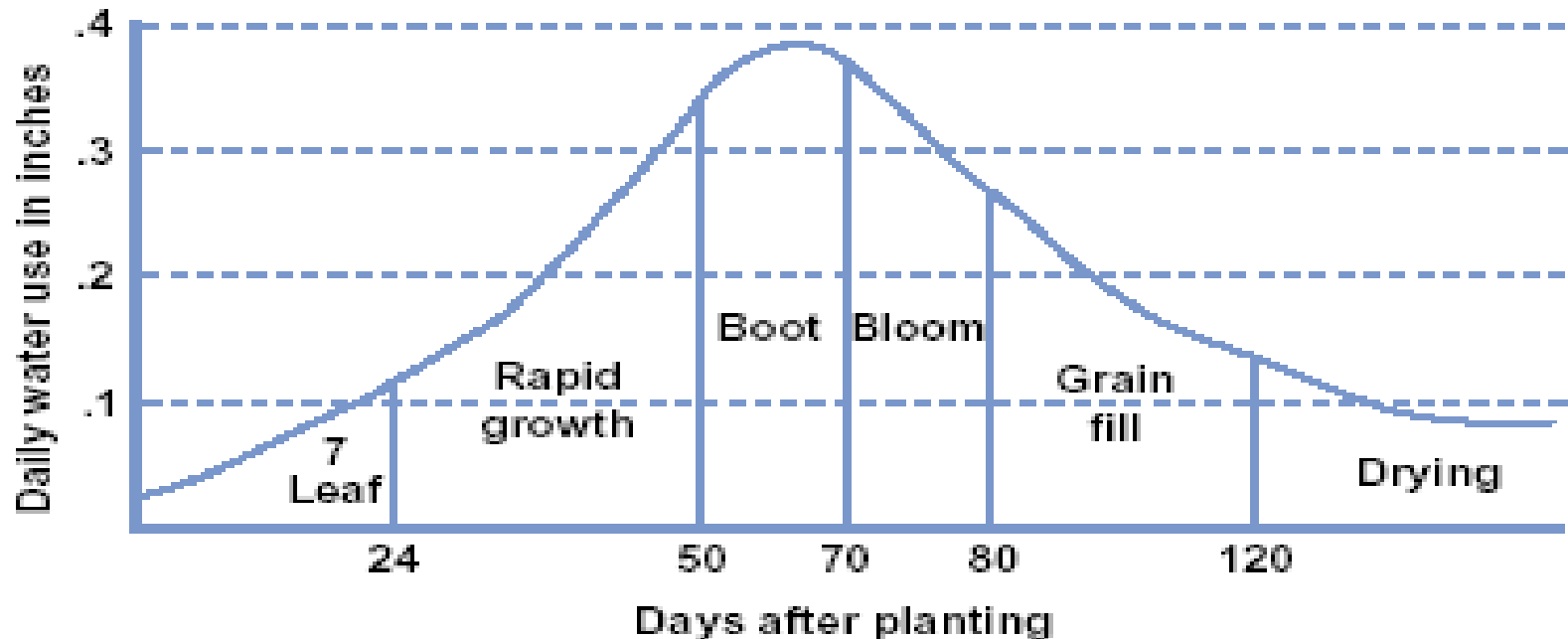
# \*\*\*Sorghum & Water Relations



- Rain (and irrigation): **Catch it! Keep it! Reap it!**
- It takes 6-8" of available water to get a crop of typical sorghum plants to the point of grain production (Dan Krieg, Texas Tech)
  - ~5" for low plant population dryland sorghum
- Once met, additional moisture has large effect on yield, **350-425 lbs./A per 1"**

# Full-Season Maturity—Grain Sorghum...

## Estimated Daily Water Use for Grain Sorghum



**Figure 1. Water needs for sorghum rise sharply at the rapid growth stage, peak during the boot stage and then drop off afterward.**

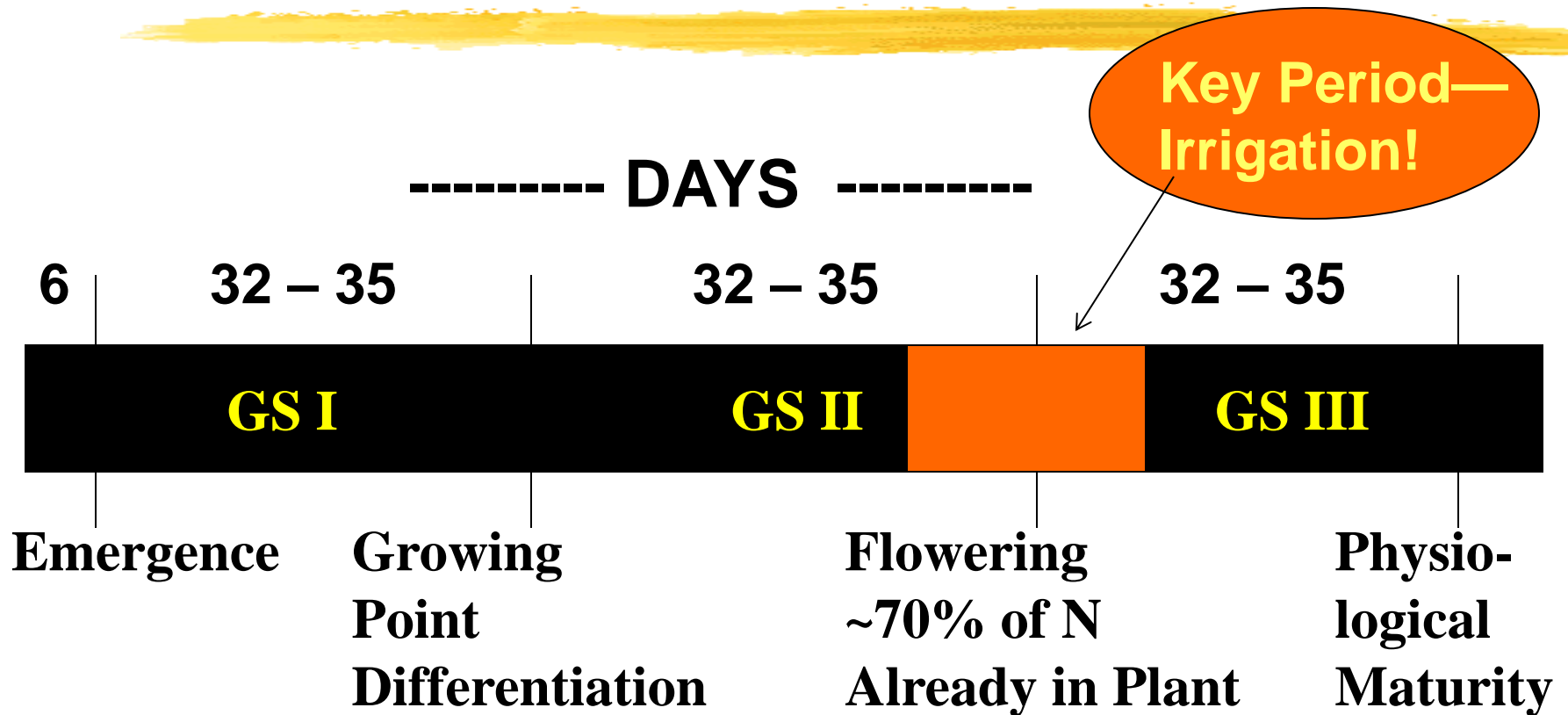
# Full Irrigation-Grain Sorghum



- Maximum yields at 3.5 to 4.5 gpm/A
  - Corn comparison would be ~5.0-6.0 gpm/A
- LEPA or low-set nozzles increase water efficiency
- Critical irrigations at mid-vegetative stage, boot, heading, flowering, grain fill

# Development of Sorghum

Medium Maturity Grain Sorghum, 17 leaves



Spikelets & Potential Seed Number Set from  
GPD +10 Days for Each Head



# Limited Irrigation Sorghum

- Highest return usually occurs if sorghum is irrigated at **boot stage** (provided you can get to that point)
- Avoid moisture stress during the mid-vegetative stage (30-35 days after planting, i.e., growing point differentiation)

Sorghum growing point  
or immature head





Similar to grain sorghum, growing point differentiation in wheat leads to small head down in stem—spikelet number and seeds per spikelet pretty much already determined. If grazing and then going to grain then cattle should have been off about 7-10 days prior.

# 9,600 lbs./A, Hale Co.



- 24" of water (irrig./rain) for grain yield
  - Add in 7" to get the crop to the point of grain yield (31" total)
- A more realistic goal: 6,000 lbs./A with medium or medium-long maturity
- 15" of water for grain yield
  - Add in 6" to reach point of grain yield (21")
  - 3" soil water, 6" rain, 12" irrigation

# Irrigation Termination & Harvest



- Termination of irrigation: near soft dough, if good soil moisture is still present
- Physiological maturity is at black layer (~10-12 days after soft dough)
- Seed moisture at black layer is ~25-35%
- Harvest below 20% moisture with drying required
- Market price based on 14% grain moisture to avoid dockage (may depend on delivery point)



**[http://lubbock.tamu.edu/programs/  
disciplines/irrigation-water/](http://lubbock.tamu.edu/programs/disciplines/irrigation-water/)**