

# How to Manage Sorghum for Peak Performance

**2016 Sorghum Symposium**

**Grand Island, NE**

January 21th

Brent Bean

USCP Agronomist



# Why Sorghum

- **Drought tolerant crop, but responds well to additional water**
- **Long planting window**
- **Rotation benefits for soybean**
- **Improved control of resistant weeds**
- **Lower input costs compared to many other crops**

# Compare Input Costs

## Example: Seed Costs

Sorghum		Corn	
Population	Cost*	Population	Cost*
30,000	\$5	16,000	\$54
60,000	\$10	24,000	\$82
90,000	\$15	32,000	\$109

\* Based on 2015 TAMU AgriLife D-2 Enterprise Budgets

# Minimizing Crop Inputs in a Low Commodity Price Environment

- **Minimize seed costs**
  - Use lowest seeding rate to meet yield goal
- **Soil sampling and testing**
  - Including deep sampling for N
- **Maximize irrigation efficiency**
  - Timely application, efficient system
- **Weed control**
  - Compare costs of herbicides
  - Adjuvants – use only what is necessary and proven
- **Insect control**
  - Scouting and timely application is critical



**Crop Water Use Efficiency of Corn, Soybean, and  
Sorghum under Dryland Conditions**  
**Lawrence, NE**

**Source: Jenny Rees, UNL, Clay County**

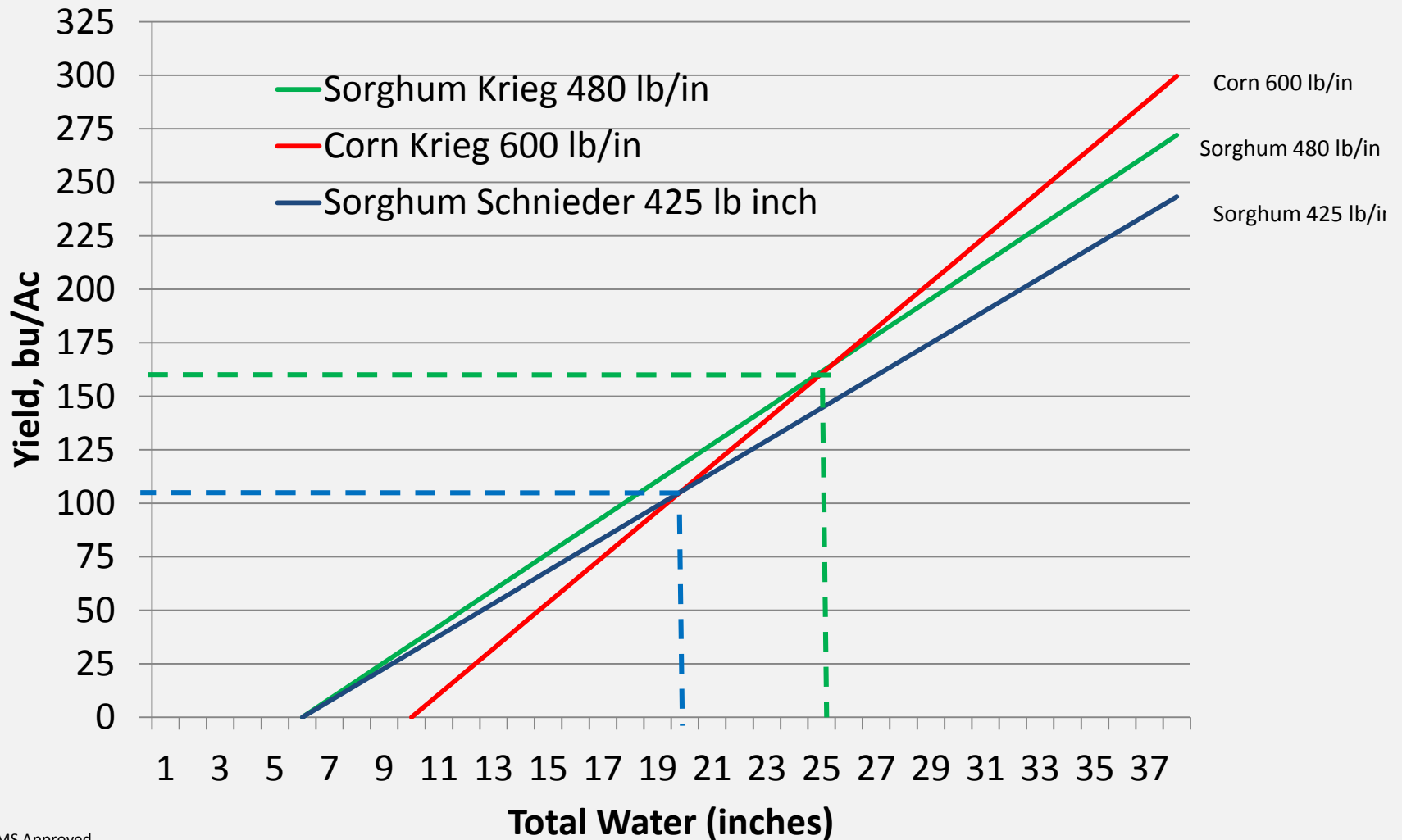


## 2009-2011 Seasonal Crop Water Use

	2011 Etc (in)	2011 Yield (bu/ac)	2011 CWUE (bu/in)	2010 Etc (in)	2010 Yield (bu/ac)	2010 CWUE (bu/in)	2009 Etc (in)	2009 Yield (bu)	2009 CWUE (bu/in)
Corn	22.0	<b>127.2</b>	5.8	23.3	101.2	4.3	14.5	97.5	6.7
Soybean	21.3	61.3	2.9	22.0	44.0	2.0	14	33.4	2.4
Sorghum	17.3	<b>138.9</b>	8.0	21.3	118.0	5.5	13.7	77.4	5.6

Source: Jenny Rees, UNL

# Sorghum and Corn Response to Water



# Pre-Plant Decisions

- **Hybrid Selection**
- **Seeding Rate**
- **Date to Plant**
- **Nutrient Plan**
- **Weed Control Plan**
- **Irrigation Plan**
- **Insect Control Plan**



# Hybrid Selection

## Characteristics

- **Adaptability to the region**
- **Yield, Yield, Yield**
- **Standability**
- **Days to maturity**
- **Drought tolerance**
- **Insect tolerance**

## Sources of Information

- **Seed Company Representative**
- **University Extension**
- **Good Sorghum Growers in the Area**
- **Sorghum Checkoff Webpage**

## Variety Maturity

Relative Maturity*	Days to Mid-Bloom
Very Early	48 - 52
Early	53 - 57
Medium-Early	58 - 63
Medium	64 - 69
Medium-Full	70 +

\* Will vary with seed company

To reach physiological maturity add 30 to 45 days  
Depending on hybrid and temperature



# Lodging

- Population too high
- Hybrid differences
- Too much N
- Stalk Rot
  - Charcoal Rot
  - Fusarium
- Stalk insect damage
- Good yield potential with dry weather late
- Hail damage



# Seeding Rate

Managing water resources for  
maximum grain production





# Seeding Rate and Harvest Index

- Harvest Index is the ratio of grain produced vs total above ground plant weight.
- Range
  - 0.35 to 0.55



Low Harvest Index

High Harvest Index

## Seeding Rate

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Seeding Rate per Acre	Yield Goal
30,000	3,000 - 4,500 lb 60 – 80 bu
50,000	5,000 – 7,500 lb 90 – 135 bu
70,000	8,000 - 10,000 lb 145 - 180 bu
90,000	Greater than 10,000 lb or 180 bu

# Tillering

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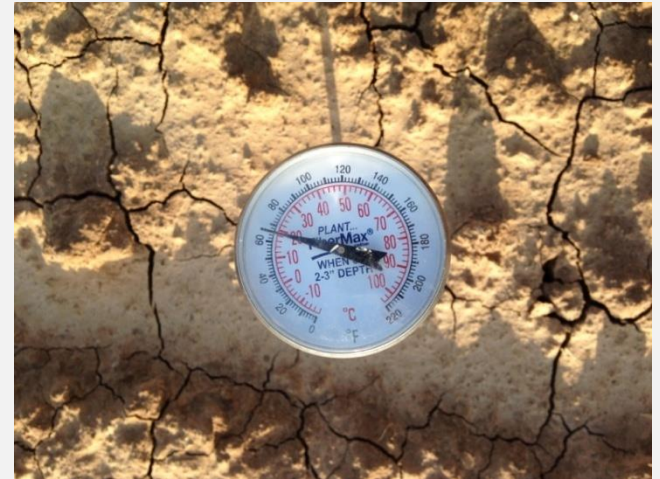
# Plant Population Effect on Sorghum

	1986		1987		1988	
<b>Seed/Ac</b>	<b>32000</b>	<b>64000</b>	<b>32000</b>	<b>64000</b>	<b>32000</b>	<b>64000</b>
<b>Plant Pop.</b>	<b>20000</b>	<b>32000</b>	<b>21000</b>	<b>41000</b>	<b>21000</b>	<b>50000</b>
<b>Tillers/Plt</b>	<b>1.5</b>	<b>1.1</b>	<b>1.8</b>	<b>1.3</b>	<b>1.4</b>	<b>1.0</b>
<b>Heads@ Harvest</b>	<b>30000</b>	<b>38000</b>	<b>40000</b>	<b>56000</b>	<b>30000</b>	<b>43000</b>
<b>Lbs. Grain/Hd</b>	<b>0.166</b>	<b>0.13</b>	<b>0.11</b>	<b>0.076</b>	<b>0.10</b>	<b>0.064</b>
<b>Yield,lb/A</b>	<b>5000</b>	<b>5000</b>	<b>4600</b>	<b>4300</b>	<b>3100</b>	<b>2760</b>



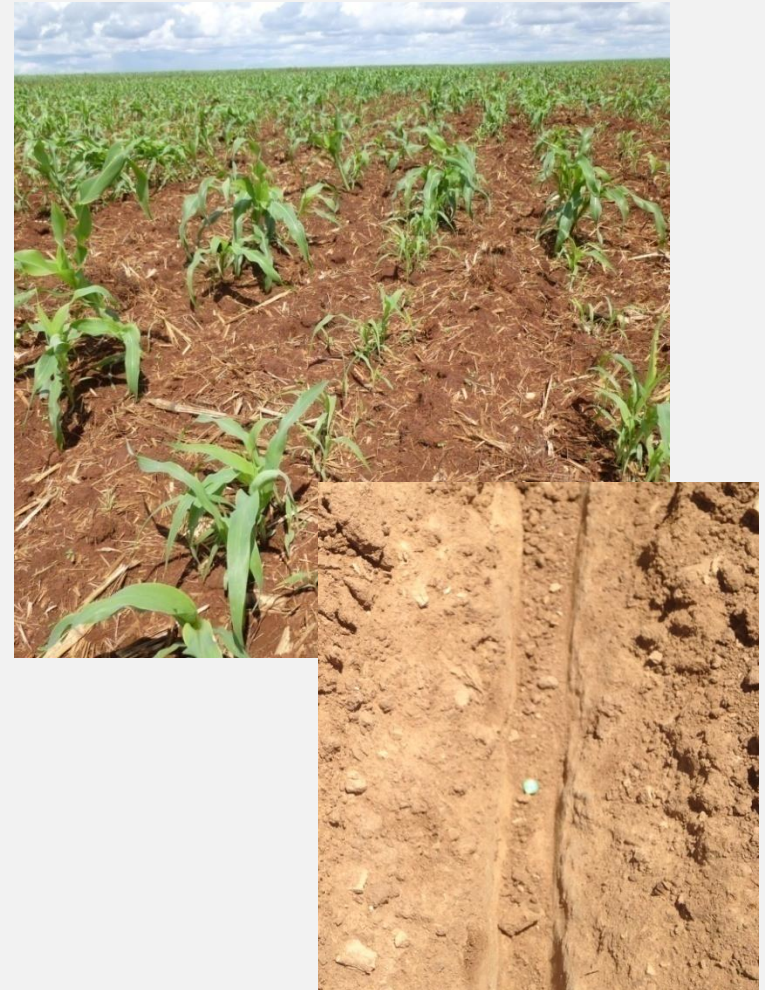
# Planting Date

- **Planting date should be tied to soil temperature and rainfall patterns**
- **Sorghum can be planted when the soil temperature reaches 60 F and seven day forecast is for warm weather**

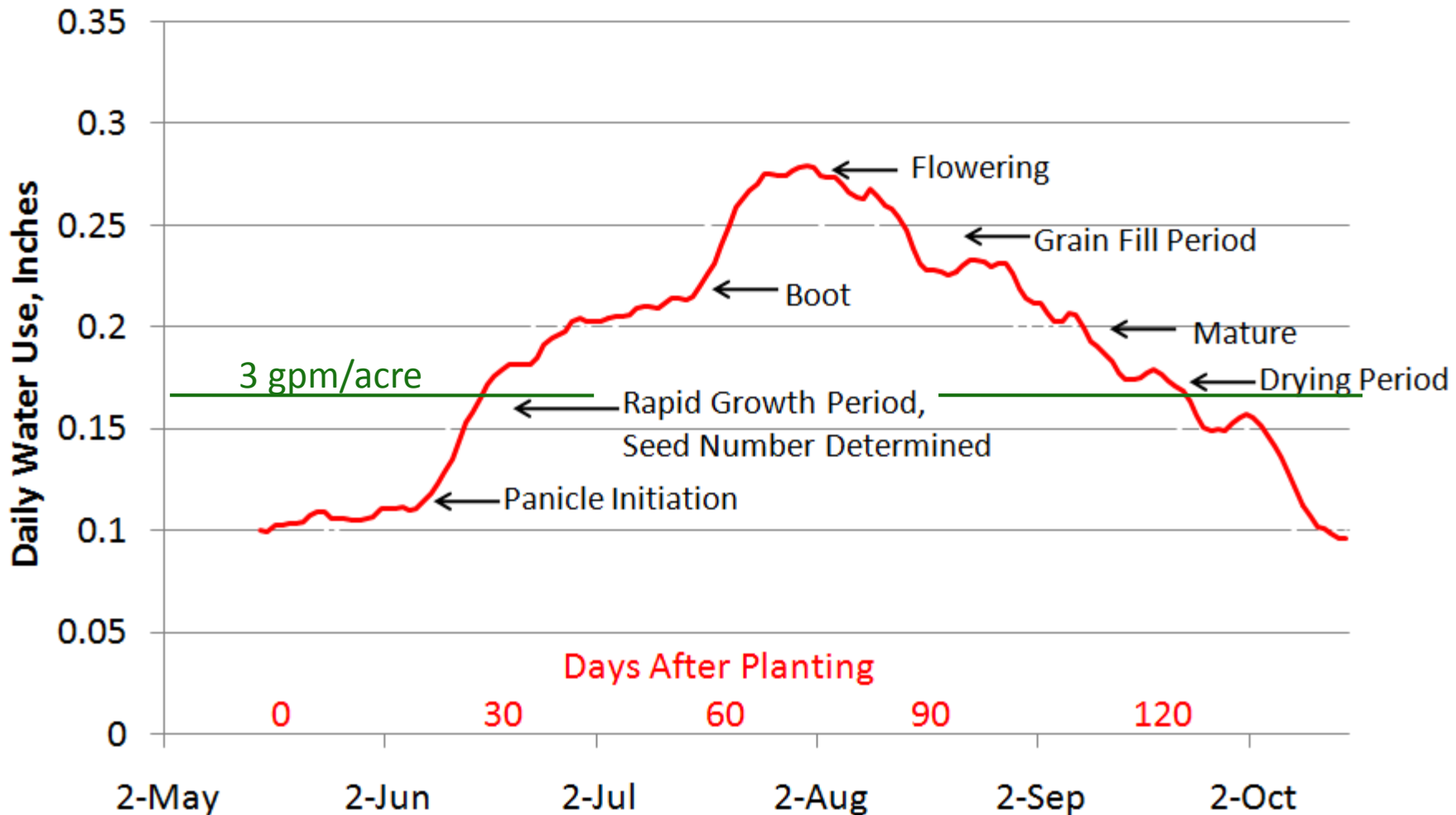


# Sorghum Planting

- **Firm seed bed**
- **1.25 to 2 inches deep**
- **Best to plant with 0.5 inches of moisture above the seed**
- **Thick crust will hinder plant's ability to emerge**



## Sorghum Development and Daily Water Use 20 Yr Avg, Near Amarillo, TX





# Sorghum Fertility

## ➤ Nitrogen

- **Requires 2 lbs N for every 100 lbs of grain yield**
  - 6000 lb (107 bu) yield requires 120 lbs N
  - In a wheat sorghum fallow rotation you will likely have 30 to 40 lbs residual N
  - Behind soybean a N credit of 40 lbs is typical
    - ✓ See NE Economic Optimum N Rate Table
  - **Organic Matter N Credit**
    - ✓ Depends on yield potential of soil
    - ✓ Ranges from 5 to 25 lb N per percent of OM
- **To maximize yield and N efficiency**
  - **Consider split application**
    - ✓ Starter, 50% preplant, 30% sidedress, 20% at milk stage if possible



**Table I. Economically optimum nitrogen rate (EONR) for grain sorghum following soybean in rotation.**

<i>Expected yield (EY, bu/ac)</i>	<i>Grain price to nitrogen price ratio (<math>P_G/P_N</math>), (\$/bu grain) / (\$/lb N)</i>				
	<b>4</b>	<b>6</b>	<b>8</b>	<b>10</b>	<b>12</b>
<b>70</b>	0	10	20	35	50
<b>90</b>	5	20	30	45	60
<b>110</b>	15	30	40	55	70
<b>130</b>	25	40	50	65	80
<b>150</b>	35	50	60	75	90
<b>170</b>	45	60	70	85	100
<b>190</b>	55	70	80	95	110

Grain price to nitrogen price ratio ( $P_G/P_N$ ), (\$/bu grain) / (\$/lb N).

$$EONR = -68 + 0.49 EY + 6.9 P_G/P_N$$

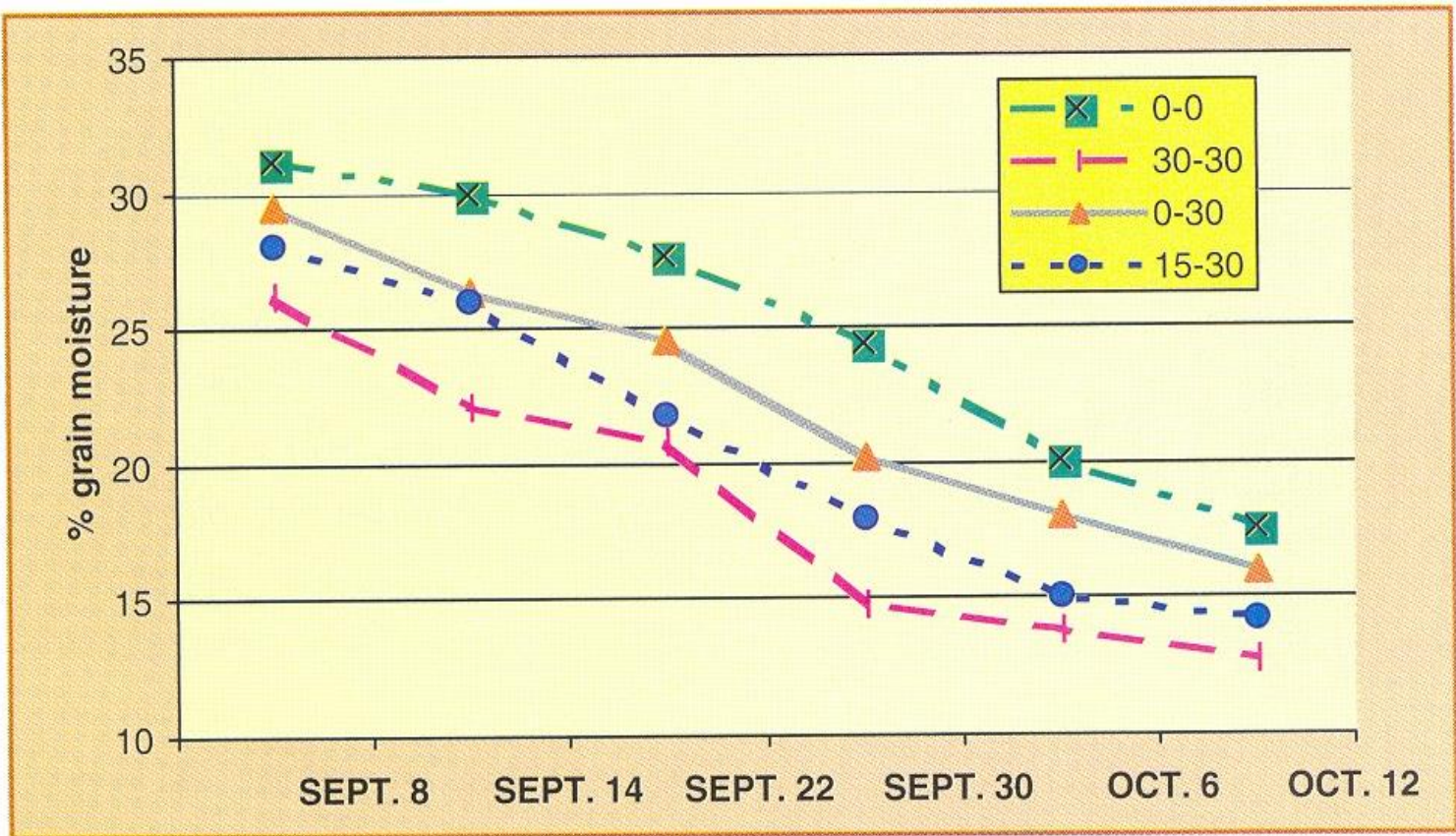


Figure 3. Effect of NP starter fertilizer composition on grain moisture dry-down for a 2 x 2 placement (values averaged over tillage system), Gordon and Whitney, Belleville, 2001.

# Sorghum Fertility

## ➤ Phosphorus

- Maintain a soil level of 60 to 80 lbs of P<sub>2</sub>O<sub>5</sub>
- P fertilizer rates can be cut in half by banding rather than applying broadcast

## ➤ Potassium

- Often not needed in Nebraska soils
- Sorghum requirement is similar to N

## ➤ Sulfur

- May be of benefit in high yield environments

## **Water Management**

- **Sorghum requires 6 to 8 inches of water just to grow the vegetation necessary to produce any grain**
- **Yield response will increase 500 to 600 lbs of grain per inch of water after the 6 to 8 inches has been received.**
- **If 20 inches are available then a 7000 lb yield is obtainable**

## Available water holding capacity of area soils

<b>Soil Description</b>	<b>Avail. Water in 3 ft. (inches)</b>
<b>Sherm Silty Clay Loam</b>	<b>6.57</b>
<b>Olton Clay Loam</b>	<b>6.12</b>
<b>Pullman Clay Loam</b>	<b>5.94</b>
<b>Acuff Loam</b>	<b>5.71</b>
<b>Dalhart Fine Sandy Loam</b>	<b>5.67</b>
<b>Amarillo Fine Sandy Loam</b>	<b>5.20</b>
<b>Grandfield Fine Sandy Loam</b>	<b>4.80</b>
<b>Brownfield Fine Sand</b>	<b>3.36</b>

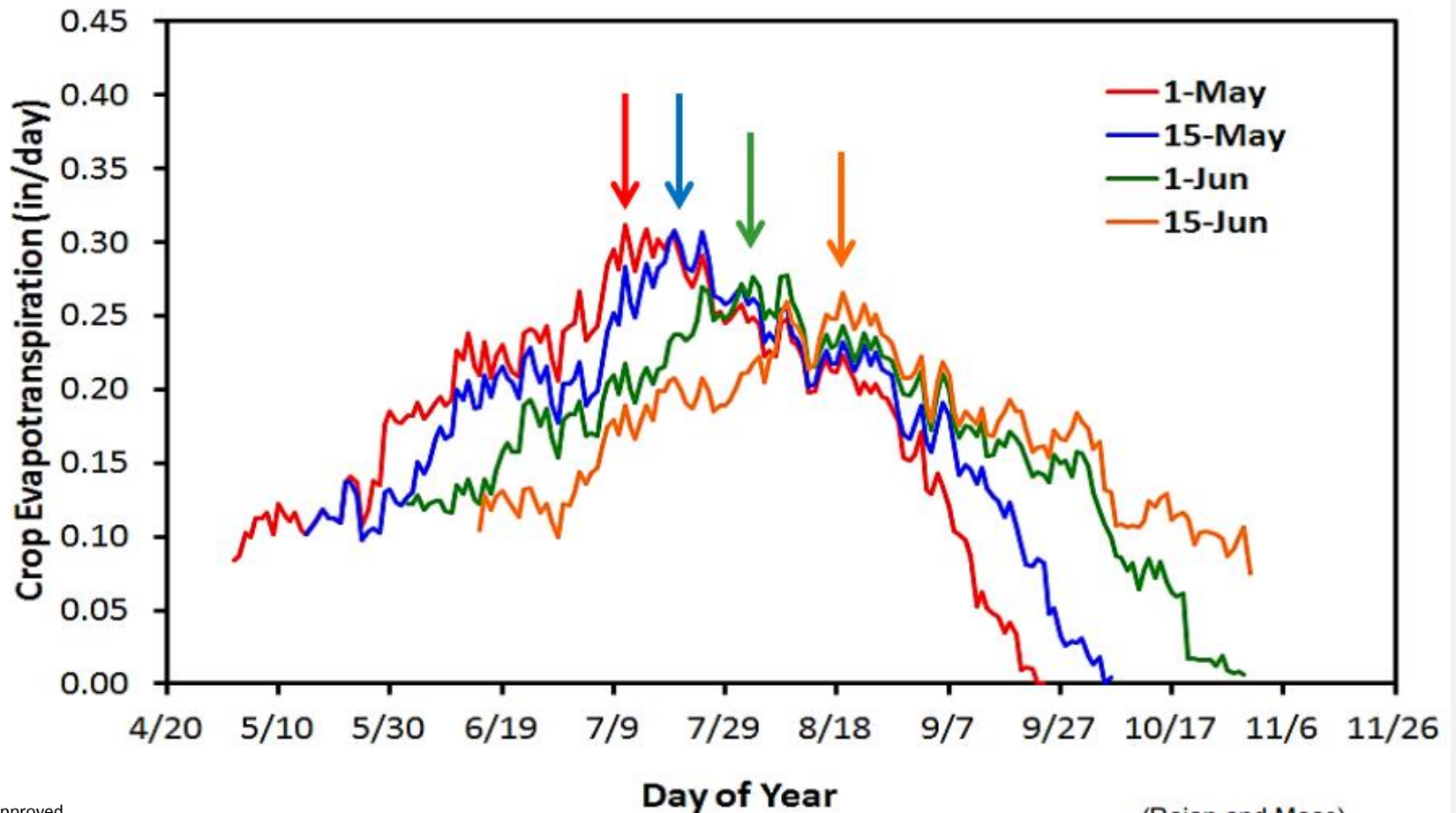
# Optimizing Sprinkler Irrigation Water

- **Always apply a minimum of 0.75 inches of irrigation water at a time**
  - **1.0 to 1.5 is better**
  - **Minimizes evaporation loss, this adds up over the season**
    - **6 applications x 0.2 inches = 1.2 inches or 660 lbs (12 bu).**





# Sorghum Evapotranspiration Long-term Average (1997-2011)





# Grain Sorghum Weed Control



<http://sorghumcheckoff.com/pest-management>

## **Weed Control Guides**

[Alabama Weeds, Disease and Insect Control Guide](#)

[Arkansas Recommended Chemicals for Weed and Brush Control](#)

[Kansas Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland](#)

[Louisiana Grain Sorghum Weed Management](#)

[Mississippi Weed Control Guidelines](#)

[Missouri Pest Management Guide](#)

[Nebraska Guide for Weed Management with Insecticide and Fungicide Information](#)

[North Carolina Weed Management in Grain Sorghum](#)

[South Carolina Weed Control in Grain Sorghum](#)

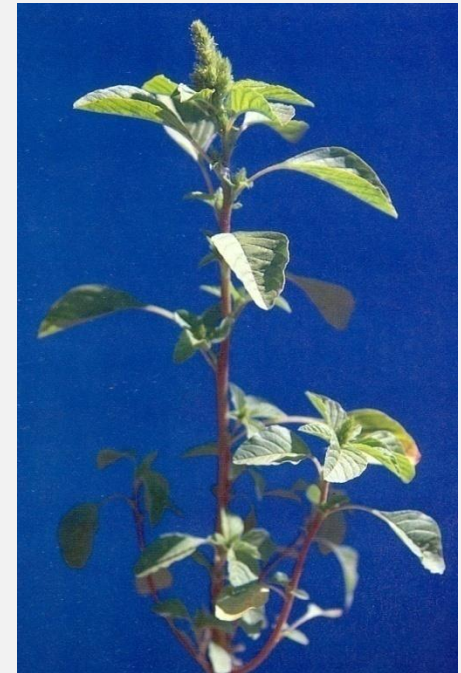
[South Dakota Sorghum Weed Control Guide](#)

[Tennessee Weed Control Manual for Tennessee](#)

[Texas Grain Sorghum Weed Control Guide](#)

## Building a Weed Control Program

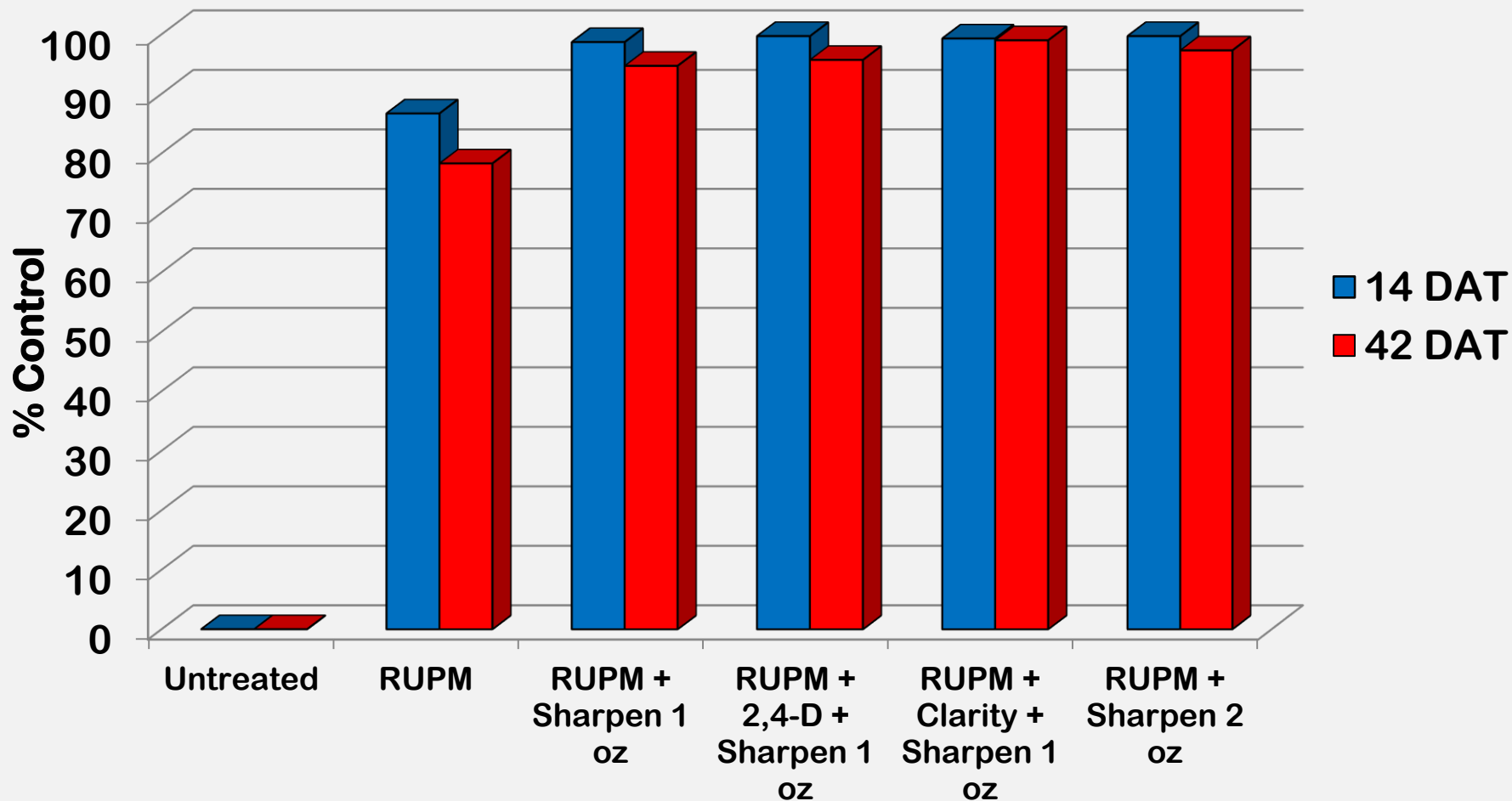
- **Know and prioritize your weeds**
- **Control all weeds prior to planting**
- **Must have a pre-emergence program**
- **Be prepared to use post emergence herbicide**
- **Consider crop rotation**



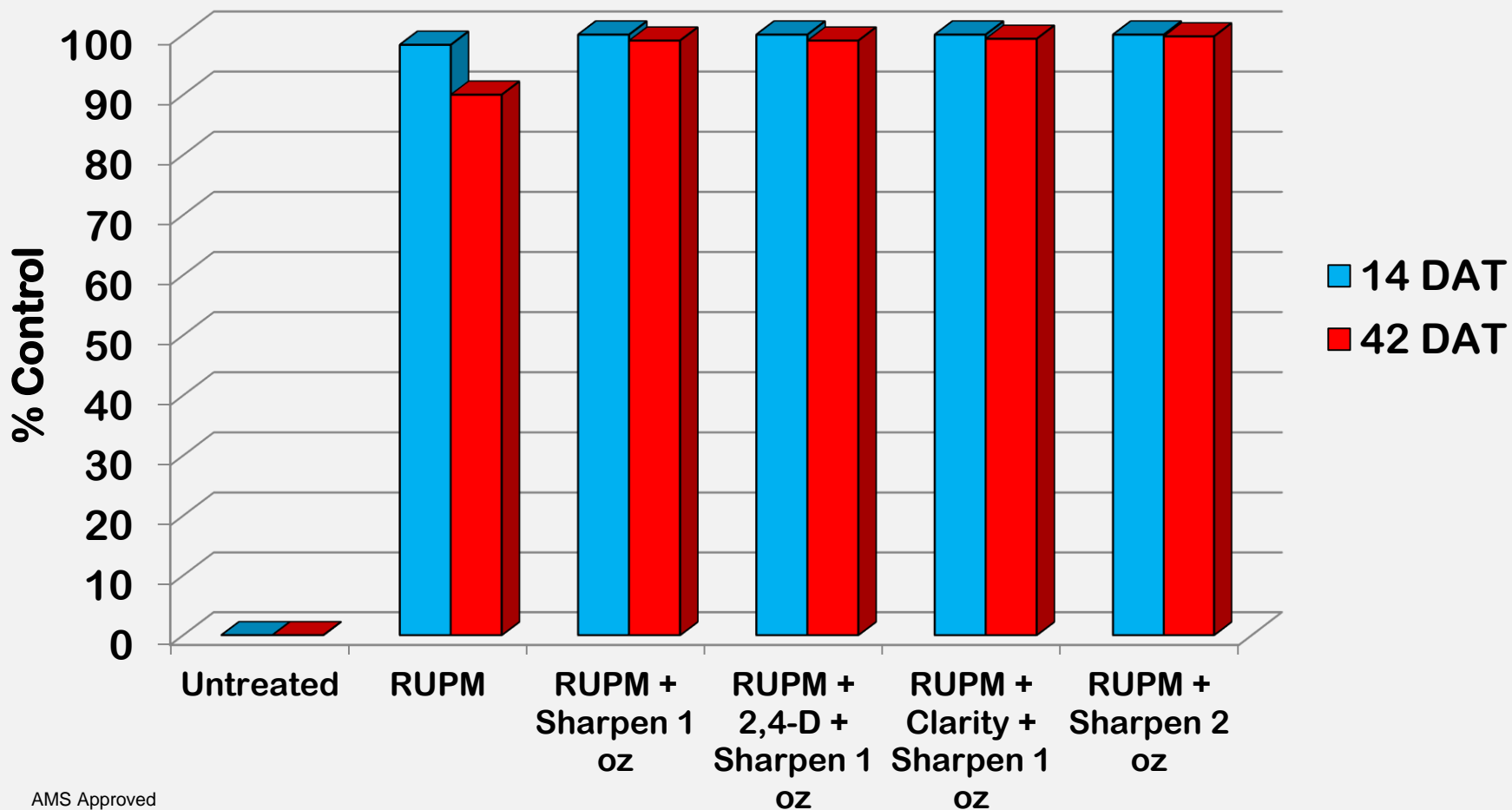
# Keys to Effective Burn-down Control

- **Weed size**
  - **Smaller the better, once weeds get over 4 inches tall they will be more difficult to control**
  - **Mustards and prickly lettuce are much easier to control in the rosette stage than after they bolt**
- **Drought stressed weeds are more difficult to control**
- **Make application in front of the strip tillage operation, or a couple of days later to avoid the weed being covered up by soil at the time of application**
- **Add appropriate additives as needed (surfactant, UAN, etc)**

# Kochia Control with Sharpen



# R Thistle Control with Sharpen



## Pre Sorghum Broadleaf Herbicides

- **Atrazine (AAtrex, atrazine)**
- **Saflufenacil (Sharpen or Verdict)**
- **Propazine (Milo-Pro)**
- **Lumax EZ or Lexar EZ (atrazine + metolachlor + mesotrione)**
- **Zemax (metolachlor + mesotrione)**



# Weed Control Base in Sorghum

## Consider Atrazine



Atrazine, Pre

- **Cost, \$3.75 per pound**
- **Effective on Most Common Weeds**
- **Good Residual**
- **Post or Pre**
- **Excellent Tank Mix Partner**

# Weeds Controlled with Atrazine

## Broadleaf Weeds, Pre

- **Pigweed**                      **Excellent**
- **Kochia**                        **Excellent**
- **Lambsquarter**            **Excellent**
- **Velvetleaf**                  **Good**
- **Sunflower**                 **Good**
- **Cocklebur**                 **Good**

## Grasses, Pre

- **Barnyardgrass**    **Fair**
- **Crabgrass**                **Poor**
- **Foxtail**                      **Good**
- **Sandbur**                     **Fair**
- **Shattercane**            **V. Poor**
- **Johnsongrass**    **V. Poor**

Post – Grass control inconsistent



## **Atrazine Weaknesses**

- **Atrazine resistant weeds**
- **Crop rotation considerations**
- **Inconsistent when applied post, specially on large weeds**
- **Can be weak on grasses**
- **Ineffective on some weeds**

## **Atrazine PRE EMERGENCE Precautions in Sorghum**

- **Do Not use on sand, loamy and sandy loam soils.**
- **Do Not use on soils containing less than 1% OM.**
- **Do Not use on soils with a pH of > 8.5.**
- **Do Not use on sorghum to be planted in furrows.**
- **Do Not rotate to cotton or soybeans if applied after June 10**
- **Rate: Varies with location but ranges from 0.75 to 2.2 qts**
- **SEE LABEL FOR OTHER RESTRICTIONS**

## **Saflufenacil (Sharpen)**

- **Very good burndown product**
- **Short term residual is significant**
- **Rate: 1 – 2 oz**
- **For pre-emergence or even late pre-plant, it is best to use Verdict (dimethenamid + Sharpen) to keep rate of Sharpen at 1 oz/ac**
- **For post activity use with MSO and AMS or UAN**

## Pre Combinations with Atrazine

- **Atrazine + metoachlor**
  - Bicep II Magnum, Cinch ATZ
- **Atrazine + dimethenamid**
  - Guardsman Max. G-  
Max Lite
- **Atrazine + alachlor**
  - Bullet, Lariat
- **Atrazine + acetochlor**
  - Degree Xtra, Fultime NXT
- **Saflufenacil + dimethenamid**
  - Verdict
- **Atrazine + metolachlor + mesotrione**
  - Lumax, Lexar

**Must use Concep III treated seed**

# Lumax EZ and Lexar EZ in Sorghum

<b>Product</b>	<b>Rate/A</b>	<b>Dual II Magnum</b>	<b>AAtrex</b>	<b>Callisto</b>
Lumax EZ	2.7 qt	1.8 pt	0.625 qt	5.4 oz
AI	2.47 lb ai	1.68 lb ai	.625 lb ai	0.17 lb ai
Lexar EZ	3.0 qt	1.4 pt	1.3 qt	5.4 oz
AI	1.3 lb ai	1.3 lb ai	1.3 lb ai	0.17 lb ai

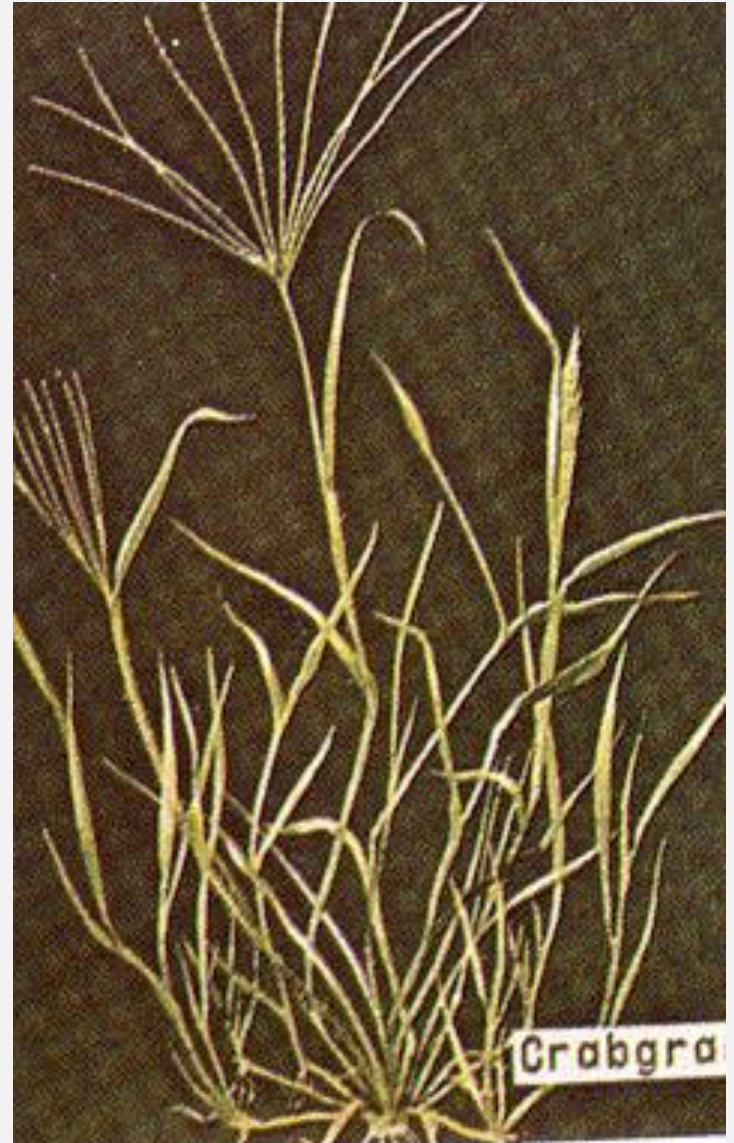


## Restrictions for Lumax and Lexar in Grain Sorghum

- **Do not apply to sorghum grown on sandy soils (sand, sandy loam or loamy sand)**
- **Do not apply to emerged grain sorghum**
- **Warning of possible crop injury if applied within 7 days of planting**



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# Pre Sorghum Grass Herbicides

- **Primarily grass control with some broadleaf activity**
  - **Metolachlor (Dual II Magnum, Cinch, Parallel, Me-Too-achlor, Frontier, others)**
  - **Dimethenamid-P (Outlook, Propel)**
  - **Alachlor (Micro-Tech)**
  - **Acetochlor (Warrant)**
- **If crop injury is of concern, then apply early post**

**Must use Concep III treated seed!!**

# Grass Control Ratings

<b>Herbicide</b>	<b>BYD-grass</b>	<b>Crab-grass</b>	<b>Fall Panicum</b>	<b>Fox-tail</b>	<b>Sand-bur</b>	<b>Shatter-cane</b>	<b>Witch-grass</b>
<b>Dual II Mag</b>	<b>G-E</b>	<b>G-E</b>	<b>G-E</b>	<b>G-E</b>	<b>F-G</b>	<b>P</b>	<b>G</b>
<b>Outlook</b>	<b>G-E</b>	<b>G-E</b>	<b>G-E</b>	<b>G-E</b>	<b>F-G</b>	<b>P</b>	<b>G</b>
<b>Bicep II Mag</b>	<b>G-E</b>	<b>E</b>	<b>G-E</b>	<b>E</b>	<b>F-G</b>	<b>P</b>	<b>G-E</b>
<b>Guardman Max</b>	<b>G-E</b>	<b>E</b>	<b>G-E</b>	<b>E</b>	<b>F-G</b>	<b>P</b>	<b>G-E</b>
<b>Degree Xtra</b>	<b>E</b>	<b>E</b>	<b>E</b>	<b>E</b>	<b>F-G</b>	<b>F</b>	<b>E</b>
<b>Lumax EZ</b>	<b>E</b>	<b>E</b>	<b>E</b>	<b>E</b>	<b>F-G</b>	<b>P</b>	<b>E</b>

## Reasons for Pre Failure

- **Herbicide does not get activated (move into soil)**
- **Crop residue results in herbicide tie up or poor soil coverage**
- **Too much rain resulting in leaching and dilution of herbicide**
- **Rate not high enough for the soil type**
- **Resistance**



## Reasons for Crop Injury

- **Rain moves herbicide on top of seed**
- **Cool conditions slow down emergence allowing more herbicide to be absorbed by crop**
- **Rate too high for the soil type and pH**

# Post Emergence Weed Control



# Herbicide Weed Ratings

	<b>E Nightshade</b>	<b>Cocklebur</b>	<b>Kochia</b>	<b>Lambsquarter</b>	<b>Morningglory</b>	<b>Pigweed</b>	<b>C Ragweed</b>	<b>Sunflower</b>	<b>Velvetleaf</b>
<b>Atrazine</b>	<b>G-E</b>	<b>G</b>	<b>G-E</b>	<b>F</b>	<b>G</b>	<b>F</b>	<b>G</b>	<b>G</b>	<b>G</b>
<b>Ally +2,4-D</b>				<b>G</b>	<b>F</b>	<b>G</b>	<b>G-E</b>	<b>G-E</b>	<b>F</b>
<b>2,4-D</b>	<b>G</b>	<b>F</b>	<b>G</b>	<b>F</b>	<b>F</b>	<b>G</b>	<b>G-E</b>	<b>F</b>	<b>G</b>
<b>Banvel</b>	<b>G</b>	<b>G-E</b>	<b>G-E</b>	<b>G</b>	<b>G-E</b>	<b>G</b>	<b>G</b>	<b>G</b>	<b>F-G</b>
<b>Starane</b>	<b>F</b>	<b>G</b>	<b>F</b>	<b>P</b>	<b>F</b>	<b>P</b>	<b>F</b>	<b>G</b>	<b>g</b>
<b>Peak</b>	<b>F</b>	<b>F</b>	<b>G</b>	<b>G</b>	<b>F</b>	<b>G</b>	<b>F</b>	<b>F</b>	<b>F</b>
<b>Huskie</b>	<b>F</b>	<b>F</b>	<b>G</b>	<b>F</b>	<b>F</b>	<b>G-E</b>	<b>F</b>	<b>F</b>	<b>F</b>
<b>Permit</b>		<b>F</b>	<b>G</b>	<b>F</b>	<b>P</b>	<b>F</b>	<b>F</b>	<b>F</b>	<b>G-E</b>



# Atrazine Precautions in Sorghum

## POST EMERGENCE

- Labeled rate is 1.0 – 2.0 lb/ac + Crop Oil.
- Apply when sorghum is between 6 and 12 inches.
- Watch rotation restrictions with late application.
- *Should be able to get by with 0.75 lb atrazine if weeds are small.*



Atrazine, 0.75 lb + Crop Oil  
80% Pigweed Control

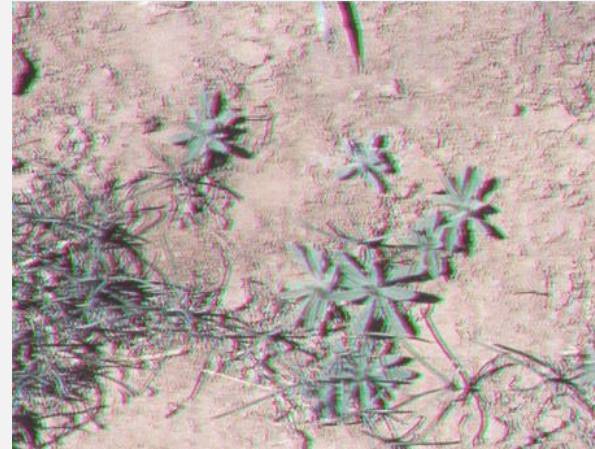
## **2,4-D TIMING AFFECT ON SORGHUM YIELD**

<b>Treatment</b>	<b>Sorghum Height at Application (inches)</b>	<b>Yield Lb/Acre</b>
<b>Untreated</b>	<b>-----</b>	<b>8432</b>
<b>2,4-D LV6</b>	<b>6</b>	<b>8828</b>
<b>2,4-D LV6</b>	<b>10</b>	<b>5885</b>
<b>2,4-D LV6</b>	<b>12</b>	<b>4950</b>
<b>2,4-D LV6 was applied at a rate of 2/3 qt per acre</b>		



## Starane

- **Pros**
  - Safer on crop
  - Excellent kochia control and some other broadleaf weeds
- **Negative**
  - Weak on pigweed
- **Works best with mixed with atrazine**



## Peak

- **Strength is with weeds other than pigweed, such as cocklebur, sunflower and velvetleaf**
- **Can be applied up to 30 inch tall sorghum when applied alone**
- **Can be applied in KS and NE pre-emergence to control emerged weeds and provide some pre activity**
- **Rate: 0.5 to 1.0 oz**
- **Rotation: For soybeans, cotton and canola mostly 10 months, although 18 months in high pH areas of TX, NM and OK. SEE LABEL!**
- **Recommend using Clarity or atrazine tank mix with 0.5 oz/ac Peak.**

# Post Rescue Treatment for Broadleaf Weeds



**Pyrasulfotole +  
bromoxynil (Huskie)**





**10 oz/a Huskie 16 inch weeds 4 DA-A**  
**10 oz/a Huskie 18 inch weeds 2 DA-A**

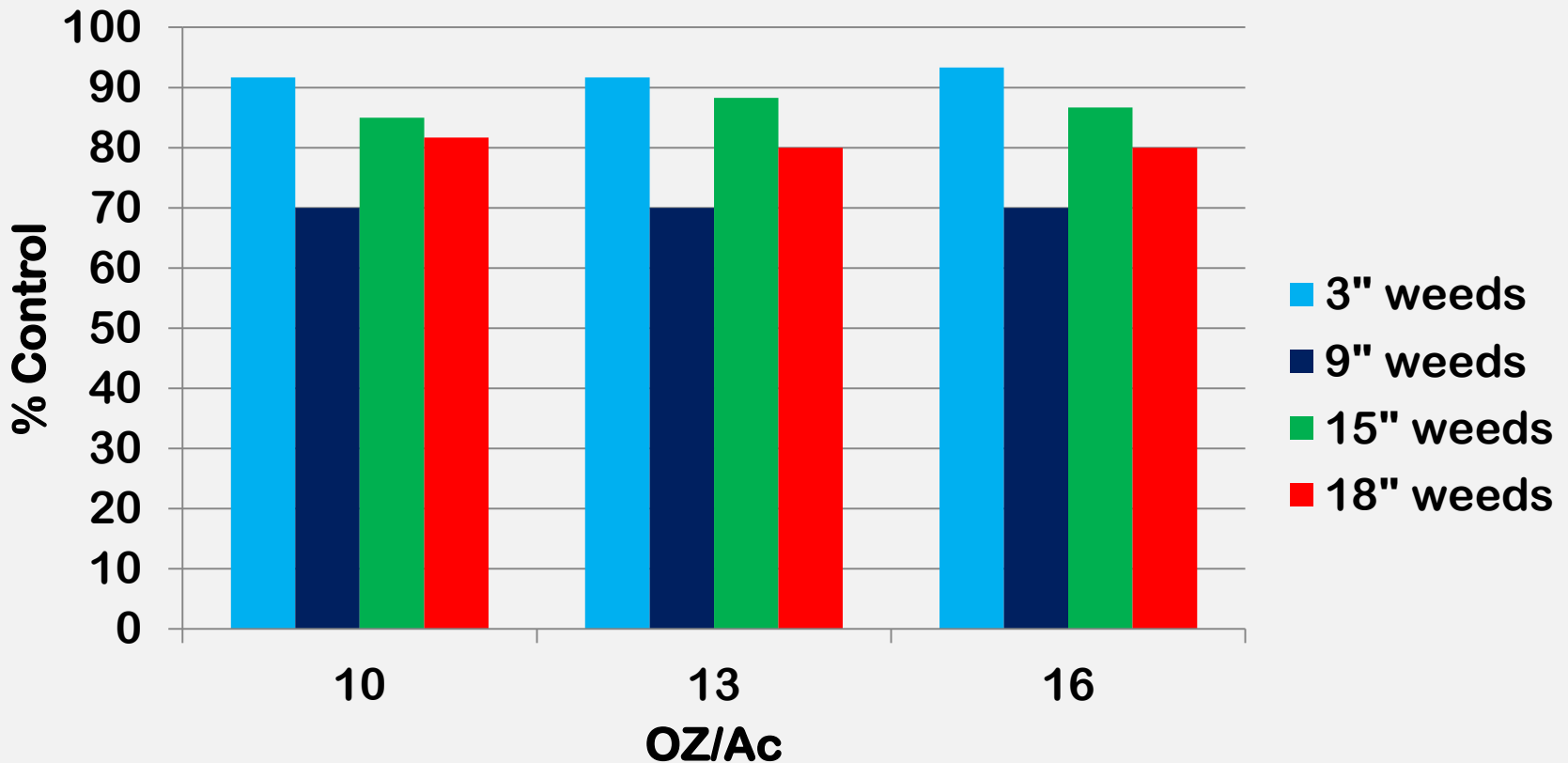


## **Weed Control with Huskie when Applied to Palmer amaranth at Different Heights**

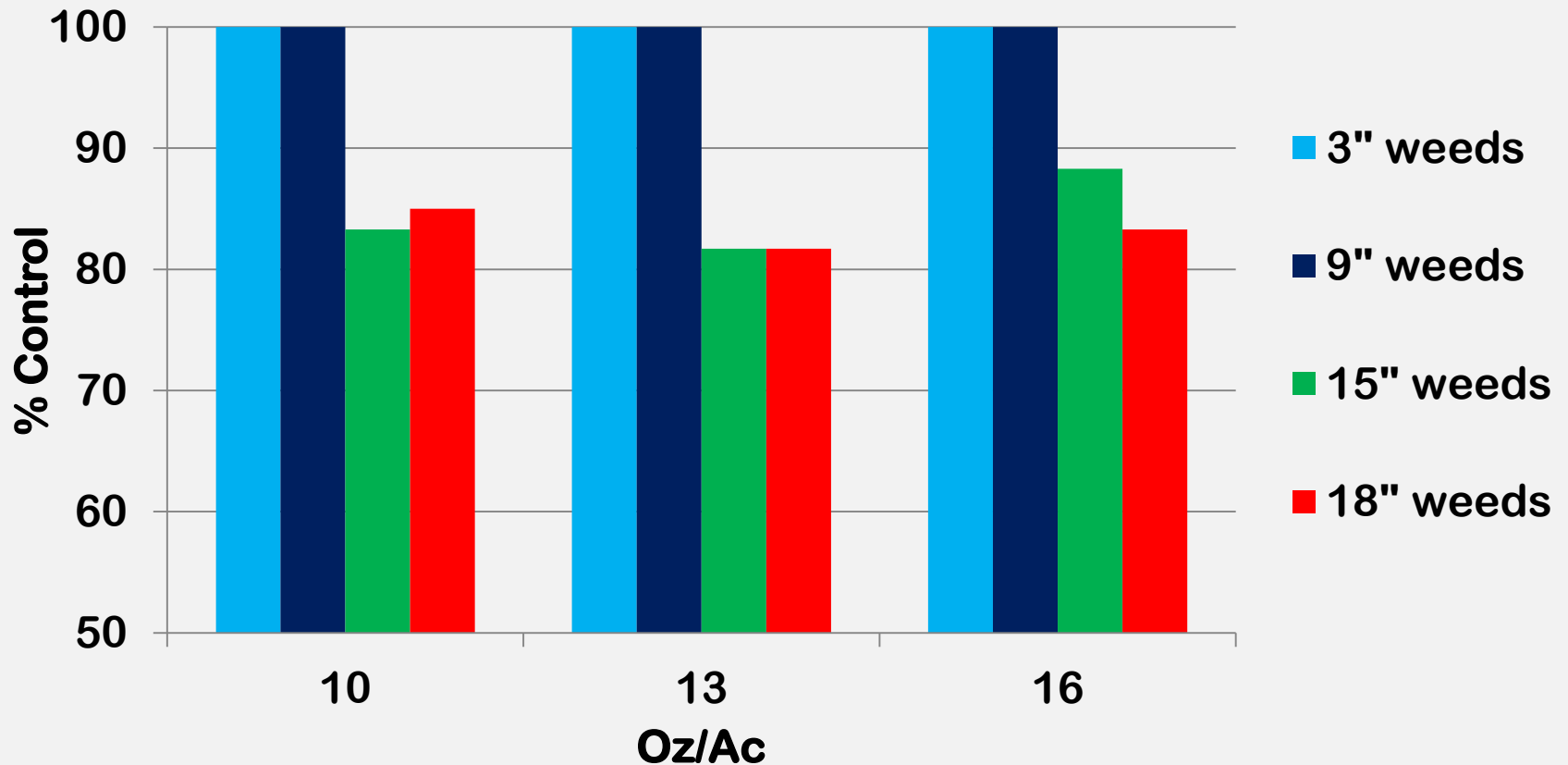
- **12 treatments plus one untreated control**
  - **Huskie – 10, 13, 16 oz/a**
    - **Atrazine – 0.5 lb/a**
    - **Ammonium Sulfate – 8.5 lb/100 gal**
  - **Application – 3, 9, 16, 18 inch weeds**



# Palmer amaranth Control 7 DAT



# Palmer amaranth Control 42 DAT



**10 oz/a Huskie with 0.5 lb/a atrazine  
9 inch weeds – 9 days after treatment**





## 10 oz/a Huskie and 16 inch weeds

14 DAT



33 DAT





## **Huskie Injury to Sorghum, 7 DAT**





## **Huskie Injury to Sorghum, 7 DAT**



## **Crop Rotation**

- **Wheat – 7 days**
- **Grain and Forage Sorghum – 7 days**
- **Alfalfa, Corn, Soybeans – 4 months**
- **Sunflowers, Canola – 9 months**
- **Cotton – Field Bioassay**

## **Post Grass Weed Control**

- **DuPont™ Inzen™ Z**
  - herbicide-tolerant trait – ALS Tolerance
- **DuPont™ Zest™ Herbicide**
  - nicosulfuron





# **SORGHUM: THE SMART CHOICE<sup>®</sup>**





# **Inzen™ Herbicide Tolerant Sorghum**

***KSU; HAYS***

***UNTREATED CHECK***



**ANNUA  
L  
GRASS  
ES**

***ALS Treated***





## **Stewardship and Best Management Practices for Inzen™ Sorghum**

- **Best management practices to prevent shattercane and Johnsongrass from becoming tolerant to ALS herbicides will be critical. Guidelines are being developed.**



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