

How to Manage Sorghum for Peak Performance 2016 Sorghum Symposium Grand Island, NE January 21st Brent Bean

USCP Agronomist











- > 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

Sorg	hum	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	2011	2011	2010	2010	2010	2009	2009	2009
	Etc	Yield	CWUE	Etc	Yield	CWUE	Etc	Yield	CWUE
	(in)	(bu/ac)	(bu/in)	(in)	(bu/ac)	(bu/in)	(in)	(bu)	(bu/in)
Corn	22.0	127.2	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	138.9	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

Modified from http://www.reganpdesigns.com/illustrations/ SORGHUM: THE SMART CHOICE

Seeding Rate

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	

SORGHUM: THE SMART CHOICE

Tillering



AMS Approved

Plant Population Effect on Sorghum

	1986		19	87	1988		
Seed/Ac	32000	64000	32000	64000	32000	64000	
Plant Pop.	20000	32000	21000	41000	21000	50000	
Tillers/Plt	1.5	1.1	1.8	1.3	1.4	1.0	
Heads@ Harvest	30000	38000	40000	56000	30000	43000	
Lbs. Grain/Hd	0.166	0.13	0.11	0.076	0.10	0.064	
Yield,lb/A	5000	5000	4600	4300	3100	2760	

SORGHUM: THE



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
 - \checkmark Depends on yield potential of soil
 - \checkmark 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.

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





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 P2O5
- 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 Ib yield is obtainable



Available water holding capacity of area soils

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



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)



(Rajan and Maas)



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 preemergence 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



Atrazine, Pre

Consider Atrazine

- 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

Grasses, Pre

- > Pigweed Excellent > Barnyardgrass Fair
- > Kochia Excellent > Crabgrass Poor
- > Lambsquarter Excellent > Foxtail Good
- Velvetleaf Good
 Sa
 - Sunflower Good
 - Cocklebur Good

- Sandbur
 Fair
- Shattercane
- > 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

Product	Rate/A	Dual II Magnum	AAtrex	Callisto
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











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

Herbicide	BYD- grass	Crab- grass	Fall Panicum	Fox- tail	Sand- bur	Shatter- cane	Witch- grass
Dual II Mag	G-E	G-E	G-E	G-E	F-G	Р	G
Outlook	G-E	G-E	G-E	G-E	F-G	Р	G
Bicep II Mag	G-E	Е	G-E	Е	F-G	Ρ	G-E
Guardsman Max	G-E	Е	G-E	Е	F-G	Ρ	G-E
Degree Xtra	Е	Е	E	Е	F-G	F	E
Lumax EZ	Е	Е	Е	Е	F-G	Р	Е



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 to high for the soil type and pH



Post Emergence Weed Control





Herbicide Weed Ratings

	E Nightshade	Cocklebur	Kochia	Lambsquarter	Morningglory	Pigweed	C Ragweed	Sunflower	Velvetleaf
Atrazine	G-E	G	G-E	Е	G	Е	G	G	G
Ally +2,4-D				G	Е	G	G-E	G-E	Е
2,4-D	G	Е	G	Е	Е	G	G-E	Е	G
Banvel	G	G-E	G-E	G	G-E	G	G	G	F-G
Starane	F	G	Е	Ρ	Е	Ρ	Е	G	g
Peak	F	Е	G	G	F	G	Е	Е	Е
Huskie	Е	Е	G	Е	Е	G-E	Е	Е	Е
Permit		Е	G	F	Ρ	F	Е	Е	G-E

KSU Ratings

Atrazine Precautions in Sorghum POST EMERGENCE

 Labeled rate is 1.0 – 2.0 lb/ac + Crop Oil.

SORGHUM: THE

- 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

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



Starane

- Pros
 - Safer on crop
 - Excellent kochia control and some other broadleaf weeds
- Negative
 - Week 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









Inzen™ Herbicide Tolerant Sorghum

KSU; HAYS

UNTREATED CHECK



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.

Brent Bean

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