Grain Sorghum Production Management

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Knowledge for Life

Outline:

- Yield trends
- Sorghum Characteristics
- Planting Management
  - Row Spacing
  - Plant Population
  - Planting Date
  - Hybrid Selection
  - Tillage and Rotation Effects
  - Water use

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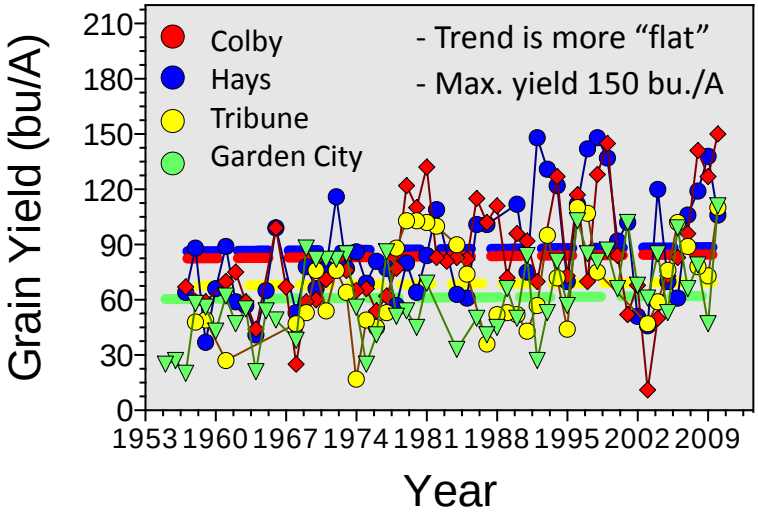
Dryland Sorghum Yields (Long-term)



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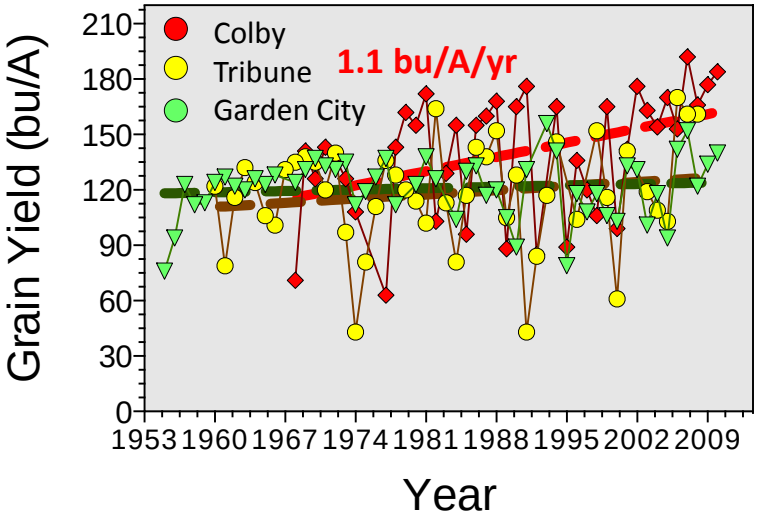
Irrigated Sorghum Yields (Long-term)



- Overall: 0.5 bu/A/yr increase
- Colby yield trend last 10-yrs

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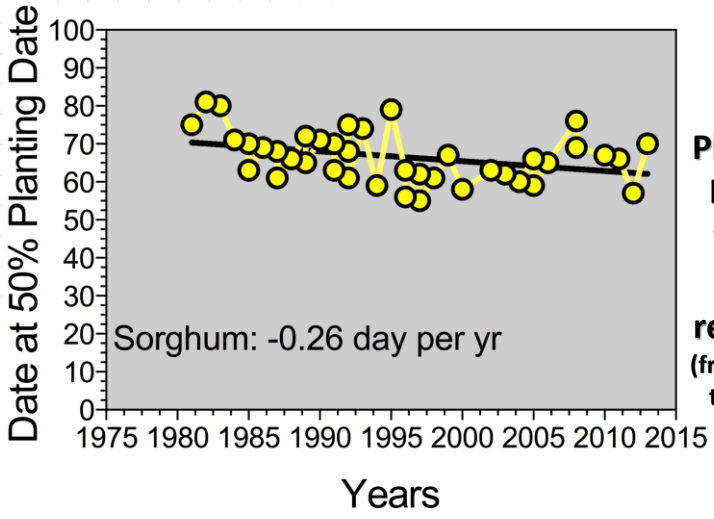
Planting Date (50%) Evolution: Sorghum in Kansas

(Sorghum – Days after March 31st)



Sorghum Planting Dates: In the last 30 yrs, planting date was reduced 8 days
(from June, 14th 1981 to May 27th 2012)

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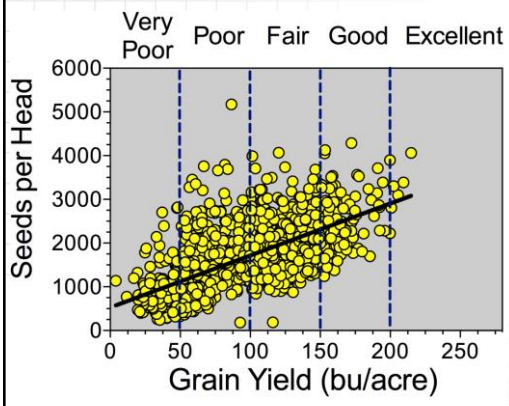
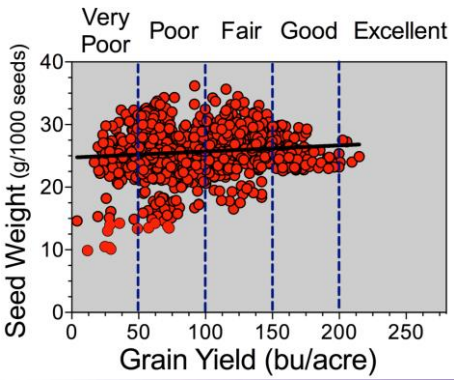
Management Practices: Understanding Sorghum Yield Components



Grain weight is slightly influencing ("flat trend") the final sorghum YIELD.

Grain number is the main YIELD component highly associated with the final sorghum YIELD.



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Sorghum and Drought

- Drought Tolerance
  - The ability to maintain growth during periods of water stress.
- Drought Avoidance
  - The ability to alter plant development or physiological processes to survive a period of water stress.

Sorghum Drought Tolerance

- 50% more stomata per in^2 of leaf than corn
- Stomata are smaller
- Extensive root system
- Small leaf:root ratio compared to other crops
- Perfect flowers
- Stay-Green Traits

Drought Avoidance

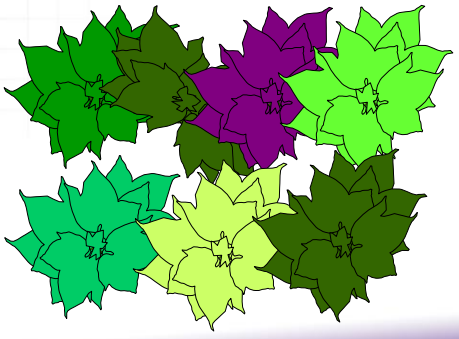
- Heavy wax layer (bloom) on leaves
- Slow/hasten maturity under stress
- Motor cells at leaf midrib to facilitate leaf curling under stress

Management Practices:

- Row Spacing
- Plant Population
- Planting Date
- Hybrid Selection
- Rotation effect
- Water use

Crop Water Use

- Often thought of in a single plant frame of reference.
  - "If one plant uses 1000 g of water per day, two plants must use 2000 g of water per day."



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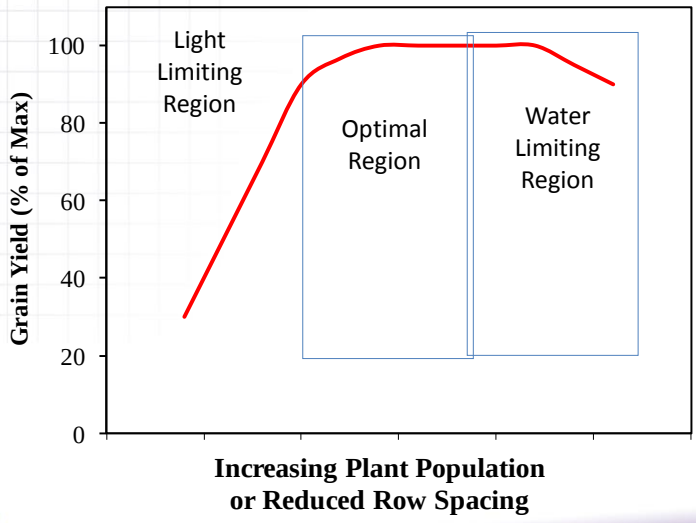

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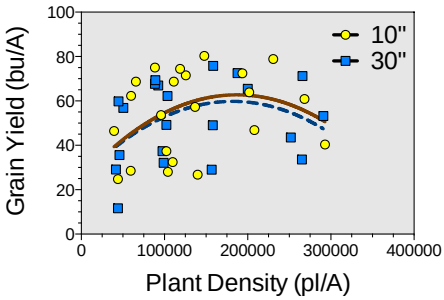
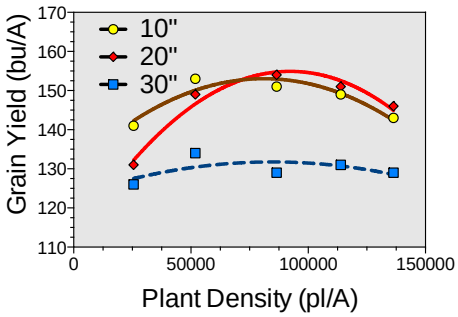
Grain Sorghum: Row Spacing x Plant Density

Narrow rows can produce greater yields at typical or greater populations in high-yield environment

Tribune & Hutchinson, 1985

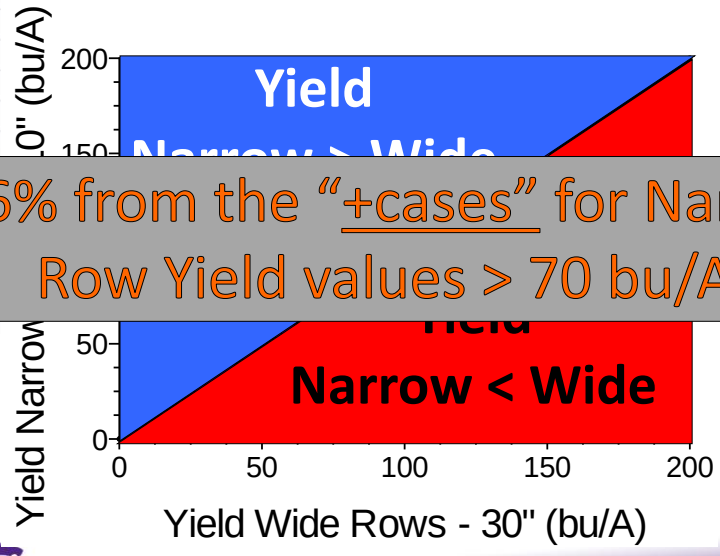


Manhattan, 2008



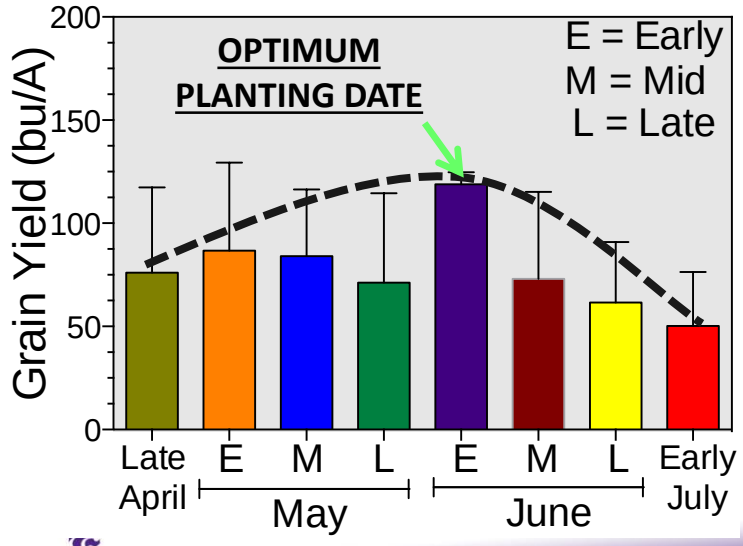
Under low yielding environments, the response to narrow rows under diverse population levels is similar to wide rows

Grain Sorghum Yield Response to Row Spacing



66% from the "+cases" for Narrow Row Yield values > 70 bu/A.

Grain Sorghum: Planting Date



This summary showed "Early June as the optimum planting date for Max. Yields.

Planting Date Revision:

Tribune/ Hutchinson/ Manhattan (Vanderlip)
Scandia 1994-1996 (Gordon)
St. John 1993-1995 (Martin & Vanderlip)
Columbus 2000/03 (Kelley)

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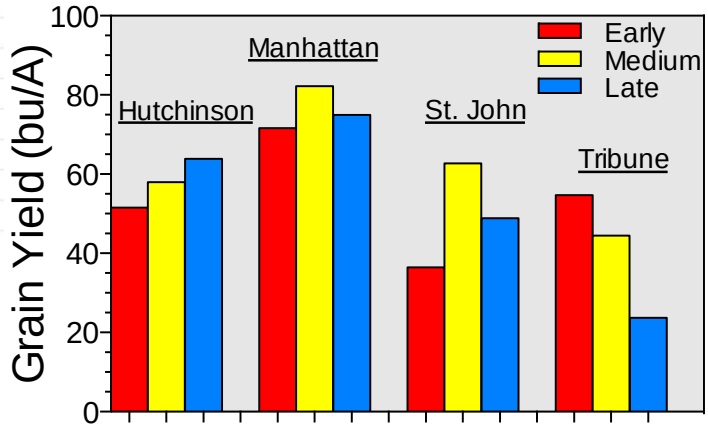
Grain Sorghum: Hybrid Selection Maturity



This summary showed the complexity of the hybrid selection. "Full (early) to medium maturity hybrids showed high yields.

Planting Date Revision:

Tribune/ Hutchinson/ Manhattan (Vanderlip)
Scandia 1994-1996 (Gordon)
St. John 1993-1995 (Martin & Vanderlip)

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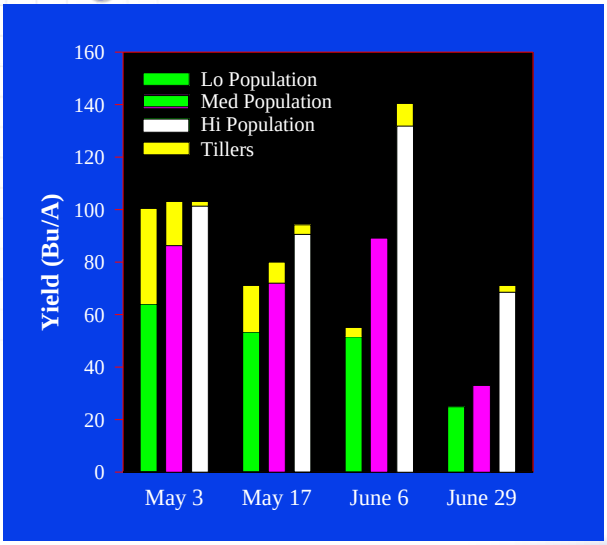
Planting Date effects on Tillering



Vanderlip, 1979

Grain Sorghum: Hybrid x Planting Date

- Plant as early as soil temperatures allow
  - Once soil temperatures reach 65° to 70° F
  - Can benefit from delayed planting into mid-June depending on year (heads and fills grain after worst of heat, catches late-summer rains)
- Plant the fullest maturity hybrid adapted to your area
  - Earlier maturing hybrids when planting is delayed into mid-June or later in W, NC KS and SC NE, late June in SC KS, July in eastern KS
  - Usually want sorghum to head
    - By early August in NW KS
    - By mid-August in SW, SC, NC, NE
    - By late August in central KS
    - By early September in SC, SE KS
- Think about next crop
  - e.g. If planting wheat immediately after sorghum…
    - Use an earlier hybrid
    - Plant earlier

Long-term Cropping Systems Research

Alan Schlegel
Lucas Haag
Southwest Research-Extension Center – Tribune, Kansas

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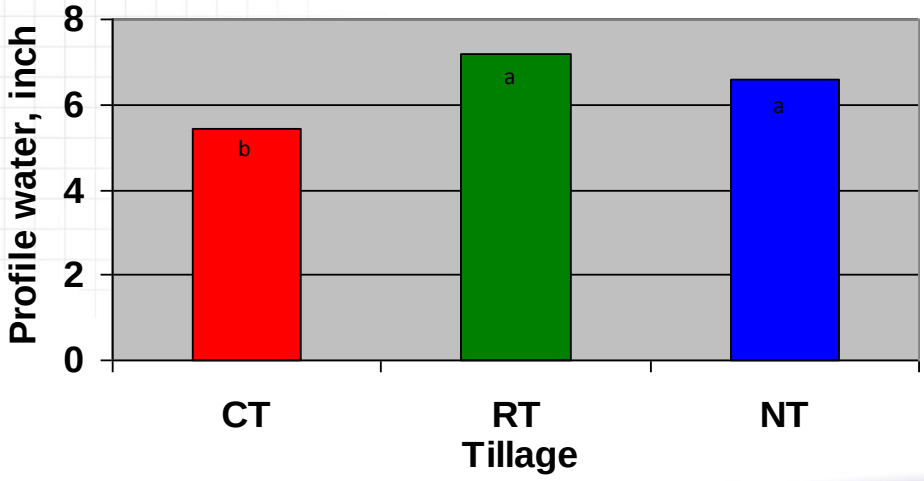
Soil Water at Sorghum Planting

WSF, Tribune, 2001-2016



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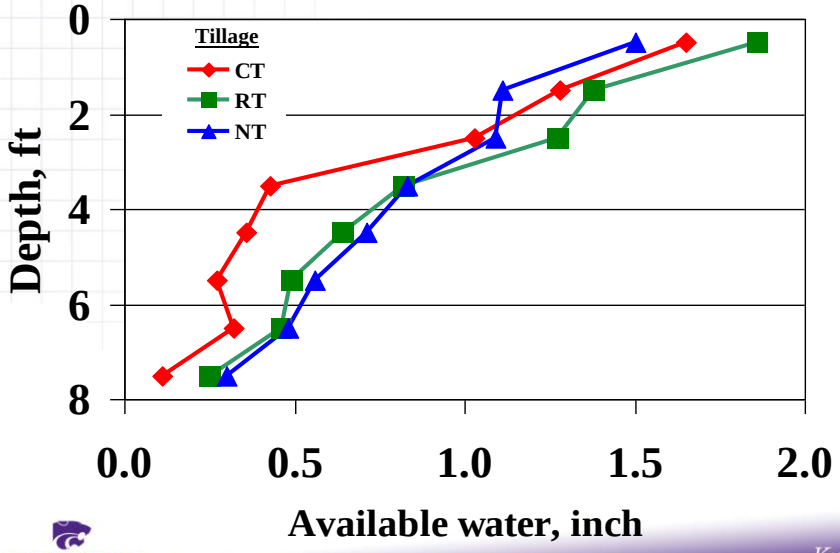
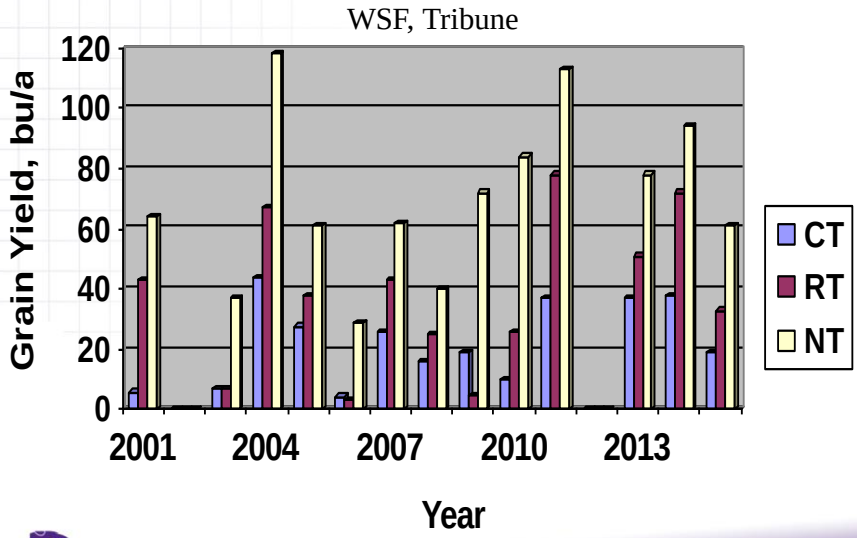
Sorghum Planting

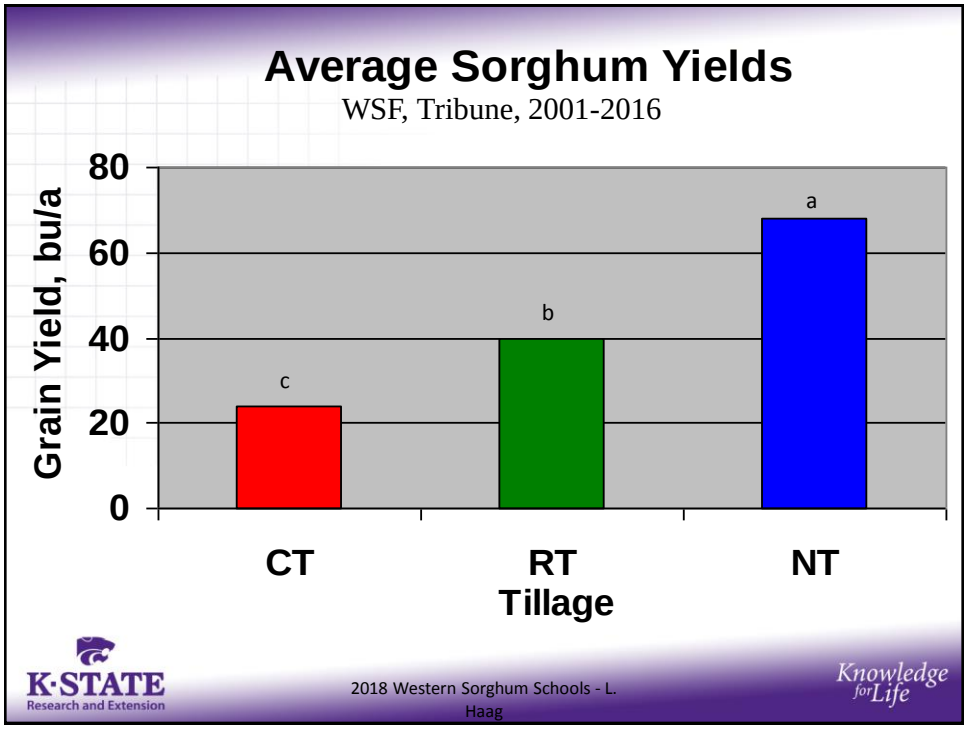


Tillage Intensity
Tribune, KS 2001-2016

Sorghum Yield



A. J. Schlegel, SWREC-Tribune


Average Sorghum Yields
WSF, Tribune, 2001-2016
Grain Yield, bu/a
80
60
40
20
0
c
b
a
CT
RT
NT
Tillage
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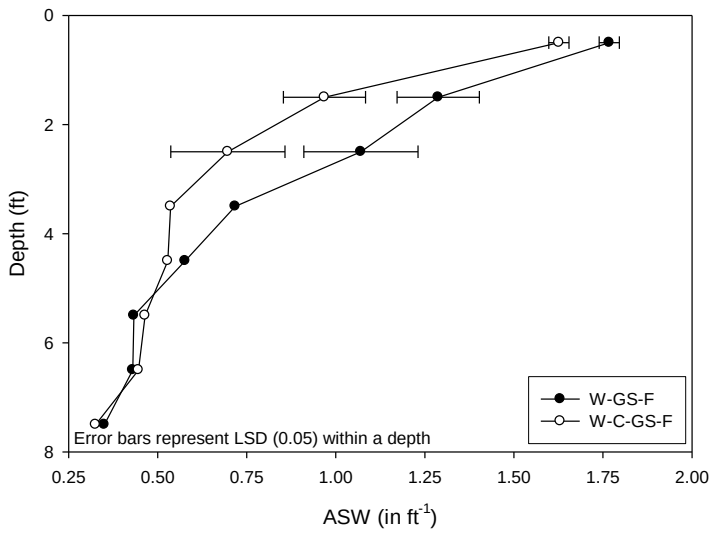
What About Re-Cropping?

Available Soil Water at Sorghum Planting
Tribune, Kansas 1999-2008



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Row crop yields as affected by rotation
Tribune, Kansas 1998-2009

Crop	Rotation	Row-Crop Grain Yield		Subsequent Wheat Yield	
Grain Sorghum		bu ac^{-1}		bu ac^{-1}	
	w-S-f	60.0	a[†]	30.4	a
	w-c-S-f	35.1	b	26.5	a
Sunflowers		lbs ac^{-1}			
	w-SF-f	646.2	ns	19.9	b
	w-c-SF-f	630.5	ns	19.4	b
Corn		bu ac^{-1}			
	w-C-sb-f	35.9	ns	28.6	a
	w-C-s-f	35.9	ns	26.5	a
	w-C-sf-f	32.4	ns	19.4	b
	w-C-f (WP)	50.5[‡]	-		
	w-C-f (KDWP)	51.2[#]	-		

[†] Letters within a crop and column represent differences at LSD (0.05)

[‡] WP w-C-f yields are average of like crop sequences in WP study 1998-2002

[#] KDWP w-C-f yields are average of an adjacent study 2001-2006

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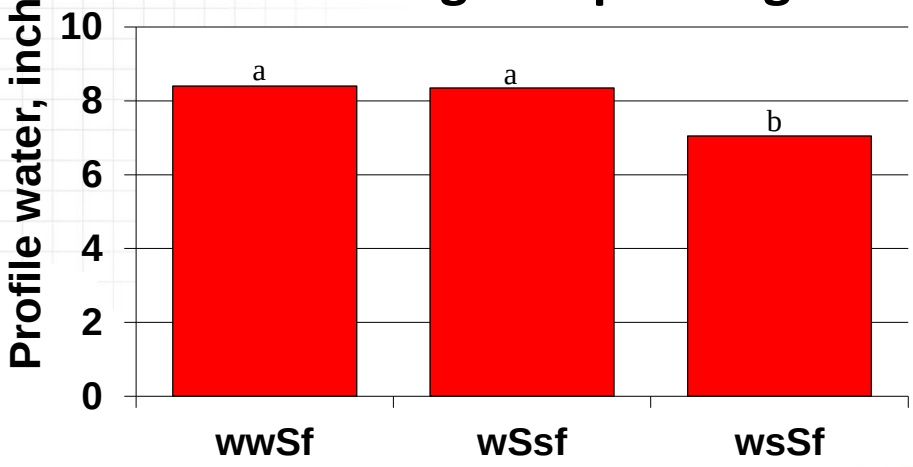
Profile available soil water at sorghum planting



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Dryland Rotation, Tribune, KS, 1998-2016

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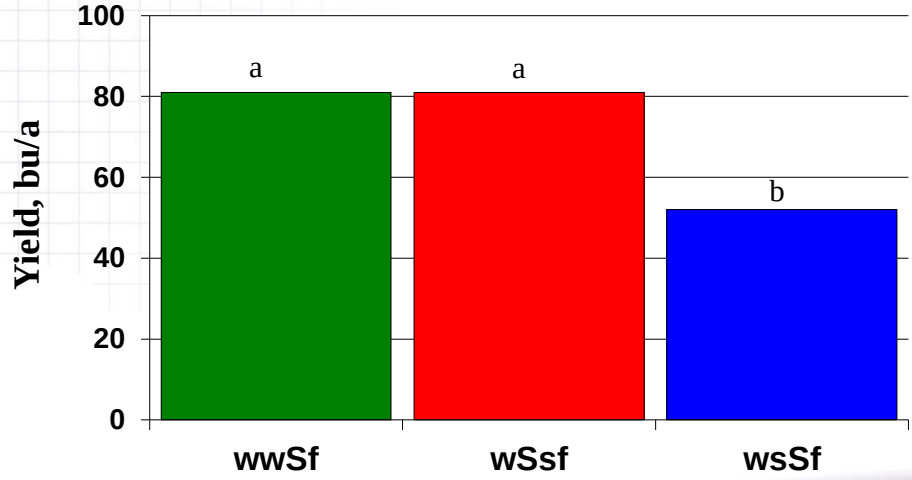
Sorghum Yield



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Dryland Rotation, Tribune, KS, 1996-2016

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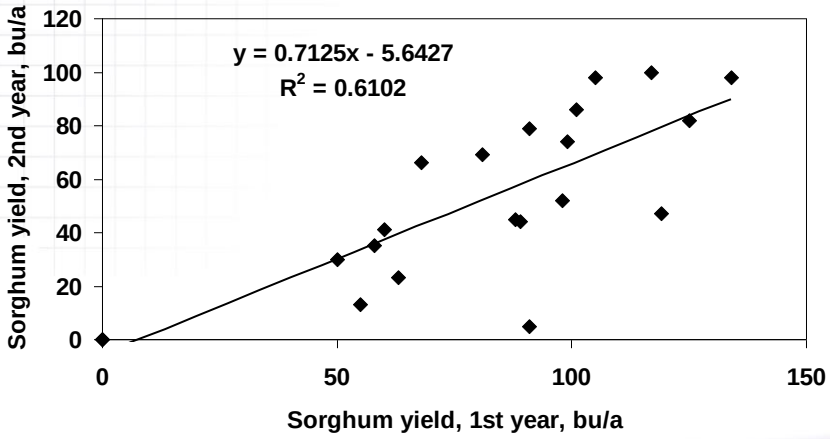
Sorghum Yields, 1st vs 2nd year 1996-2016



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OPREC Dryland Sorghum Tillage Study

Tillage	2004	2005	2006	Three-year
No-till	54.8	53.9	73.7	60.8
Strip till	44.2	46.4	51.2	44.6
Minimum till	28.0	38.3	35.6	36.7
Mean	42.3	46.2	53.5	47.4
CV %	6.4	13.6	19.0	20.1
L.S.D.	6.1	NS	24.2	9.9

Timing	2004	2005	2006	Two-year
No-till	62.5a	81.7a	80.1a	74.8a
September (fall)	47.6b	77.6a	54.1b	59.1b
March (spring)	45.5b	66.9a	56.6b	57.9b
January	42.1b			
November	37.9b			

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Dryland Strip-Till

Do the perceived benefits outweigh the known residue cost?

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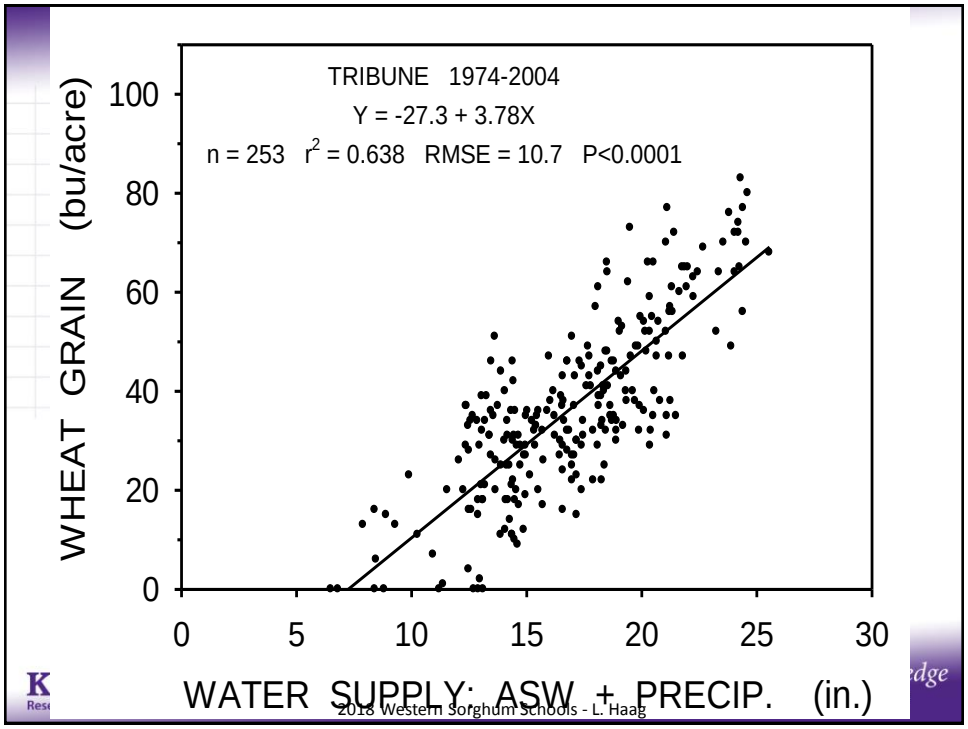

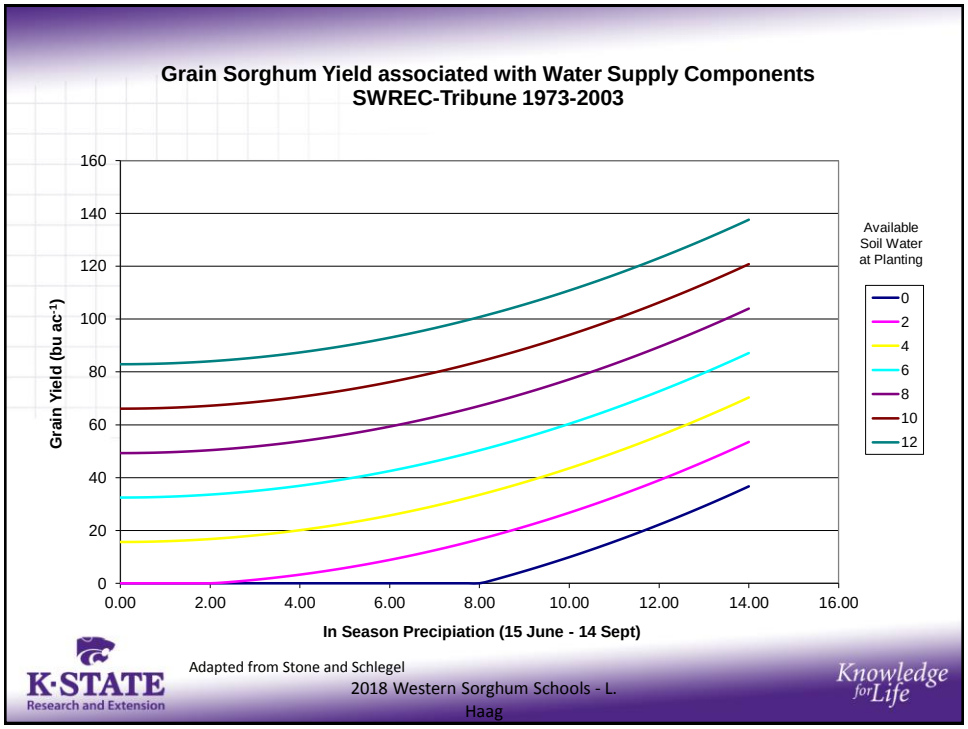

Adapted from Stone and Schlegel

In-Furrow Humic Acid in Grain Sorghum – Year 1



Lucas Haag, Northwest Area Agronomist, NWREC-Colby
Jeanne Falk Jones, Sunflower Dist. Agronomist
Alan Schlegel, Agronomist-in-Charge, SWREC-Tribune

Rationale

- We had received reports of in-furrow applications of humic acid reducing the occurrence of iron chlorosis

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Materials and Methods

- Two Products Used
  - Raw Humic Acid (Soil Boost), 72% humic acid
  - Humic DG (The Andersons), 70% humic acid
- IDC Tolerant Hybrid, P87P06 used
- Planted in 30” rows, 45,000 seed drop
- 4 Replications per location
- 4 Locations
  - Colby, Wallace 1, Wallace2, Wallace 3

In-Furrow Rates

Product	30" Rate	Equivilent 10" Rate
	lbs/acre	
Raw Chipped Humic Acid	0	0
	10	30
	20	60
	30	90
	40	120
	70	210
Humic DG	7	21
	14	42
	21	63
	28	84
	35	105

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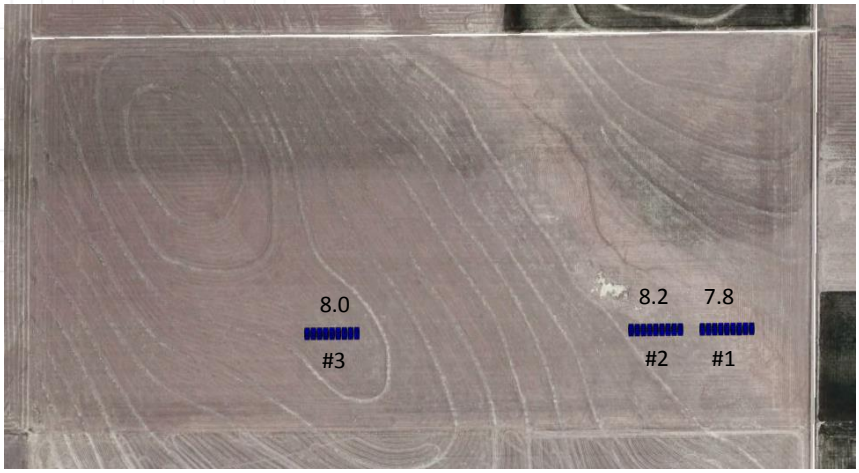
Locations - Wallace



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Locations - Colby

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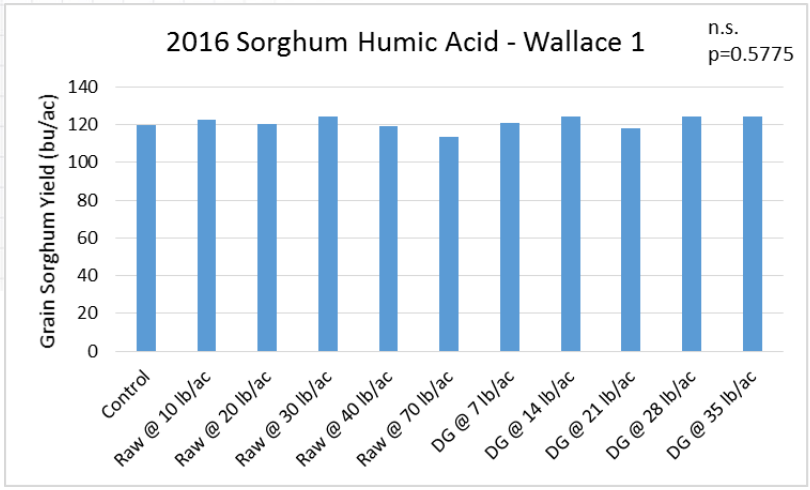
Results – Wallace 1



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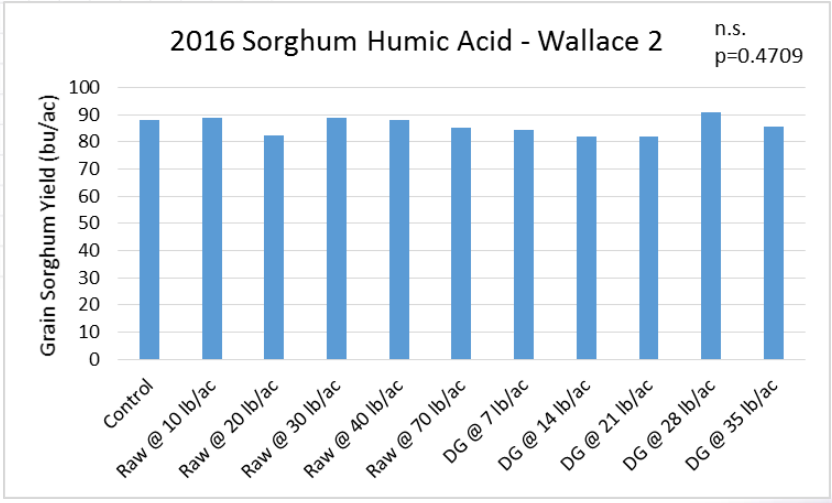
Results – Wallace 2



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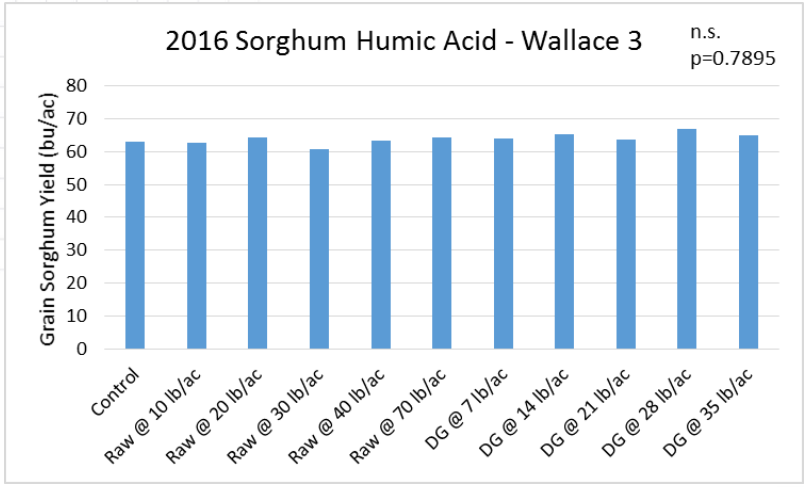
Results – Wallace 3



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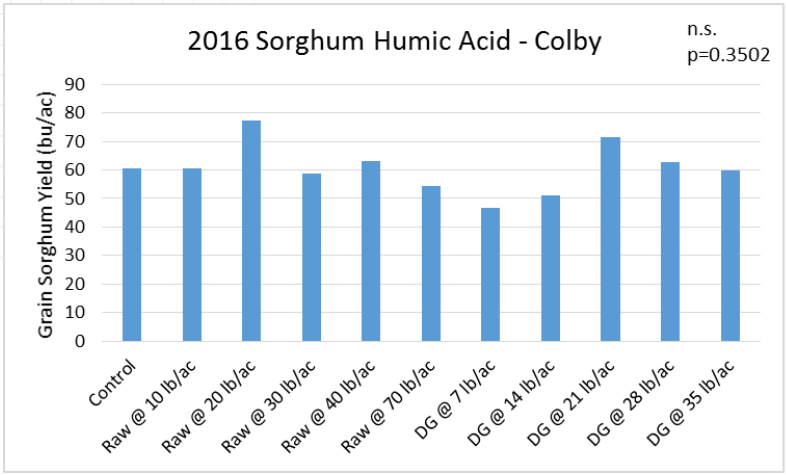
Results - Colby



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Summary

- In year one of the study, across four locations, we did not see a statistical or numerical response to in-furrow applications of humic acid in grain yield or IDC score
- We are considering extending the study another year

Questions?

Stanton County Clump/Conventional Sorghum, 2009. Photo by L. Haag