Integrated Jointed Goatgrass Management Systems in the Central and Southern Great Plains

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National Jointed Goatgrass Research Program

www.jointedgoatgrass.org

JGG Seed Longevity in Soil

- In CO, KS & NE, <8% of seed on or in the top 2 inches of soil survived >2 yr
- Persists longer in dryer environments
- <0.5% of buried seed survived >5 yr
- Not greatly affected by depth to 12”
- Can emerge from as deep as 4 inches

W.W. Donald, USDA-ARS

Individual Control Practices

- Type & time of tillage
- Fertilizer placement
- Wheat seeding rate
- Wheat row spacing
- Wheat cultivar
- Crop rotation
- Herbicide
- Burning

JGG seedling emergence over 5 yr

Akron, CO

Tillage treatment	Years after seed entry into soil					
	1	2	3	4	5	Total
	---------- Seedlings/m^2 ----------					
No-till	38	25	0.6	2.5	10	76
Tillage	66	22	0.3	1.3	8	98

Red indicates significance within columns at P = 0.05.

R.L. Anderson, USDA-ARS

Effect of tillage on JGG in winter wheat

North Platte, NE

	1998	1999	2000	2001	2002	2003	2004	2005
In winter wheat in April								
Tillage	29	12	1	13	0	34	1	125
No-till	79	15	8	29	0.01	341	5	177
In winter wheat stubble in fall								
Tillage	147	0	0	286	0	0	0	20
No-till	224	0	0	1,442	1.2	0	4	29

Wicks & Klein
Univ. of NE

Effect of Post-harvest Tillage and Burning

North Platte, NE

	JGG density in winter wheat in June, 2007	
Imazamox	No	
Burn	0 c	
Burn + plow	0 c	
Disk in spring	18 b	
Disk in fall	16 b	
Plow	3 c	
No-till	29 a	

Wicks and Klein, Univ. of Nebraska

Effect of Post-harvest Tillage and Burning

North Platte, NE

	JGG density in winter wheat in June, 2007	
Imazamox	No	Yes
Burn	0 c	0 c
Burn + plow	0 c	0 c
Disk in spring	18 b	1 c
Disk in fall	16 b	0 c
Plow	3 c	0 c
No-till	29 a	1 c

Plowing and burning recommended only in extreme circumstances

Wicks and Klein, Univ. of Nebraska

Effect of tillage on jointed goatgrass spikelet distribution in the soil profile

Soil depth	Plow		Chisel	
Inches	---------- % ----------			
0 (surface)	0		30	
0 – 2	17	37	42	89
2 - 4	20		17	
4 - 6	23		11	
>6	23		0	

Miller & Neider, University of Wyoming

Effect of Nitrogen Fertilizer Placement

Archer, WY 1995-1997

	Wheat grain yield		Wheat biomass	
Placement (45 kg/ha N)	JGG absent	JGG present[a]	JGG absent	JGG present[a]
	ton/ha	%	ton/ha	%
Check (no N)	3.0 b	-17	13.7 b	-30
Deep band	3.3 ab	-13	15.7 a	-16
Broadcast	3.3 ab	-20	14.8 ab	-30
Spoke wheel injection	3.4 a	-10	15.9 a	-16

[a] 35 jointed goatgrass plants/m^2; wheat plant density was not affected by fertilizer placement or JGG presence.

Mesbah and Miller. 1999. Weed Technol. 13:374-377

Effect of Nitrogen Fertilizer Placement

Archer, WY 1995-1997

	Jointed goatgrass			
N placement (45 kg/ha)	Spikes/plant	Spikelets/spike	200-seed wt	Biomass
	no.	no.	g	tons/ha
Check (no N)	5.0	7.4	64.8	3.4
Deep band	-10%	-3%	+0.5%	-15%
Broadcast	+16%	+3%	+4%	+6
Spoke wheel injection	-8%	-3%	+2%	-21%

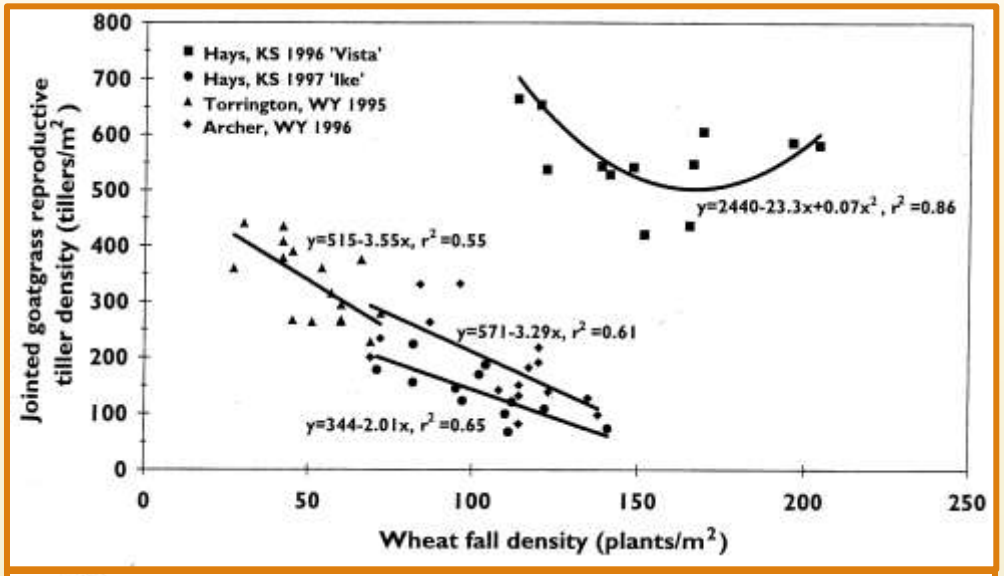
JGG plant density was not affected by fertilizer placement.

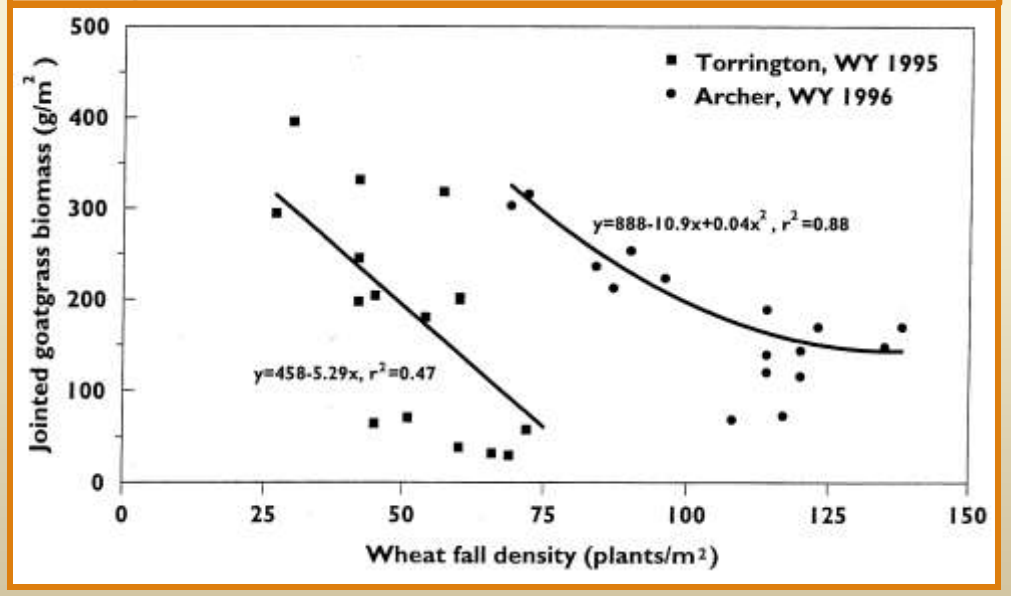
Mesbah and Miller. 1999. Weed Technol. 13:374-377

Wheat Plant Density Affects JGG

- Reproductive tillers reduced in four of six site-years
- Biomass reduced in two of four site-years
- For every 10 additional wheat plants above threshold density, grain dockage was reduced

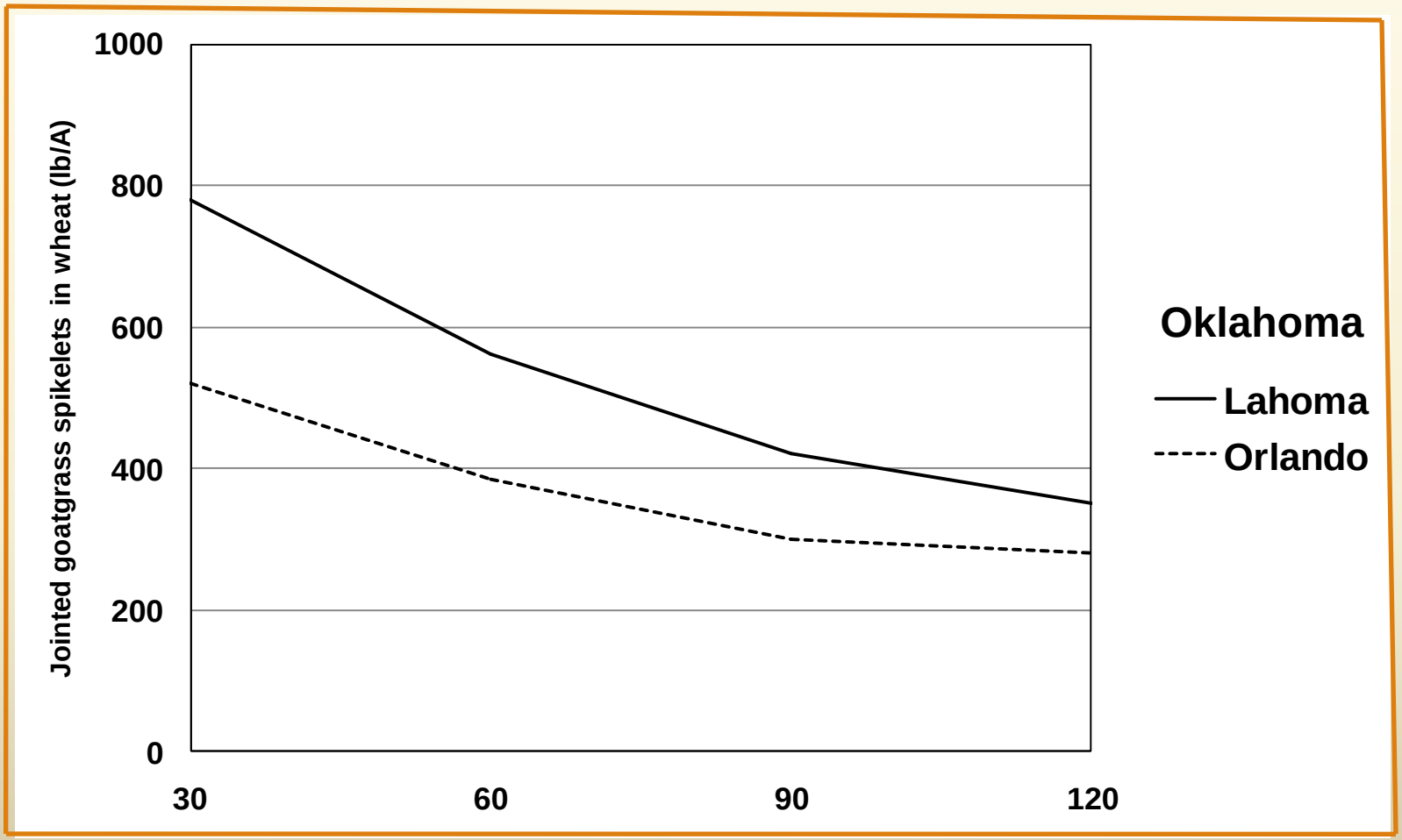
  ~6% at Archer, WY
  ~0.5% at Hays, KS





Kappler et al. 2002. Weed Technol. 16:102-108

Effect of wheat seeding rate on JGG



T.F. Peeper, Oklahoma State University

Influence of Wheat Cultivar on JGG

- Studies in CO, KS, NE
- Results inconsistent
- Important traits
  - establishment & fall growth
  - root mass
  - vegetative dormancy & spring green-up
  - erect vs. leaning growth habit
  - plant height
- Uniform stand is essential

Grazing Can Increase Jointed Goatgrass

JGG Control in Clearfield Winter Wheat

Colby, KS

Untreated control →

Beyond + UAN + MSO →

5 oz/A + 1.25% + 1.25%

Application Dec. 4, 2000

Photo April 30, 2001

Stahlman & Price, Kansas State University

JGG Control in Clearfield Winter Wheat

- In KS & WY, imazamox controlled JGG ≥95%, regardless of rate or application timing.
  Geier et al. 2004. Weed Technol. 18:924-930.

- In KS, JGG control increased slightly with increasing UAN concentration from 1 to 50%. Fall-POST ~40% better than spring-POST.
  Geier and Stahlman. 2009. Crop Prot. (in press)

- In WY, use of Clearfield technology every other year, or two out of every three years, provided benefits in subsequent years.
  Kniss et al. 2008. Crop Sci. 48:2414-2420.

JGG Density in Winter Wheat

Sidney, NE

Crop Rotation	1996	1997	Avg.
	---------- Plants/m^2 ----------		
WW-F till	16	3.6	9.6
WW-F herb	28	5.5	17
WW-F-F	0.02	0	0.01
WW-SF-F	0	0.3	0.15
WW-PM-F	0	0.13	0.07
	---------- Significance of contrasts ----------		
2-yr vs. 3-yr	*	NS	*
WW-F till vs. WW-F herb	*	NS	*
Within 3 yr	NS	NS	NS

Final 2 yr of a 7-yr study.

Daugovish et al. 1999. Weed Technol. 13:120-126.

JGG Spikelets in the Soil Seed Bank & Grain

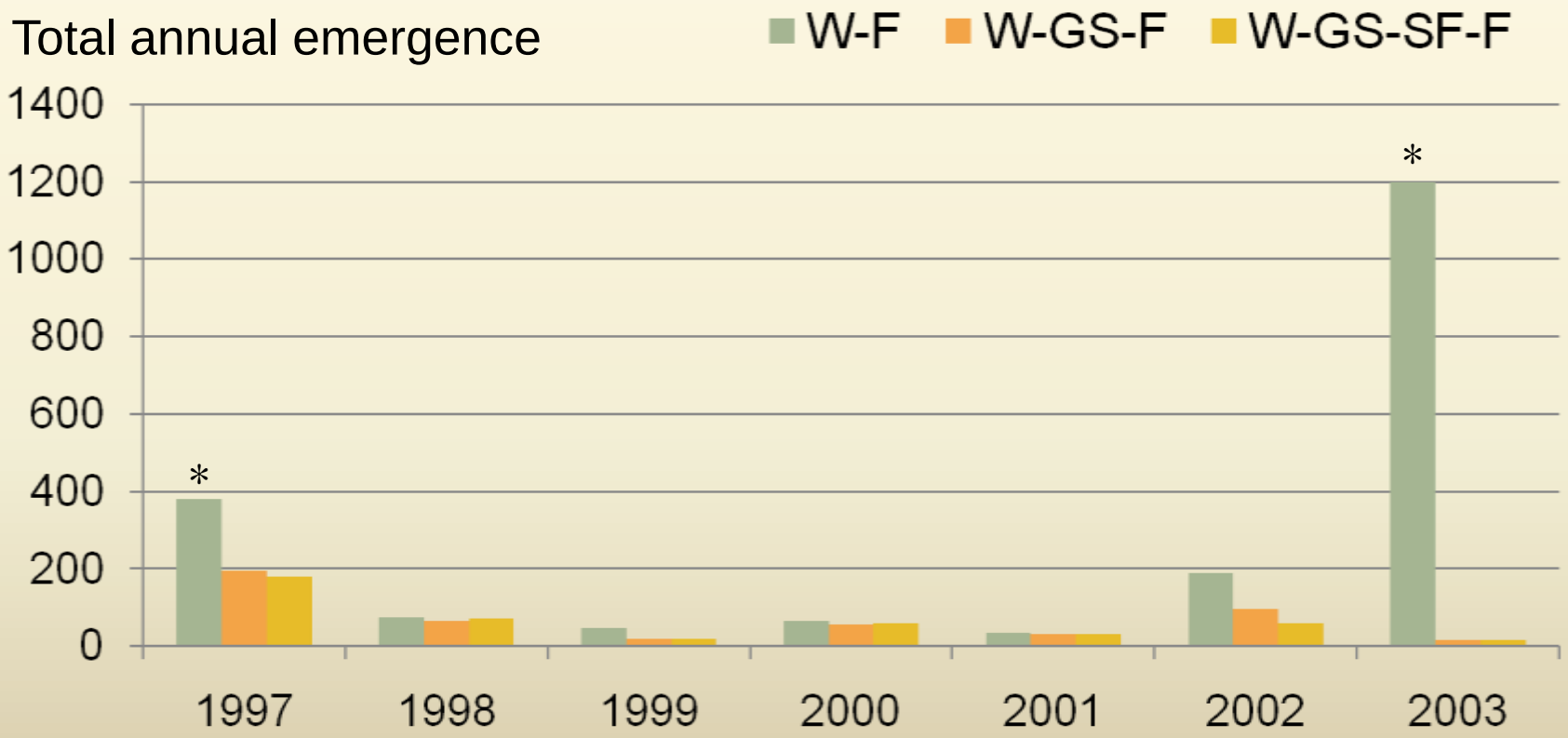
Sidney, NE

Rotation	Seed bank	Grain
	Spikelets/m^2	
WW-F till	548	86
WW-F herb	1,010	95
WW-F-F	0	2.0
WW-SF-F	0	1.3
WW-PM-F	0	2.6
	---- Significance of contrasts ----	
2-yr vs. 3-yr	*	*
WW-F till vs. WW-F herb	*	NS
Within 3 yr	NS	NS

Average of the final 2 yr of a 7-yr study.

Daugovish et al. 1999. Weed Technol. 13:120-126.

Effect of Crop Rotation on JGG Density
Hays, KS

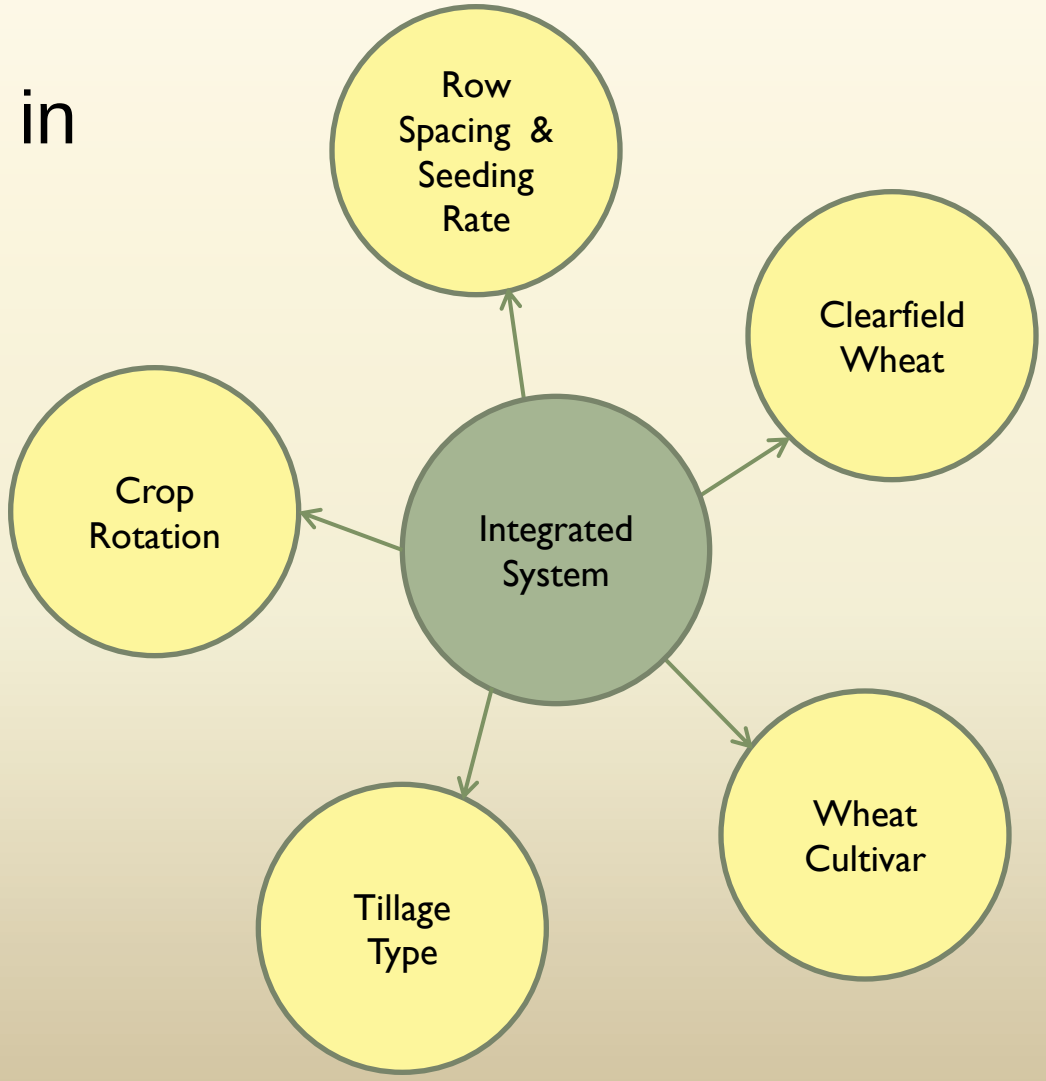


* significance within year

White et al. 2004. Weed Sci. 52:1010-1017.

Integrated JGG Management Systems

- Long term studies in
  - Colorado
  - Kansas
  - Nebraska
  - Oklahoma
- Multi-practice approach



Integrated Management of Jointed Goatgrass

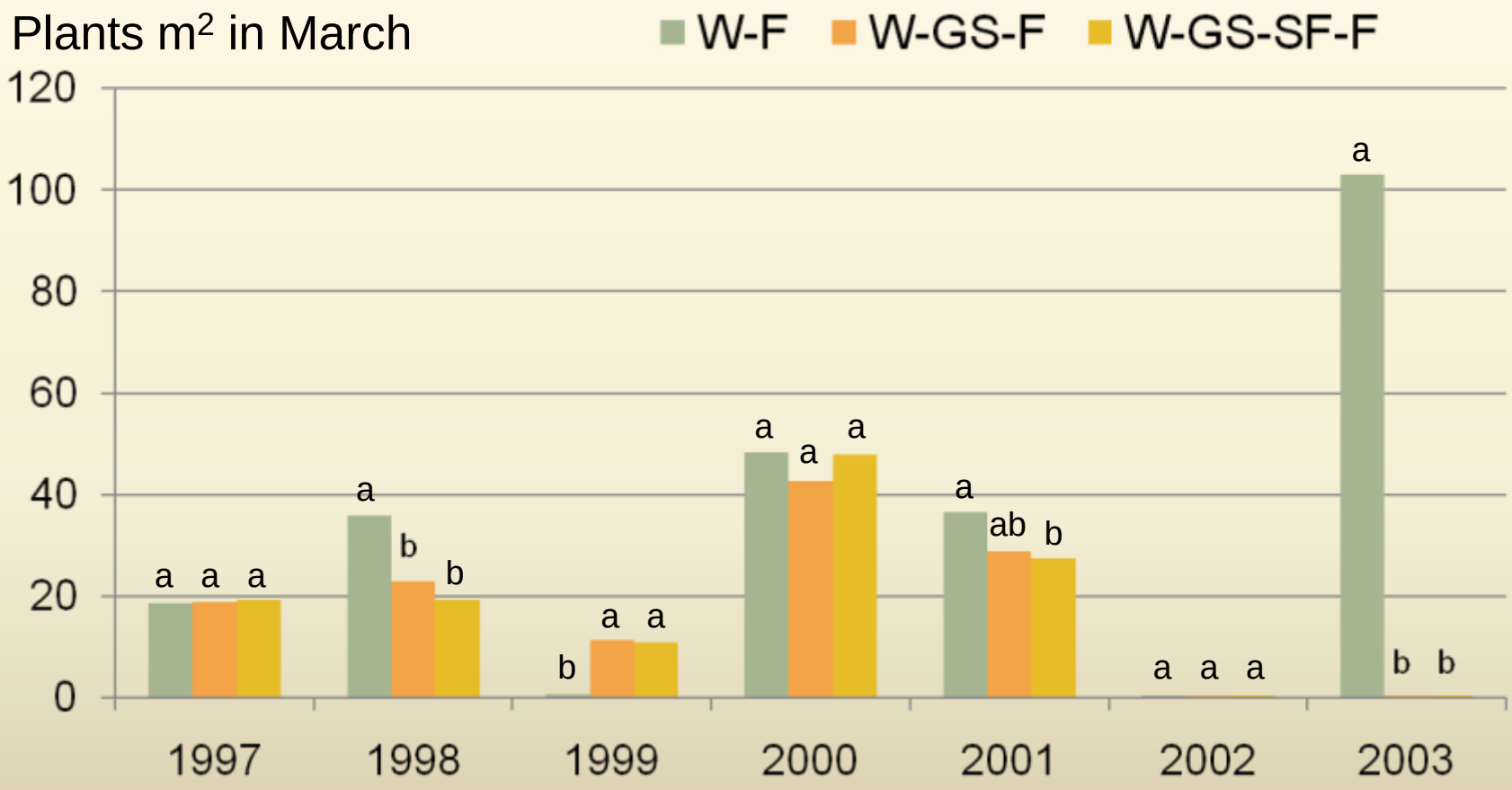
Hays, KS 1997-2003

- Crop rotation
  - W-F 2-yr
  - W-GS-F 3-yr
  - W-GS-SF-F 4-yr
- Method of Fallow Management
  - Chemical
  - Mechanical
- Wheat cultivar
  - Short stature
  - Mid stature

W-F				W-GS-F				W-GS-SF-F			
Chem		Mech		Chem		Mech		Chem		Mech	
C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2

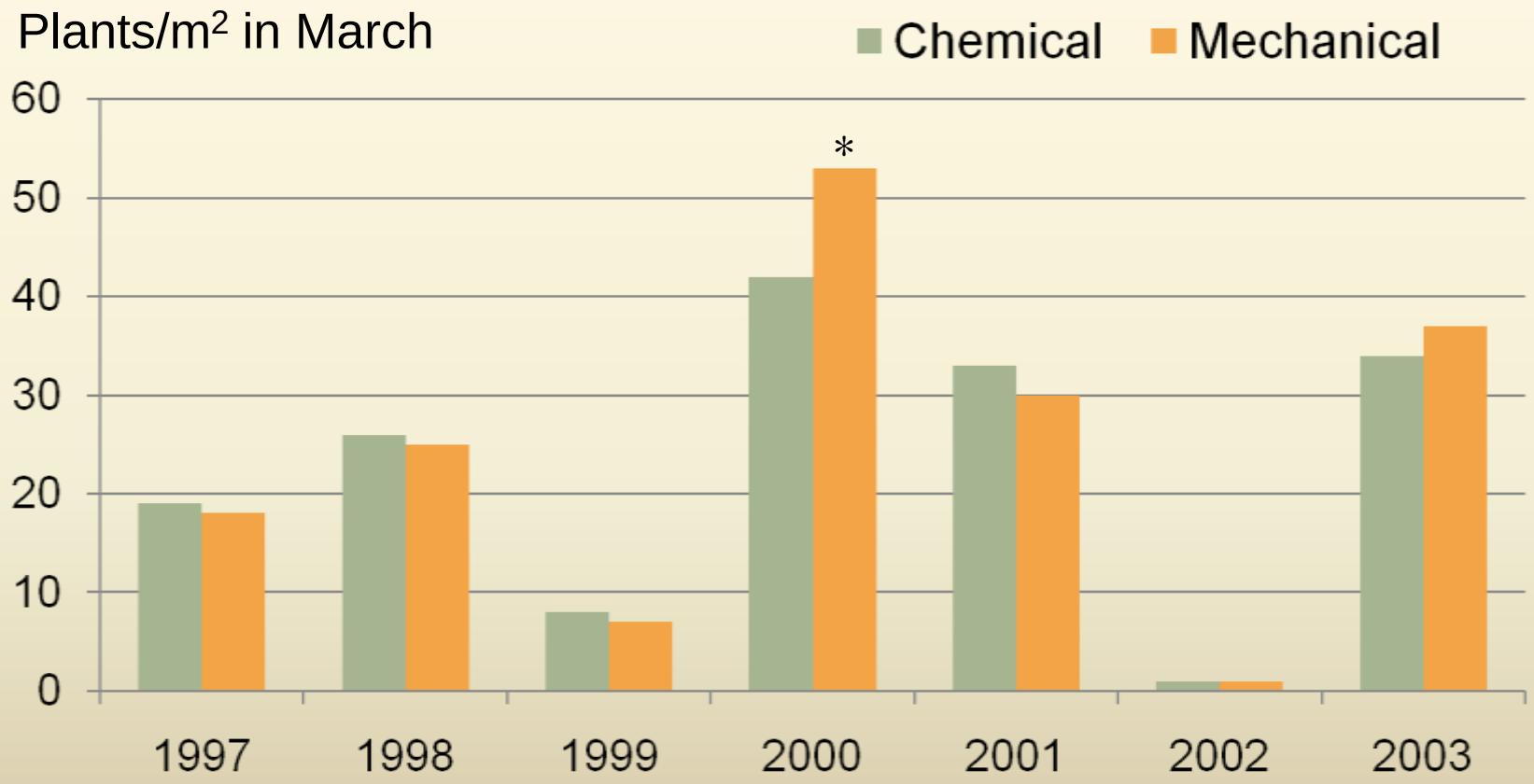
Split-split block. Each phase of rotation each year.

Effect of Crop Rotation on JGG Density in Wheat
Hays, KS



White et al. 2004. Weed Sci. 52:1010-1017.

Method of Fallow Weed Management on JGG Density
Hays, KS



* significance within year

White et al. 2004. Weed Sci. 52:1010-1017.

Integrating Clearfield Winter Wheat and Best Management Practices

Year	Trt 1	Trt 2	Trt 3	Trt 4	Trt 5
2001-02	CRCL 5 oz BMP	CRCL 3 oz BMP	CRCL 3 oz Conv	CRCL 5 oz BMP	Jagger BMP
2002-03	CRCL 5 oz BMP	CRCL 3 oz BMP	BRCL 3 oz Conv	BRCL 3 oz BMP	Jagger BMP
2003-04	CRCL 5 oz BMP	CRCL 3 oz BMP	BRCL 3 oz Conv	Jagger BMP	Jagger BMP
2004-05	CRCL 5 oz BMP	CRCL 3 oz BMP	BRCL 3 oz Conv	CRCL 5 oz BMP	Jagger BMP
2005-06	CRCL 5 oz BMP	CRCL 3 oz BMP	BRCL 3 oz Conv	BRCL 3 oz BMP	Jagger BMP

Stahlman et al., Kansas State University

Best Management Practices

St. John, KS

- inversion tillage after 3rd wheat crop
- 90 lb/A seeding rate
- 7.5-inch row spacing
- large seed
- preplant N plus 10-34-0 starter plus topdress N in spring

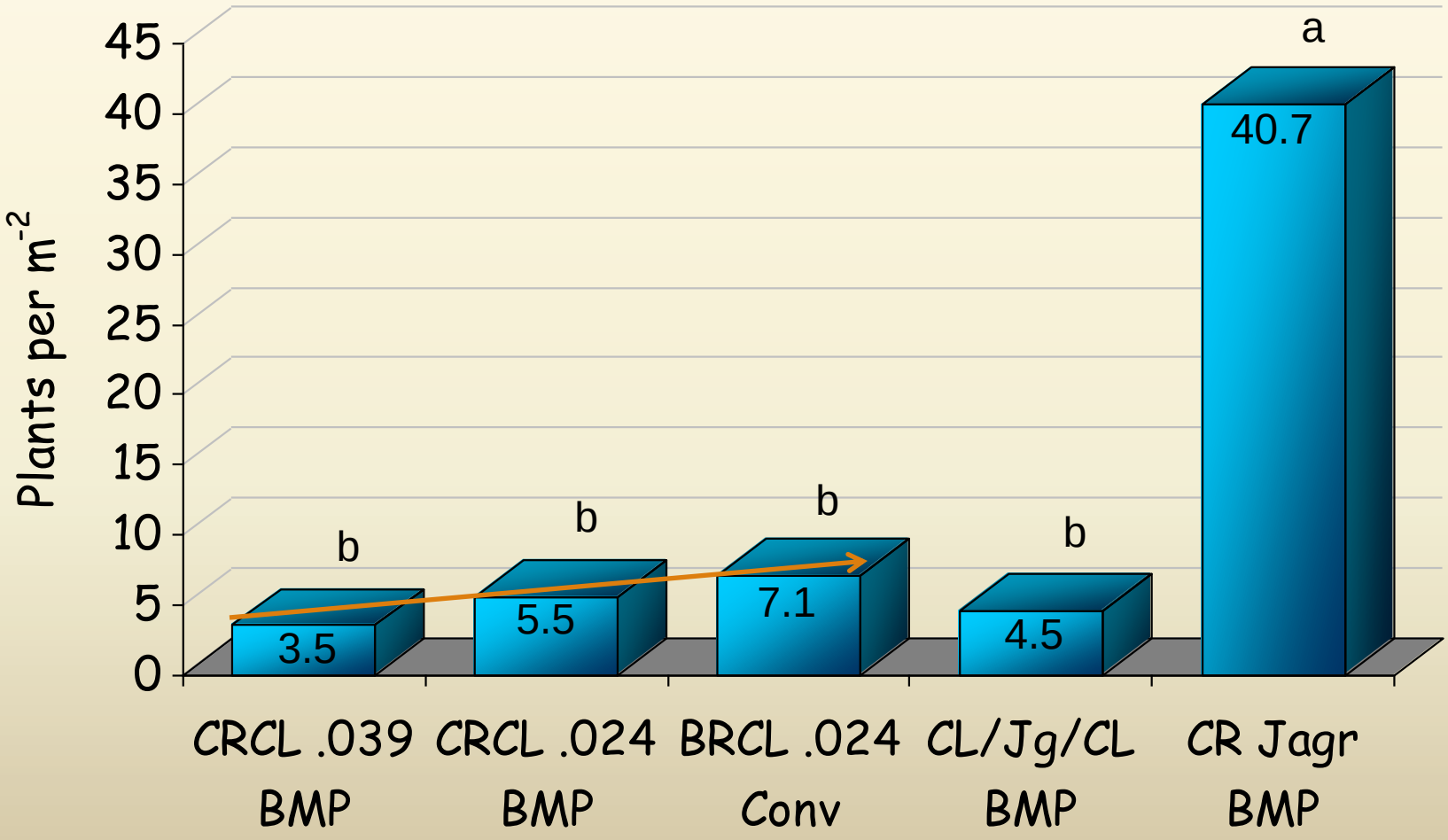
Conventional Practices

St. John, KS

- non-inversion tillage all years
- 60 lb/A seeding rate
- 10-inch row spacing
- non-sized seed
- preplant N, no starter fertilizer, topdress N in spring

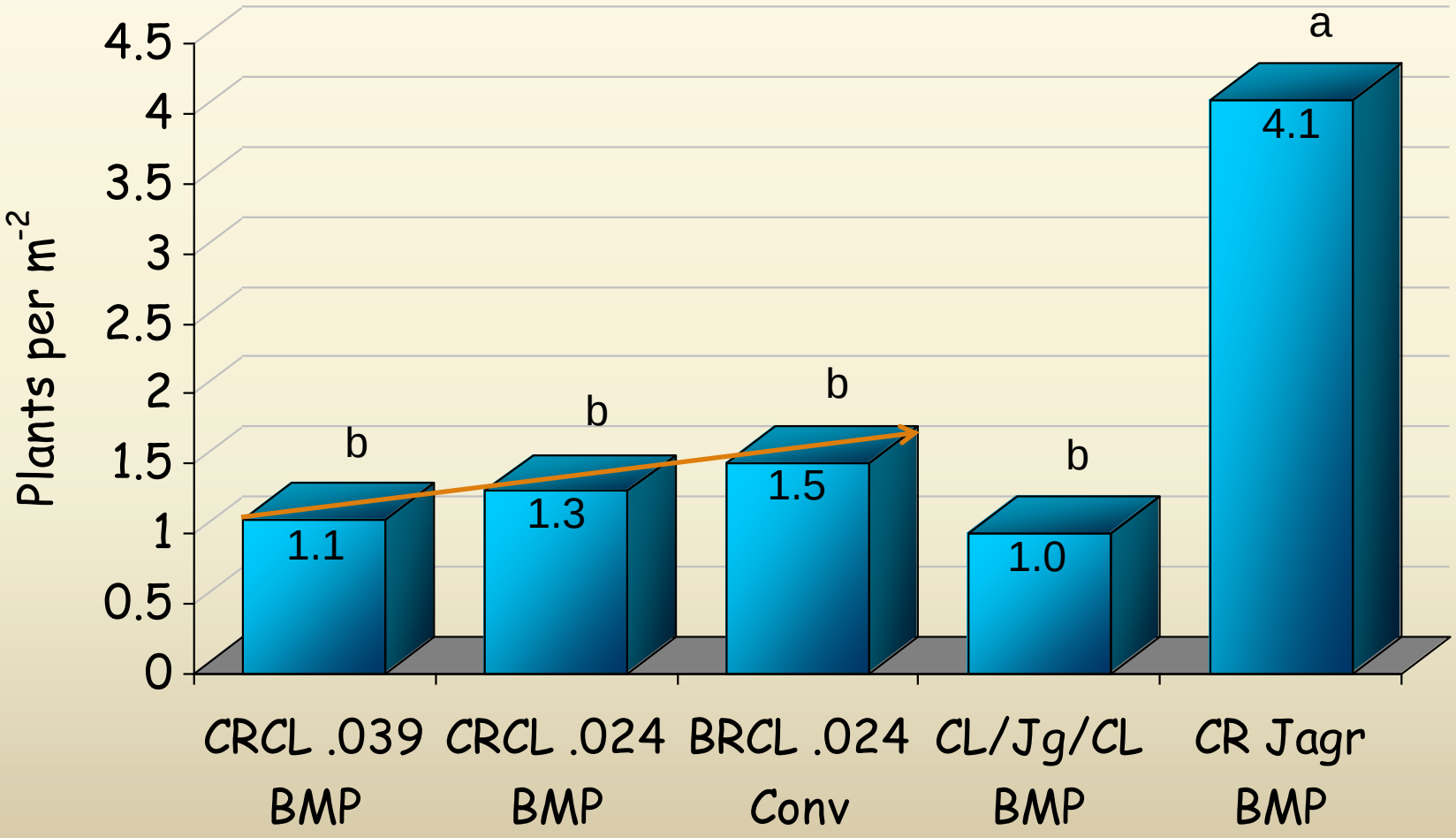
Preplant JGG Density, 2002-2006

St. John, KS



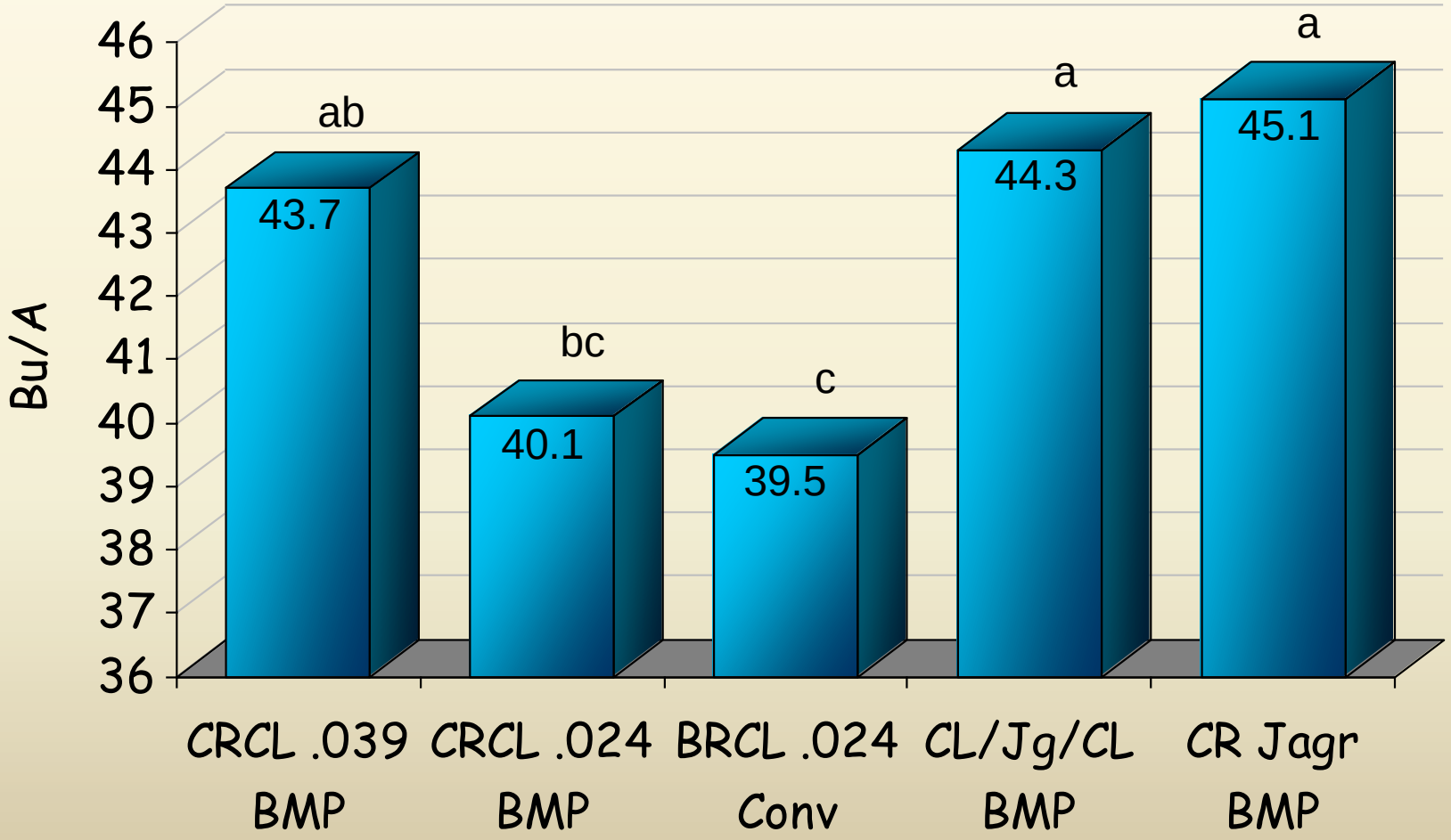
In-Crop JGG Density, 2002-2006

St. John, KS



Wheat Yield, 2002-2006

St. John, KS



Integrating Clearfield Wheat into Oklahoma Wheat Production Systems

1	Moldboard plow, 60 lb/A, 8-in spacing, 18-46-0 banded, no Beyond
2	Stubble-mulch, 60 lb/A, 8-in spacing, no 18-46-0, no Beyond
3	Stubble-mulch, 60 lb/A, 8-in spacing, no 18-46-0, 4 oz/A Beyond
4	Stubble-mulch, 60 lb/A, 8-in spacing, no 18-46-0, 4 oz/A Beyond first 3 yr, followed by Jagger with same cultural practices in 2005 & 2006
5	Stubble-mulch, 60 lb/A, 8-in spacing, no 18-46-0, 4 oz/a Beyond first 2 yr, followed by Jagger with same cultural practices in 2004, 2005 & 2006
6	Stubble-mulch, 60 lb/A, 8-in spacing, no Beyond first or alternate years, 4 oz/A Beyond in years 2003 and 2005
7	Moldboard plow, 120 lb/A, 6-in spacing, no Beyond first or alternate years, 4 oz Beyond in years 2003 & 2005

Peeper & Sidwell, Oklahoma State Univeristy

JGG spikelets per bushel of grain and grain yield

Lahoma, OK

Trt.		2002	2003	2004	2005	2006
1	Spikelets/bu	2,111	136	0	17	0
	Bu/A	34	45	46	68	74
2	Spikelets/bu	3,718	19,326	20,267	23,784	1,123
	Bu/A	21	27	38	46	77
3	Spikelets/bu	994	272	0	51	68
	Bu/A	16	51	42	51	69
4	Spikelets/bu	654	613	0	136	0
	Bu/A	21	51	41	65	85
5	Spikelets/bu	586	2,588	327	1,243	34
	Bu/A	18	51	46	67	84
6	Spikelets/bu	3,170	42,631	1,199	426	102
	Bu/A	26	39	46	50	87
7	Spikelets/bu	4,263	1,566	0	0	34
	Bu/A	25	51	46	56	81

Yellow shading indicates data following application of Beyond herbicide. Red font indicates grain yields of Clearfield wheat, black font grain yields of Jagger traditional wheat.

Peeper & Sidwell, Oklahoma State University

Producer Recommendations

Central & Southern Great Plains

- Integrated approach is best.
- Crop rotation generally is the most effective cultural practice.
- Plowing and burning can be effective; consider negative implications.

Producer Recommendations

Central & Southern Great Plains

- Clearfield technology is highly effective, especially used with Best Management Practices.
- Avoid surface broadcast fertilizer application.
- Avoid overgrazing.

Best Management Practice Bulletin

- Multi-practice approach
- Central Great Plains
- Southern Great Plains
- www.jointedgoatgrass.org