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Agricultural Experiment Station

College of Agricultural Sciences | Department of Soil and Crop Sciences | Plainsman Research Center | Cooperative Extension

Plainsman Research Center 2005 Research Reports

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Plainsman Research Center, 2005 Research Reports

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This research booklet is dedicated to Dennis Thompson for his 25 years of service and commitment to the Plainsman Research Center and Plainsman Agri-Search Foundation. Ed Langin hired him in March 1981 and throughout his tenure Dennis has been a loyal and productive employee of Colorado State University. This year, on Dennis' silver anniversary, he was also honored with the 2005 Agricultural Experiment Station Support Staff Award. We thank Dennis for his support and dedication to all the growers served by the Plainsman Research Center.

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2006 Climatological Summary
Plainsman Research Center

Month	Temperature Max. F	Min. F	Max. Mean F	Min. Mean F	Mean F	Precip. In.	Greatest Day of Precip-atation	Snow-Fall In.	Greatest Snow Depth In.	Evapor-ation In.
Jan.	72	1	45.9	22.3	34.1	0.74	0.40	7.90	5.00	
Feb.	73	15	49.4	26.1	37.8	0.91	0.67	3.50	3.50	
Mar.	77	18	57.2	28.5	42.9	0.92	0.40	5.50	4.00	
Apr.	85	26	66.1	36.4	51.3	1.72	0.75	0.00	0.00	3.70
May.	97	32	75.7	48.2	62.0	2.53	0.53	0.00	0.00	8.56
Jun.	101	45	88.1	56.4	72.3	1.16	0.49	0.00	0.00	12.04
Jul.	106	48	94.9	61.7	78.3	1.01	0.80	0.00	0.00	15.84
Aug.	101	54	88.5	60.7	74.6	1.90	1.26	0.00	0.00	9.92
Sept.	98	41	86.3	55.8	71.1	0.24	0.12	0.00	0.00	12.93
Oct.	92	24	71.0	41.3	56.2	1.66	0.96	0.00	0.00	3.82
Nov.	83	12	60.9	29.7	45.3	0.10	0.07	1.00	1.00	
Dec.	72	-8	47.0	19.2	33.1	0.06	0.03	0.25	0.25	
Total Annual			**69.25**	**40.53**	**54.89**	**12.95**		**18.15**		

***NOTE: Evaporation read mid April through October 15th.
Wind velocity is recorded at two feet above ground level.
Total evaporation from a four foot diameter pan for the period indicated.
Very high evaporation for month of July- 15.84

	2005	2004
Highest Temperature:	106 degrees on July 21	102 degress on June 8
Lowest Temperature:	-8 degrees on Dec. 8	-12 degrees on Dec. 24
Last freeze in spring:	32 degrees on May 1	30 degrees on May 14
First freeze in fall:	30 degrees on Oct. 7	32 degrees on Oct. 14
2005 frost free season:	160 frost free days	150 frost free days
Avg. for 22 years:	Avg for 22 years 20.15 inches	Avg for 21 years 20.50 inches

Maximum Wind:

Jan.	32 mph on 28th	Jul.	52 mph on 4th
Feb.	33 mph on 14th & 20th	Aug.	36 mph on 12th
Mar.	50 mph on 30th	Sept.	34 mph on 10th
Apr.	60 mph on 6th	Oct.	40 mph on 31st
May	58 mph on 25th	Nov.	50 mph on 28th
Jun.	45 mph on 7th	Dec.	44 mph on 1st and 28th

Winter Wheat Variety Selection in Colorado for Fall 2005

Jerry Johnson and Scott Haley *(August 2005)*

Colorado's unpredictable climate and the occurrence of various insect, disease, and weed pests of wheat make it difficult to predict the future performance of wheat varieties based upon their performance in previous trials. Nevertheless, in the tables below we provide the information wheat producers need to make the best possible decision under our variable circumstances.

Issues specific to variety selection in 2005:

Stripe rust- The most common question thus far this year has been whether we will have stripe rust next year. No one knows of course because it has caused damage in three of the last five years and in 2005 appeared weeks earlier than we had seen it in previous years. On the other hand, stripe rust epidemics require a favorable environment, a susceptible variety, and presence of stripe rust spores - all three of which coincided in 2005. Many of the available varieties are susceptible to some degree, some more than others. The favorable environment last year was promoted by early planting, good moisture and good late-fall growing conditions followed by a mild winter, prolific tillering and rapid early spring growth. These environmental conditions are rare in Colorado and might not occur in 2006. The presence of spores is becoming more common in Colorado but clearly irrigated wheat production is at much greater risk than dryland wheat.

White wheat- CSU personnel and the Colorado wheat industry are convinced that white wheat is most promising future for wheat production and marketing in Colorado. The white wheat varieties, Avalanche and Trego, have performed well in the past few years but Trego must have been more affected by the heat and drought stress in May than Avalanche and some of the other varieties. We remain convinced that a white wheat variety should be high on the list for variety selection in 2005.

Russian wheat aphid- New forms (called "biotypes") of RWA have evolved and rendered ineffective the resistance found in all available RWA-resistant varieties. However, some of these varieties perform very well and should be considered for their yielding capability compared to other susceptible varieties. Hatcher, Bond CL, and Ankor are examples of RWA-resistant varieties that are high performance varieties for Colorado.

CLEARFIELD* wheat- The variety Above is still a top performing variety but the new variety from CSU, Bond CL, has performed even better under dryland conditions over the past three years. It is important to remember that you can't save seed of these varieties - even to plant on your own farm. The Plant Variety Protection Act and a U.S. Utility Patent protect them.

Selecting your variety

Dryland wheat producers: **Our first suggestion is to plant more than one variety in order to spread your risk**. The yield table below is based on 3-Yr average performance in our trials, a method for variety comparison shown to be more reliable than single location or single year performance. Note that varieties are alphabetically ranked within a column, rather than ranked by average yields, to stress that differences among the varieties are not statistically significant.

Bond CL and Hatcher are the two newcomers to the highest potential performance column and are the newest CSU releases. These two varieties will be included in the new 2005/06 Collaborative On-Farm Test program. Relative maturity, measured by heading date, might be one way to spread risk related to drought, hail, or freeze damage. Susceptibility to stripe rust might also be a criterion for variety selection in 2005 although be careful not to base variety selection on stripe rust resistance alone. Under our normal low rainfall conditions, wheat streak mosaic virus might be a more consistent threat than stripe rust and worthy of consideration when selecting a variety. Plant height and coleoptile length might be important criteria for southeastern Colorado producers.

Irrigated wheat producers: Most irrigated producers plant a single variety and the most important criteria are yield and straw strength from the tables below. The Platte program has returned profit to many irrigated wheat producers through the incentive package, although some yield loss might be expected when stripe rust is a problem and is not effectively controlled with fungicides. The irrigated trials in Colorado have been very good the past three years and Jagalene, Yuma, Hatcher, and Ankor have performed very well even though Yuma and Jagalene are the only ones with above average straw strength. The newly released varieties Hatcher and Bond CL are welcome additions to our high yielding irrigated wheat varieties.

High Performance Varieties for Dryland Eastern Colorado

Higher Yielding	Intermediate	Lower Yielding
Above Avalanche Bond CL Hatcher Jagalene	Alliance Ankor AP502 CL Jagger Prairie Red TAM 111 Trego Yuma Yumar	Akron Lakin Prowers 99 Stanton Thunderbolt

High Performance Varieties for Colorado Irrigated Conditions

Higher Yielding	Intermediate	Excellent 2-Yr Performance
Ankor Hatcher Jagalene Yuma	Antelope Dumas Ok102 Platte Prairie Red Wesley	Bond CL NuHills

Stripe Rust

Moderately Resistant-Resistant	Intermediate	Moderately Susceptible-Susceptible
Antelope Hatcher Jagalene Jagger TAM 111 Wesley	Alliance Dumas Prowers 99 Stanton Yuma Yumar	Above Akron Ankor AP502 CL Avalanche Bond CL Lakin Platte Prairie Red Thunderbolt Trego

Wheat Streak Mosaic Virus

Moderately Resistant-Resistant	Intermediate	Moderately Susceptible-Susceptible
	Above AP502 CL Avalanche Jagalene Jagger Lakin Prairie Red Stanton TAM 111 Thunderbolt Trego Yuma Yumar	Akron Alliance Ankor Antelope Bond CL Dumas Hatcher Platte Prowers 99 Wesley

Test Weight

Highest	Average	Lowest
Avalanche Dumas Jagalene Platte Prowers 99 Stanton TAM 111 Thunderbolt Trego	Above Akron Alliance Ankor Antelope Hatcher Jagger Lakin Wesley Yuma Yumar	AP502 CL Bond CL Prairie Red

Heading Date

Earliest	Medium	Latest
Above AP502 CL Jagger Prairie Red	Akron Alliance Ankor Antelope Avalanche Bond CL Dumas Hatcher Jagalene Lakin Platte Stanton TAM 111 Trego Wesley Yuma Yumar	Prowers 99 Thunderbolt

Height

Shortest	Medium	Tallest
Above AP502 CL Hatcher Platte Prairie Red Wesley Yuma	Akron Alliance Ankor Antelope Avalanche Bond CL Dumas Jagalene Jagger Lakin Stanton TAM 111 Thunderbolt Trego Yumar	Prowers 99

Coleoptile Length

Shortest	Medium	Longest
Antelope Dumas Platte Yuma Yumar	Alliance Avalanche Bond CL Hatcher Jagalene Lakin Trego Wesley	Above Akron Ankor AP502 CL Jagger Prairie Red Prowers 99 Stanton TAM 111 Thunderbolt

Winter Hardiness

Good	Average	Fair
Akron Alliance Ankor Antelope AP502 CL Jagalene Prowers 99 Wesley	Above Avalanche Bond CL Dumas Hatcher Lakin Platte Prairie Red Stanton TAM 111 Thunderbolt Trego Yuma Yumar	Jagger

Protein Content

Highest	Average	Lowest
Akron Ankor Antelope Jagger Lakin Prairie Red Prowers 99 Thunderbolt Trego Wesley	Above Avalanche Hatcher Jagalene Platte Stanton Yumar	Alliance AP502 CL Bond CL Dumas TAM 111 Yuma

Straw Strength (Irrigated Only)

Best	Intermediate	Poorest
Antelope Bond CL Dumas Jagalene NuHills NuHorizon Ok 102 Overley Platte Wesley Yuma	Ankor Hatcher NuFrontier Prairie Red	

Winter wheat Uniform Variety Performance Trial at Walsh in 2005[1]

Variety	Yield	Grain Moisture	Test Weight	Plant Height	Stripe Rust[2]
	bu/ac	%	lb/bu	in	1-9
Hatcher	65.0	9.0	59.0	26	5
Bond CL	60.3	8.5	53.8	28	8
Enhancer	57.4	8.4	57.2	31	4
CO00016*	57.4	8.6	58.0	26	9
TAM 111	56.7	8.2	58.9	30	2
NuFrontier	55.6	8.8	58.5	31	4
Yuma	54.1	8.1	56.1	24	6
Harry	53.5	8.1	54.6	29	9
Jagger	53.5	8.5	58.3	30	2
Yumar	53.2	8.3	57.7	27	6
Danby**	52.8	8.5	55.8	27	4
HV9W98-143	51.7	8.1	54.4	31	2
Ankor	51.1	8.8	58.6	27	7
NuHorizon	51.1	8.6	59.0	25	4
Jagalene	50.5	8.7	57.6	28	4
Prowers 99	50.4	8.8	58.8	33	5
Alliance	50.4	8.4	57.6	27	6
Wahoo	49.0	8.4	56.2	28	4
Overley	48.6	8.3	57.3	29	3
Endurance	48.2	8.6	57.8	27	8
NuHills	47.0	7.4	51.9	28	3
Prairie Red	46.0	8.4	56.8	25	9
GM10006	45.9	8.8	59.1	25	9
Infinity CL	45.8	8.4	55.8	27	4
Goodstreak	45.6	8.5	59.7	30	5
Above	45.4	8.3	58.0	26	9
Millennium	44.2	8.6	58.1	30	4
AP502 CL	44.2	8.0	56.1	26	9
Akron	43.9	8.6	57.6	27	8
Avalanche	43.4	8.7	58.5	27	9
Stanton	41.9	8.6	58.6	27	8
Lakin	41.7	8.4	58.5	24	9
Thunderbolt	41.1	8.7	59.9	26	8
Trego	39.3	8.4	57.3	24	9
Average	**49.6**	**8.5**	**57.4**	**27**	**6**
$LSD_{(0.30)}$	3.2				

[1]Trial conducted at the Plainsman Research Center; seeded 9/28/04 and harvested 6/28/05.

[2]Rating scale 1-9 with 1 = very resistant to 9 = very susceptible.

*CO00016 is being advanced toward variety release in fall 2006.

**"Danby" was tested by the experimental name KS02HW34.

***The LSD is computed from the Analysis of Variance of all entries in the trial, including the Colorado experimental lines (performance not shown).

Winter wheat Uniform Variety Performance Trial at Lamar in 2005[1]

Variety	Yield	Grain Moisture	Test Weight	Plant Height
	bu/ac	%	lb/bu	in
CO00016*	44.9	8.7	56.7	27
Enhancer	44.0	8.5	56.1	33
Harry	43.7	7.7	53.8	26
Hatcher	43.5	8.4	55.9	24
Alliance	41.2	8.7	57.7	25
Goodstreak	41.2	8.3	55.9	24
Avalanche	40.6	8.9	57.4	33
Jagalene	40.3	8.4	54.9	32
NuHorizon	39.6	9.0	57.4	26
GM10006	38.3	8.0	54.5	30
Bond CL	37.5	7.9	53.5	26
Lakin	37.5	8.6	56.9	25
HV9W98-143	37.4	8.1	53.2	30
Infinity CL	37.3	8.4	55.1	27
Wahoo	36.4	7.8	53.1	27
Prowers 99	36.0	8.9	55.5	28
Overley	35.6	8.3	55.2	29
NuHills	35.2	7.6	50.9	31
Prairie Red	35.1	8.4	55.2	26
Akron	34.8	8.7	57.0	27
Above	34.7	8.2	54.7	25
AP502 CL	33.6	8.5	56.1	29
Danby**	33.5	8.4	53.1	30
Ankor	33.3	9.0	56.9	25
Jagger	32.8	8.1	54.4	29
TAM 111	32.4	8.7	56.2	31
Yumar	32.2	8.3	53.1	26
Millennium	32.0	7.8	53.2	27
Trego	31.7	8.7	56.2	30
NuFrontier	31.1	7.8	53.4	29
Thunderbolt	30.6	8.7	56.9	28
Endurance	30.4	8.7	55.7	30
Yuma	28.8	8.0	53.9	23
Stanton	25.9	8.8	56.5	27
Average	**36.0**	**8.4**	**55.2**	**28**
$LSD_{(0.30)}$	5.3			

[1]Trial conducted on the John Stulp farm; seeded 9/15/04 and harvested 6/28/05.
*CO00016 is being advanced toward variety release in fall 2006.
**"Danby" was tested by the experimental name KS02HW34.
***The LSD is computed from the Analysis of Variance of all entries in the trial, including the Colorado experimental lines (performance not shown).

Winter wheat Uniform Variety Performance Trial at Sheridan Lake in 2005[1]

Variety	Yield	Grain Moisture	Test Weight	Plant Height
	bu/ac	%	lb/bu	in
CO00016*	38.4	8.9	54.5	25
AP502 CL	30.9	9.6	56.4	23
Hatcher	30.4	9.4	55.7	26
Trego	30.1	9.7	56.6	24
NuHills	29.2	9.3	55.2	25
Endurance	28.6	9.7	55.8	26
Above	28.2	9.4	56.8	23
Avalanche	28.2	9.5	56.6	26
Bond CL	27.1	8.7	53.5	24
Infinity CL	26.8	9.0	54.9	26
Alliance	26.6	9.2	55.5	24
Wahoo	26.4	9.1	54.6	27
Danby**	25.5	10.2	57.7	24
Harry	25.3	8.4	52.7	25
Prairie Red	25.1	9.1	55.7	24
Enhancer	24.9	8.4	51.5	26
Ankor	24.5	8.6	53.5	27
Jagalene	24.0	9.4	55.4	26
TAM 111	23.4	9.3	56.0	30
Yuma	23.2	8.7	53.2	23
Thunderbolt	22.7	9.5	55.6	22
Millennium	22.7	9.2	53.5	27
Akron	22.4	9.0	53.4	25
Yumar	22.3	9.1	53.5	23
NuFrontier	22.2	9.4	55.5	25
Stanton	22.2	9.1	55.8	27
Goodstreak	22.2	9.3	54.2	26
GM10006	21.6	9.3	56.0	24
Prowers 99	21.0	8.9	53.5	25
NuHorizon	20.8	9.4	56.5	21
HV9W98-143	20.3	9.4	53.6	22
Lakin	19.2	9.3	55.4	25
Jagger	16.8	8.7	52.8	23
Overley	15.7	8.8	53.4	21
Average	**24.7**	**9.2**	**54.8**	**25**
$LSD_{(0.30)}$	3.1			

[1]Trial conducted on the Burl Scherler farm; seeded 9/7/04 and harvested 6/28/05.
*CO00016 is being advanced toward variety release in fall 2006.
**"Danby" was tested by the experimental name KS02HW34.
***The LSD is computed from the Analysis of Variance of all entries in the trial, including the Colorado experimental lines (performance not shown).

Colorado winter wheat Uniform Variety Performance Trial summary for 2005.

	----Location----											----2005 Averages----			
Variety[1]	Akron	Arapahoe	Bennett	Burlington	Genoa	Julesburg	Lamar	Sheridan Lake	Walsh	Yuma	2005	% of Trial Average	Grain Moist[2]	Test Wt	Plant Ht[3]
	----Yield (bu/ac)----											%	%	lb/bu	in
Bond CL	33.5	30.5	41.3	34.5	66.2	28.4	37.5	27.1	60.3	30.7	39.0	125	10.1	56.4	22
CO00016*	31.3	34.6	37.3	35.0	53.1	31.9	44.9	38.4	57.4	25.0	38.9	125	10.4	56.9	23
Hatcher	26.7	24.3	35.3	14.8	66.2	33.4	43.5	30.4	65.0	18.0	35.8	115	10.6	57.6	20
Enhancer	28.6	25.7	37.6	27.1	59.4	26.0	44.0	24.9	57.4	24.5	35.5	114	10.3	55.3	25
HV9W98-143	26.6	20.9	36.9	17.6	72.5	28.1	37.4	20.3	51.7	25.1	33.7	108	10.9	56.2	24
AP502 CL	25.5	23.3	36.5	29.7	54.5	29.8	33.6	30.9	44.2	24.3	33.2	107	10.0	57.5	23
Prairie Red	26.6	25.0	40.7	25.4	57.8	32.3	35.1	25.1	46.0	17.4	33.1	106	10.3	57.6	21
Above	27.1	30.6	33.7	24.3	60.0	27.9	34.7	28.2	45.4	19.5	33.1	106	10.5	58.2	21
Jagalene	22.2	18.8	31.4	19.7	63.5	35.0	40.3	24.0	50.5	25.2	33.1	106	10.5	57.2	23
Avalanche	26.4	19.1	36.3	18.9	57.8	33.9	40.6	28.2	43.4	25.2	33.0	106	10.7	58.5	23
Jagger	31.2	25.8	26.6	19.8	66.8	28.9	32.8	16.8	53.5	25.1	32.7	105	10.2	56.4	23
GM10006	28.6	15.3	35.4	22.1	63.8	31.9	38.3	21.6	45.9	21.7	32.5	104	10.7	58.2	23
Alliance	25.1	21.1	33.8	21.0	55.2	27.4	41.2	26.6	50.4	20.7	32.2	103	10.3	57.7	22
NuHills	25.0	24.8	38.2	15.6	59.4	21.7	35.2	29.2	47.0	26.2	32.2	103	10.3	55.3	23
NuFrontier	23.5	20.3	38.1	18.4	61.5	26.9	31.1	22.2	55.6	22.2	32.0	103	10.5	57.4	24
Overley	16.9	25.9	34.1	25.6	53.7	29.9	35.6	15.7	48.6	32.8	31.9	102	10.3	56.2	24
Harry	30.0	20.1	28.4	15.7	51.8	25.7	43.7	25.3	53.5	20.0	31.4	101	9.8	54.4	22
Prowers 99	23.9	15.9	39.0	18.8	54.4	32.8	36.0	21.0	50.4	20.6	31.3	100	11.0	57.7	24
Infinity CL	26.2	23.2	32.0	17.8	57.1	27.4	37.3	26.8	45.8	17.8	31.1	100	10.3	56.6	22
Danby**	20.4	18.6	38.9	11.8	66.4	22.8	33.5	25.5	52.8	17.9	30.9	99	11.2	57.8	23
Yuma	18.9	19.6	35.4	19.3	56.0	28.8	28.8	23.2	54.1	24.2	30.8	99	10.2	56.5	20
Yumar	25.6	20.5	33.3	16.8	50.8	29.0	32.2	22.3	53.2	23.7	30.7	99	10.3	56.5	22
Endurance	17.2	22.9	29.4	23.0	61.4	25.4	30.4	28.6	48.2	20.4	30.7	98	11.1	58.0	24
Goodstreak	18.9	22.2	33.8	18.7	55.7	26.4	41.2	22.2	45.6	16.0	30.0	96	10.7	58.2	24
Ankor	22.0	21.1	38.4	9.8	55.8	27.3	33.3	24.5	51.1	14.4	29.7	95	10.5	57.1	21
TAM 111	23.0	17.0	28.3	7.1	62.4	27.4	32.4	23.4	56.7	16.6	29.4	94	11.4	57.5	25
Millennium	22.8	16.8	31.6	21.3	43.3	31.0	32.0	22.7	44.2	22.6	28.8	92	10.3	55.4	25
Thunderbolt	19.4	13.2	27.5	22.5	47.7	34.9	30.6	22.7	41.1	25.4	28.5	91	10.4	56.7	22
Akron	21.0	22.1	28.7	8.9	50.4	24.4	34.8	22.4	43.9	15.5	27.2	87	10.5	57.3	21
Wahoo	17.4	12.7	30.2	6.0	60.0	20.8	36.4	26.4	49.0	11.9	27.1	87	10.7	56.4	23
Stanton	22.3	22.5	23.7	10.5	53.8	23.0	25.9	22.2	41.9	18.6	26.4	85	9.8	58.2	22
Trego	20.0	17.3	31.7	7.8	50.2	20.4	31.7	30.1	39.3	13.1	26.2	84	10.9	58.2	22
NuHorizon	21.1	16.0	24.9	10.6	47.9	12.4	39.6	20.8	51.1	16.5	26.1	84	11.1	58.8	21
Lakin	12.2	22.3	16.5	3.8	44.1	20.3	37.5	19.2	41.7	9.6	22.7	73	10.7	58.1	22
Averages	**23.7**	**21.5**	**33.1**	**18.2**	**57.1**	**27.5**	**36.0**	**24.7**	**49.6**	**20.8**	**31.2**		**10.5**	**57.1**	**22.6**
$LSD_{(0.30)}$	2.7	2.8	3.9	2.0	5.8		5.3	3.1	3.2	2.6	1.2				

[1]Varieties in table ranked by the average yield over 10 locations in 2005.
[2]No moisture taken at Julesburg.
[3]No height notes at Burlington.
*CO00016 is being advanced toward variety release in fall 2006.
**"Danby" was tested by the experimental name KS02HW34.
***The LSD is computed from the Analysis of Variance of all entries in the trial, including the Colorado experimental lines (performance not shown).

Colorado winter wheat 3-Yr and 2-Yr Uniform Variety Performance Trial summary.

Variety[1]	Averages						Averages	
	3-Yr	2-Yr		2005	2004	2003	3-Yr	2-Yr
	----------Yield (bu/ac)----------						Twt (lb/bu)	
CO00016*	46.3	43.3	[1]	38.9	52.1	53.6	57.4	56.9
Bond CL	45.9	42.1	[2]	39.0	48.4	55.2	56.7	56.0
Hatcher	44.5	39.9	[4]	35.8	48.3	56.0	58.2	57.4
Above	43.1	39.2	[5]	33.1	51.4	52.8	58.0	57.7
Avalanche	42.2	38.9		33.0	50.6	50.4	59.0	58.4
Jagalene	41.9	40.1	[3]	33.1	54.1	46.6	58.2	57.5
Prairie Red	41.5	38.1		33.1	48.0	50.2	57.8	57.4
AP502 CL	41.4	38.4		33.2	48.6	48.9	57.6	57.0
Yuma	41.3	36.7		30.8	48.4	53.0	57.3	56.5
TAM 111	41.0	36.4		29.4	50.2	52.6	58.4	57.5
Alliance	40.8	36.9		32.2	46.4	50.5	57.9	57.3
Yumar	40.6	36.7		30.7	48.7	50.3	57.6	56.8
Ankor	40.5	35.9		29.7	48.3	51.8	57.8	57.2
Jagger	40.0	37.6		32.7	47.3	46.0	57.3	56.5
Trego	38.9	33.3		26.2	47.7	52.9	59.3	58.6
Stanton	38.7	34.4		26.4	50.4	49.4	58.7	58.1
Akron	38.3	33.7		27.2	46.7	49.6	57.8	57.2
Prowers 99	37.9	34.9		31.3	42.2	45.4	58.6	57.8
Lakin	36.2	31.5		22.7	49.0	47.8	58.4	58.0
Thunderbolt	35.1	33.3		28.5	43.0	39.6	58.4	57.5
Harry	**	38.0		31.4	51.2	**	**	54.4
NuHills	**	37.5		32.2	48.1	**	**	55.6
NuFrontier	**	37.1		32.0	47.3	**	**	57.4
Goodstreak	**	37.0		30.0	51.0	**	**	58.2
Overley	**	36.3		31.9	45.1	**	**	56.5
Wahoo	**	34.4		27.1	49.1	**	**	56.4
Millennium	**	34.2		28.8	45.1	**	**	56.1
NuHorizon	**	32.0		26.1	43.7	**	**	58.5

[1]Varieties in table ranked based on 3-Yr average yields.

[1……5]Varieties rank based on 2-Yr average yields.

*CO00016 is being advanced toward variety release in fall 2006.

**Harry, NuHills, NuFrontier, Goodstreak, Overley, Wahoo, Millennium, and NuHorizon have been tested in the UVPT only two years.

Winter wheat Irrigated Variety Performance Trial at Rocky Ford in 2005[1]

Variety	Yield	Grain Moisture	Test Weight	Plant Height	50% Heading[2]
	bu/ac	%	lb/bu	in	date
NuFrontier	99.1	9.4	58.9	37	137
NuHills	99.1	10.0	62.7	35	136
TAM 111	97.5	10.1	61.8	36	137
Hatcher	97.2	10.0	61.6	36	137
Jagalene	92.5	10.2	61.7	35	139
Bond CL	92.0	9.2	58.6	37	135
GM10006	88.9	10.0	61.8	37	137
Wesley	88.7	9.3	59.4	33	137
Dumas	87.3	9.6	58.7	33	136
CO00016*	86.4	8.8	57.6	35	136
NuHorizon	84.6	10.2	61.8	31	138
Antelope	83.9	9.6	60.2	35	137
Yuma	82.1	9.7	60.8	35	137
Ankor	81.6	9.1	58.3	35	137
Prairie Red	81.0	9.2	59.0	35	136
Overley	80.2	10.0	61.6	37	136
W04-417	80.0	9.4	60.5	34	136
Ok102	78.4	9.6	60.3	33	137
Platte	77.7	9.6	60.3	31	138
Average	**87.3**	**9.6**	**60.3**	**35**	**137**
$LSD_{(0.30)}$	3.9				

[1]Trial conducted at the Arkansas Valley Research Center; seeded 10/28/04 and harvested 7/8/05.

[2]Julian date 50% to heading.

*CO00016 is being advanced toward variety release in fall 2006.

**The LSD is computed from the Analysis of Variance of all entries in the trial, including the Colorado experimental lines (performance not shown).

Colorado winter wheat 3-Yr and 2-Yr Irrigated Variety Performance Trial summary.

	Averages							
Variety[1]	3-Yr	2-Yr		2005	2004	2003	3-Yr	2-Yr
	-----------Yield (bu/ac)-----------						Twt (lb/bu)	
Jagalene	100.2	91.2		84.9	100.7	115.1	59.8	60.1
Yuma	98.3	93.0	3	78.5	114.6	107.1	58.5	58.5
Hatcher	97.0	94.5	2	89.7	101.6	101.4	59.2	59.6
Ankor	93.3	92.7	4	81.8	108.9	94.3	57.7	58.0
Antelope	92.6	87.3		78.5	100.6	101.5	58.4	58.2
Wesley	91.8	82.6		71.9	98.6	107.1	57.7	57.1
Prairie Red	91.7	81.7		64.4	107.6	108.5	56.9	56.8
Ok102	91.1	88.1		76.1	106.1	96.2	58.9	59.5
Dumas	90.4	84.4		73.4	101.0	100.3	58.8	59.0
Platte	85.9	78.2		68.7	92.5	98.8	58.2	59.1
Bond CL	**	99.0	1	89.8	112.9	**	**	58.3
NuHills	**	91.8	5	84.3	102.9	**	**	59.2
CO00016*	**	89.2		76.0	109.0	**	**	57.6
NuFrontier	**	88.2		79.0	101.9	**	**	59.1
Overley	**	87.1		76.8	102.7	**	**	59.4
NuHorizon	**	82.8		71.6	99.5	**	**	59.6

[1]Varieties in table ranked based on 3-Yr average yields.

[1......5]Varieties rank based on 2-Yr average yields.

*CO00016 is being advanced toward variety release in fall 2006.

**Bond CL, NuHills, CO00016, NuFrontier, Overley, and HuHorizon have been tested in the IVPT only two years.

Dryland Wheat Strips for Forage and Grain Yield at Walsh, 2005

K. Larson, D. Thompson, D. Harn, and C. Thompson

PURPOSE: To determine which wheat varieties are best suited for forage and grain production in Southeastern Colorado.

MATERIALS AND METHODS: Fifteen wheat varieties were planted on October 6, 2004 at 50 Lb Seed/A in 20 ft. by 800 ft. strips with two replications. We applied 50 Lb N/A with a sweep and seedrow applied 5 Gal/A of 10-34-0 (20 Lb P_2O_5, 6 Lb N/A). Ally 0.1 Oz/A and 2,4-D 0.38 Lb/A was sprayed for weed control. Two 2 ft. by 2.5 ft. forage samples were taken at jointing (March 28) and at boot (April 27). We measure the forage for fresh weight, oven-dried the samples, and recorded dry weight at 15% moisture content. There were serious infestations of both Russian Wheat Aphid and Stripe Rust. These infestations were not controlled in this study; however, the infestation levels were high enough that we applied an insecticide and a fungicide to the adjacent wheat seed fields to control these pests. We harvested the plots on June 29 with a self-propelled combine and weighed them in a digital weigh cart. Grain yields were adjusted to 12% seed moisture content.

RESULTS: Heavy infestations of both Russian Wheat Aphid and Stripe Rust impacted yields of nonresistant varieties. TAM 111 produced the highest grain yield with 50 Bu/A; but its yield was not significantly higher than Hatcher, T 81, and Jagger. The top five grain producing varieties displayed high levels of resistance to Stripe Rust: TAM 111, Hatcher, T 81, Jagger, and Jagalene. Above and Jagalene produced the highest dry forage yield at jointing, averaging 2241 Lb/A, whereas Hatcher produce the most forage at boot, 5641 Lb/A. The two-year grain yield average for our study placed T 81 as the highest yielding variety, 116% of TAM 107 yield, mostly because of its outstanding yield obtain this year. Above and T 81 are the only varieties that had higher three-year grain yield averages than TAM 107. Above was the only wheat variety that for the last three years consistently produced higher yields than TAM 107.

DISCUSSION: The best overall dual-purpose wheat variety was Hatcher, a new variety from CSU. It had the highest forage yield at boot, one of the highest forage yields at jointing, and the second highest grain yield. Conditions were nearly ideal for the early part of this past season, but at grain-filling Stripe Rust infestations were the worst we had ever encountered with some nonresistant varieties actually appearing overall orange. In the Wheat Strip study this year, we did not attempt to control RWA or Stripe Rust. Above in this unsprayed Wheat Strip study produced 36 Bu/A. In an adjacent seed wheat field of Above, where we controlled both RWA and Stripe Rust, we harvested 39 Bu/A, only 3 Bu/A more than from the unsprayed Above field. The cost of Stripe Rust control alone was about $20/A. There appears to be no economic advantage for controlling Stripe Rust under dryland conditions. If Stripe Rust continues to be as pervasive as it was this year, we readily recommend that growers select Stripe Rust resistant varieties.

Table .Dryland Wheat Strips, Forage and Grain Yield at Walsh, 2005.

Variety	Jointing Fresh Wt.	Jointing Dry Wt.	Boot Fresh Wt.	Boot Dry Wt.	Plant Height	Residue	Test Weight	Grain Yield
	------------------------Lb/A------------------------				In	Lb/A	Lb/Bu	Bu/A
TAM 111	6624	1921	19433	5232	30	4321	63	50
Hatcher	7410	2079	21927	5641	25	4364	63	48
T81	5628	1478	17777	4952	30	3378	64	47
Jagger	6539	1737	19381	5376	27	3678	63	47
Jagalene	8117	2239	19110	5355	26	3656	63	43
Prowers 99	6421	1707	20027	5344	28	3952	64	42
TAM 110	6354	1802	16825	5008	26	3101	62	38
Stanton	5609	1650	17492	4984	26	3590	63	37
Above	8849	2243	17852	5111	26	3266	62	36
Prairie Red	5024	1355	17290	4761	25	3221	62	35
Avalanche	5873	1702	17510	4907	27	3969	64	35
Ankor	5908	1703	18414	5202	26	4104	62	35
TAM 107	4911	1359	17114	4779	26	3025	61	33
Trego	5959	1701	17279	4940	26	3782	63	29
2137	4781	1347	18323	4850	24	3203	62	28
Average	6267	1735	18384	5096	27	3641	63	39
LSD 0.05	2802	731	5167	1020		521		6.7

Planted: Octotober 6, 2004; 50 Lb seed/A; 5 gal/A 10-34-0.
Jointing sample taken March 28, 2005.
Boot sample taken April 27, 2005.
Grain Harvested: June 29, 2005.
Wet Weight is reported at field moisture.
Dry Weight is corrected to 15% moisture content.
Grain Yield is corrected to 12% seed moisture content.

Table .--Summary: Dryland Wheat Strips Variety Performance Tests at Walsh, 2003-2005.

		Grain Yield					Yield as % of TAM 107 Average				
Firm	Variety	2003	2004	2005	2-Year Avg	3-Year Avg	2003	2004	2005	2-Year Avg	3-Year Avg
		---------------------Bu/A------------------------					-------------------------%-------------------------				
Colorado State	Akron	25	14	--	20	--	86	74	--	80	--
Colorado State	Halt	22	10	--	16	--	76	53	--	64	--
Colorado State	Prowers 99	23	8	42	25	24	79	42	127	85	83
Colorado State	Prairie Red	29	18	35	27	27	100	95	106	100	100
Colorado State	Above	31	20	36	28	29	107	105	109	107	107
Colorado State	Avalanche	28	17	35	26	27	97	89	106	98	97
Colorado State	Ankor	27	14	35	25	25	93	74	106	90	91
Kansas State	Jagger	17	14	47	31	26	59	74	142	108	92
Kansas State	2137	20	10	28	19	19	69	53	85	69	69
Kansas State	Trego	30	16	29	23	25	103	84	88	86	92
Kansas State	Jagalene	--	11	43	27	--	--	58	130	94	--
Kansas State	Stanton	28	--	37	33	--	97	--	112	104	--
Texas A & M	TAM 110	28	19	38	29	28	97	100	115	108	104
Texas A & M	TAM 107	29	19	33	26	27	100	100	100	100	100
Trio	T 81	28	17	47	32	31	97	89	142	116	109
Average		25	15	39	27	26					

Grain Yields were adjusted to 12.0 % seed moisture content.

Residual P on Dryland Wheat, Long Term Study at Manter, 2005

Kevin Larson and Lyndell Herron

PURPOSE: To determine the long-term effects from a one-time application of P rates on dryland wheat yields and incomes.

RESULTS: The highest producing P treatment was 46 Lb P_2O_5/A, yielding 57 Bu/A. Regression analysis shows the optimum P rate at about 50 Lb P_2O_5/A. With a wheat price of $2.70/Bu and 10-34-0 cost of $210/Ton (since it is the second year only half the P cost was charged to the wheat crop this year), the 46 Lb P_2O_5/A treatment made $12.31/A more the P fertilizer expense. After only two wheat crops, all P treatments are producing positive variable net incomes compared to the no P fertilizer check.

DISCUSSION: This is the second wheat crop after we applied the one-time P fertilizer rates. This wheat crop is the third crop after P fertilization. There was an intervening grain sorghum crop before the first wheat crop, but no yields were measured. This year all the P fertilizer treatments produced higher yields than the no P check. For the first wheat crop following the P rates, the yield response from the 46 Lb P_2O_5/A rate more than paid for itself ($17.24/A return from $31.50/A yield increase minus $14.26/A P cost). Since some of the P fertilizer treatments had paid or more than paid for the P fertilizer expense, and with the additional yield advantage obtained this year, all P fertilizer treatments provided positive net incomes compared to the no P check. The one-time 23 Lb P_2O_5/A treatment continues to increase wheat yields. This low P rate produced 5 Bu/A more with this second wheat crop than the no P check. It was believed that the low P rate would be available for only one season, and there would be no residual P effect because our high pH soils would bind it. If yields continue to response to residual P from these P rates, a heavy one-time application of P may be more profitable than smaller annual P applications.

MATERIALS AND METHODS: Lyndell Herron chiseled on 60 Lb N/A (as NH_3) with six phosphate fertilizer treatments: 0, 5.7, 11.4, 17.2, and 22.9 Gal/A of 10-34-0 (0, 23, 46, 69, and 92 Lb P_2O_5/A), using a 30 ft. dual placement N and P chisel applicator with 18 in. spaced shanks on July 31, 2000. Each treatment was replicated twice. Herron planted Ankor in the 60 ft. by 600 ft. plots around September 25, 2004 at 35 Lb Seed/A. He applied 50 Lb N/A last fall for the wheat crop this year. We harvested the plots on June 25, 2005 with a self-propelled combine and weighed them in a digital grain cart. Seed yields were adjusted to 12% seed moisture.

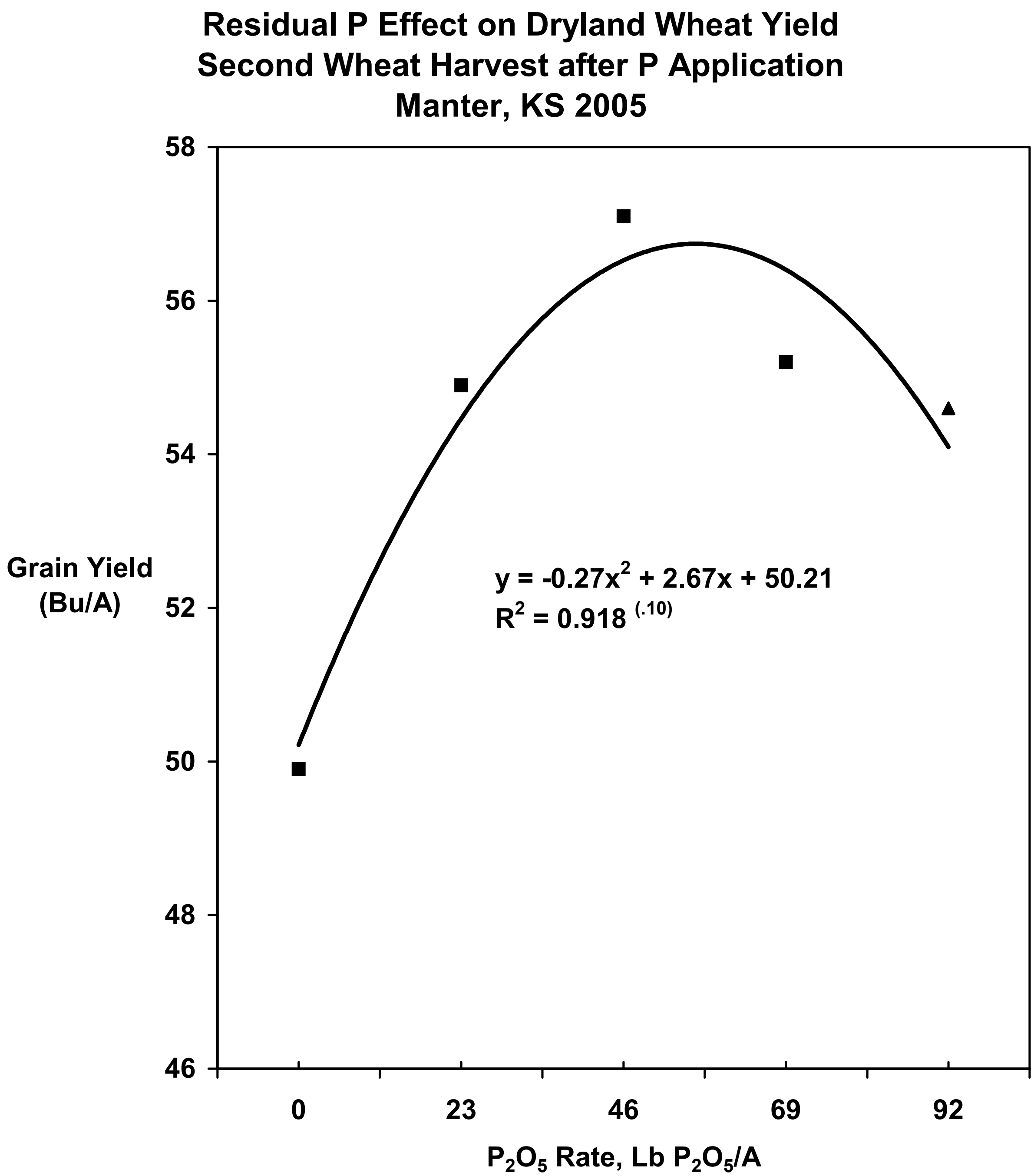

Fig. . Yield of long term P on dryland wheat, second wheat crop after P application, at Manter. P treatment are 0,23, 46, 69, 92, and 115 Lb P_2O_5/A applied with a chisel with shanks 18 in. apart to a 6 in. depth on July 31, 2000. Grain yields were adjusted to 12% seed moisture content.

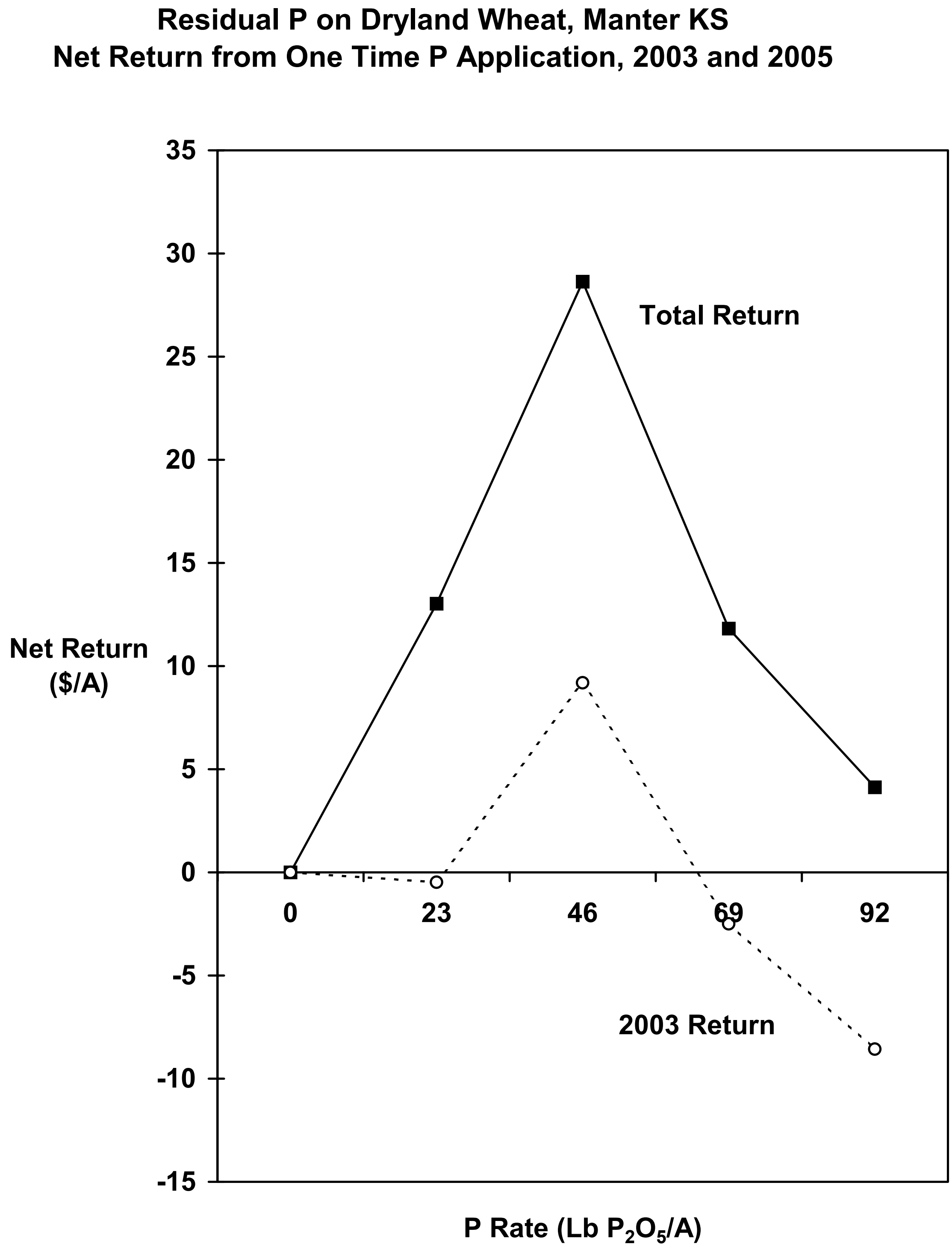

Fig. . Net return of long term P on dryland wheat, second wheat crop after P application, at Manter. P treatment are 0,23, 46, 69, and 92 Lb P_2O_5/A applied with a chisel with shanks 18 in. apart to a 6 in. depth on July 31, 2000. Total return is sum from 2003 and 2005 wheat crops.

Winter Wheat Planting Date and Seeding Rate Study for Southeastern Colorado

Kevin Larson, Dennis Thompson, and Deborah Harn

Currently there is a winter wheat planting date controversy about the deadline for winter wheat planting and government program compliance. The wheat planting date compliance cutoff for Southeastern Colorado was recently extended from October 5 to October 15. This date appears to be arbitrarily selected and not based on scientific research. Our neighboring states of Kansas and Oklahoma have much later winter wheat planting date compliance deadlines. The deadline for the Panhandle of Oklahoma is November 15, a full month later than Colorado, and the deadline for Southwestern Kansas is October 20. Our winter wheat planting date and seeding rate study will ascertain the optimum planting date and seeding rate window for winter wheat production. Materials and Methods

For our planting date and seeding rate study, we used the winter wheat variety Above. We planted five planting dates: PD1, September 14; PD2, September 27; PD3, October 14; PD4, October 28; and PD5, November 28. We tested four seeding rates: 30, 60, 90, and 120 lb/A (0.46, 0.92, 1.39, and 1.85 million seeds/A). The experimental design for our study was a split-plot design (planting date as main plots, and seeding rates as subplots) with four replications. We applied N fertilizer at 50 Lb/A to the site with a sweep plow with an anhydrous attachment. For weed control, we applied Express, 0.33 Oz/A and 2,4-D, 0.38 Lb/A in early spring. We bedded the field in order to furrow irrigate the site for stand establishment. We measured Russian Wheat Aphid (RWA) infestation by sampling 25 tillers per treatment. The percentage of tillers infested with RWA was the sum of tillers with aphids and tillers damaged from RWA. Forage samples (2.0 ft by 2.5 ft) were harvested at jointing: PD1, PD2, and PD3, April 12; PD4, April 18; and PD5, April 22. We weighed the forage samples, dried them in an oven at 100 C until no more weight loss occurred, and reweighed them. Forage yields were adjusted to 15% moisture. We harvested grain from the 10 ft. by 44 ft. plots on June 30 with a self-propelled combine equipped with a digital scale. Grain yields were adjusted to 12% seed moisture content.

Results

Forage yields for all five planting dates had significant linear responses to increasing seeding rates. Less average forage was produced with each subsequent planting date: PD1, 3500 Lb/A; PD2, 2500 Lb/A; PD3, 1500 Lb/A; PD4, 900 Lb/A; and PD5, 750 Lb/A. The earliest planting date, September 15, produced the highest forage yield. PD1 at the lowest seeding rate produced more forage than PD3 at the highest planting date, about 2500 for PD1 and 1800 for PD3. Planting date grain yield averages decrease with each subsequent planting date. PD1 and PD3 had yield maximums at 60 Lb seed/A. The first three planting dates had very little grain yield response to seeding rates. The last two planting dates had strong linear yield responses to increasing seeding rates. There was less than 10 Bu/A difference between the lowest and highest grain yields for the first three planting dates. There was more than 10 Bu/A between the highest grain yield of last planting date and the lowest grain yield from the first three planting dates. RWA infestation tended to increase with earlier planting dates, lower seeding rates, and later sampling dates. The worst RWA infestation, 80% infested tillers, occurred with the 60 Lb/A seeding rate at the last sampling date. The worst striped rust infestation occurred with the three middle planting dates and the highest seeding rate. The lowest infestation of stripe rust occurred with the last planting date at the lowest seeding rate.

Discussion

The first three planting dates, September 14, September 27, and October 14 produced substantially higher grain yields than the last two planting dates, October 28 and November 28. The large grain yield disparity between October 14 planting date and October 28 planting date suggests that the current wheat planting date deadline of October 15 is correct. The seeding rate optimum for the first three planting dates was around 60 Lb/A. However, to achieve high grain yields when planting late, growers should consider seeding at higher rates.

The RWA results are in contrast to the RWA results from last year's wheat planting date study. Typically we find high RWA infestation with later planting dates and lower seeding rates. In fact, last year we found four times more RWA infestation in the last two planting dates than in the first three planting dates. We have even suggested that less developed wheat is more susceptible to RWA or that RWA is more attracted to less developed wheat. This year the RWA results are puzzling because the highest RWA infestation occurred with the first planting date and the second highest RWA infestation was with the last planting date. We have no explanation for the highest RWA levels on both the first and last planting dates.

This is the first year that we have had an overwhelming stripe rust infestation. Stripe rust was so abundant that the wheat plants appeared orange. Our lowest stripe rust infestation occurred with the last planting date, November 28, and with the lowest seeding rate, 30 Lb/A. Since this is the first year that we have taken stripe rust data, we do not know if our findings are typical.

Forage grazing can be extended from early April to late April by manipulating planting date and seeding rate, but early planting with high seeding rate produced up to four times more than late planting. The forage production drop with late planting dates is too large to compensate for the three weeks extension in grazing. Forage production from each planting date increase with higher seeding rates. To produce high wheat forage yields, we recommend planting early with high seeding rates (90 to 120 Lb/A).

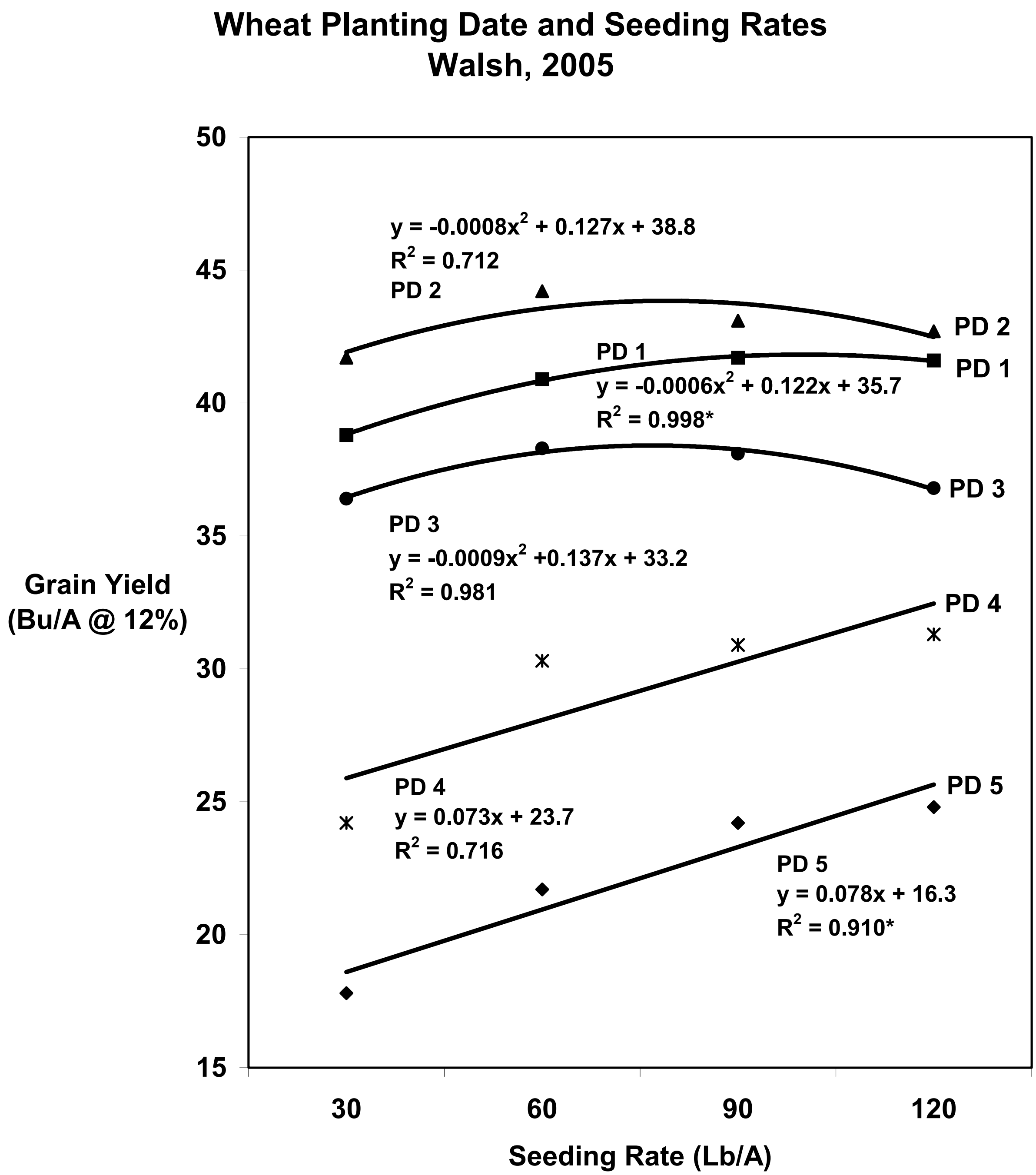

Fig. Grain yield from planting dates and seeding rates for dryland wheat at Walsh. Planting dates were PD 1, September 14; PD 2, September 27; PD 3, October 14; PD 4, October 28; and PD 5, November 28, 2004. Seeding rates were 30, 60, 90, and 120 Lb/A, corresponding to 465,000, 931,000, 1,396,000, and 1,862,000 seeds/A.

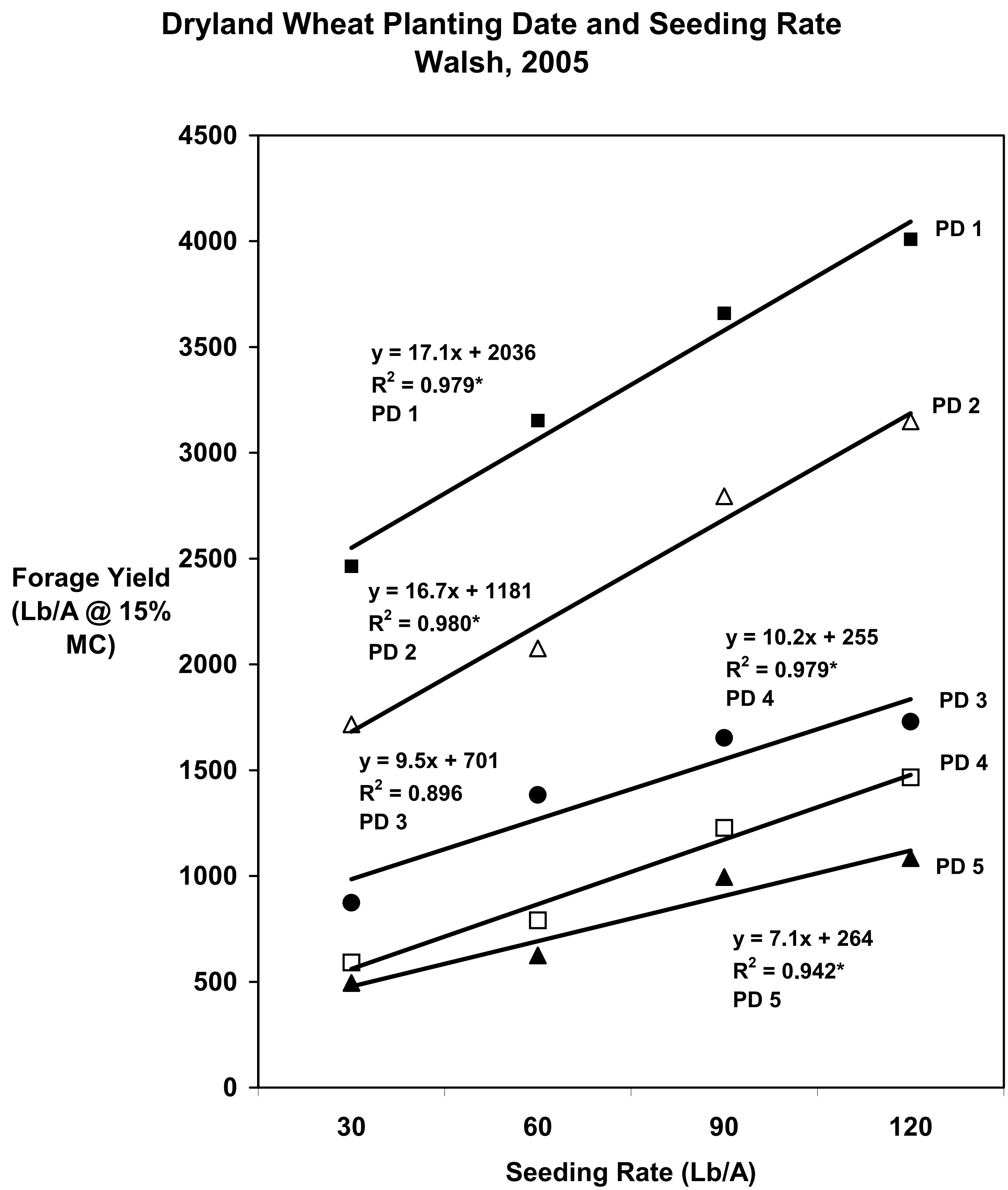

Fig. Forage yields at jointing from planting dates and seeding rates for dryland wheat at Walsh. Planting dates were PD 1, September 14; PD 2, September 27; PD 3, October 14; PD 4, October 28; and PD 5, November 28, 2004. Seeding rates were 30, 60, 90, and 120 Lb/A, corresponding to 465,000, 931,000, 1,396,000, and 1,862,000 seeds/A. Jointing dates: PD 1, March 28; PD 2, April 3; PD 3, April 10; PD 4, April 14; and PD 5, April 22.

Table .Dryland Wheat Planting Date and Seeding Rate, Russian Wheat Aphid and Striped Rust Infestations, Walsh, 2005.

	Planting Date					Seeding Rate			
Sample Date	PD 1 Sept. 14	PD 2 Sept. 27	PD 3 Oct. 14	PD 4 Oct. 28	PD 5 Nov. 28	SR 30 30 Lb/A	SR 60 60 Lb/A	SR 90 90 Lb/A	SR 120 120 Lb/A
	---------------------------------% Tillers Infested with RWA------------------------------------								
February 14	22	16	4	7	9	14	13	11	10
March 2	15	10	1	1	5	10	4	10	5
May 4	58	42	24	24	46	40	80	31	26
RWA Average	32	23	10	11	20	21	32	17	14
	---------------------------------% Tillers Infested with Rust------------------------------------								
May 4	57	72	67	68	38	52	63	58	66

RWA and stripe rust infestations recorded from 25 tillers sampled per treatment.

Irrigated Dual Purpose Wheat Planting Dates, Seeding Rates, Varieties in Southeastern Colorado, 2002 to 2004

Kevin Larson[1], Eugene Krenzer, and Rick Kochenower

Dual-purpose wheats, wheats utilized for both livestock forage grazing and grain yield, are frequently grown throughout the Southern High Plains. Typically in Colorado, dual purpose wheats are raised primarily for grain and secondarily for livestock forage. Although conditions for both forage removal and grain harvest do not occur each year, livestock grazing is an added benefit and income for wheat producers during high wheat forage production years. We conducted this study to determine the effects of seeding rates, planting dates, and varieties on irrigated winter wheat forage and grain production.

Materials and Methods:

We conducted this study at the Plainsman Research Center near Walsh, Colorado for three years: 2001-02, 2002-03 and 2003-04. We planted four winter wheat varieties, Custer, Intrada, Jagger, and TAM 107, at three seeding rates, 60, 120, and 180 lb/A, with an early planting date (August 24, 2001, September 4, 2002, and September 9, 2003) one treatment set for both forage and grain, and with a late planting date treatment (September 24, 2001, October 1, 2002 and September 29, 2003) one treatment set for both forage and grain and another treatment set for grain only. We planted the 5 ft. X 22 ft. plots using a four-row, 12 in. spacing drill in a randomized complete block design with four replications. We fertilized the site with 75 lb N/A as NH_3 applied with a sweep plow. We hand-harvested forage samples, one meter of row from each plot end, and dried them in an oven for at least two days for forage dry weight yields. The forage plots were mowed with a finishing mower to simulate livestock grazing. To compensate for N forage removal, we surface applied liquid N from 65 to 85 lb N/A to the first planting date treatments and 19 to 25 lb N/A to the second planting date treatments. For weed control, we applied Express 0.33 oz/A and 2,4-D 0.38 lb/A in the spring. We furrow irrigated the site with about 7 to 12 A-in./A of total applied water. We harvested the plots for grain with a self-propelled combine and weighed them in a digital scale. Grain yields were adjusted to 12% moisture content.

Results:

Forage yields were not significantly different between varieties and their means were pooled for forage yield analysis. For all three years of this study, the 180 lb/A seeding rate produced significantly higher forage yield than the 60 lb/A seeding for both early and late planting dates (Fig. 1). In 2002 and 2004 there were no significant forage yield differences between 180 and 120 lb/A seeding rates for both planting dates; moreover, these two seeding rates produced significantly more forage than the 60 lb/A rate (Table 1). In 2003 the 180 lb/A seeding rate produced significantly more forage than the 120 lb/A seeding rate for both planting dates. There was a significant forage yield difference between the 120 lb/A seeding rate and the 60 lb/A seeding rate for the late planting date, but not the early planting date for 2003.

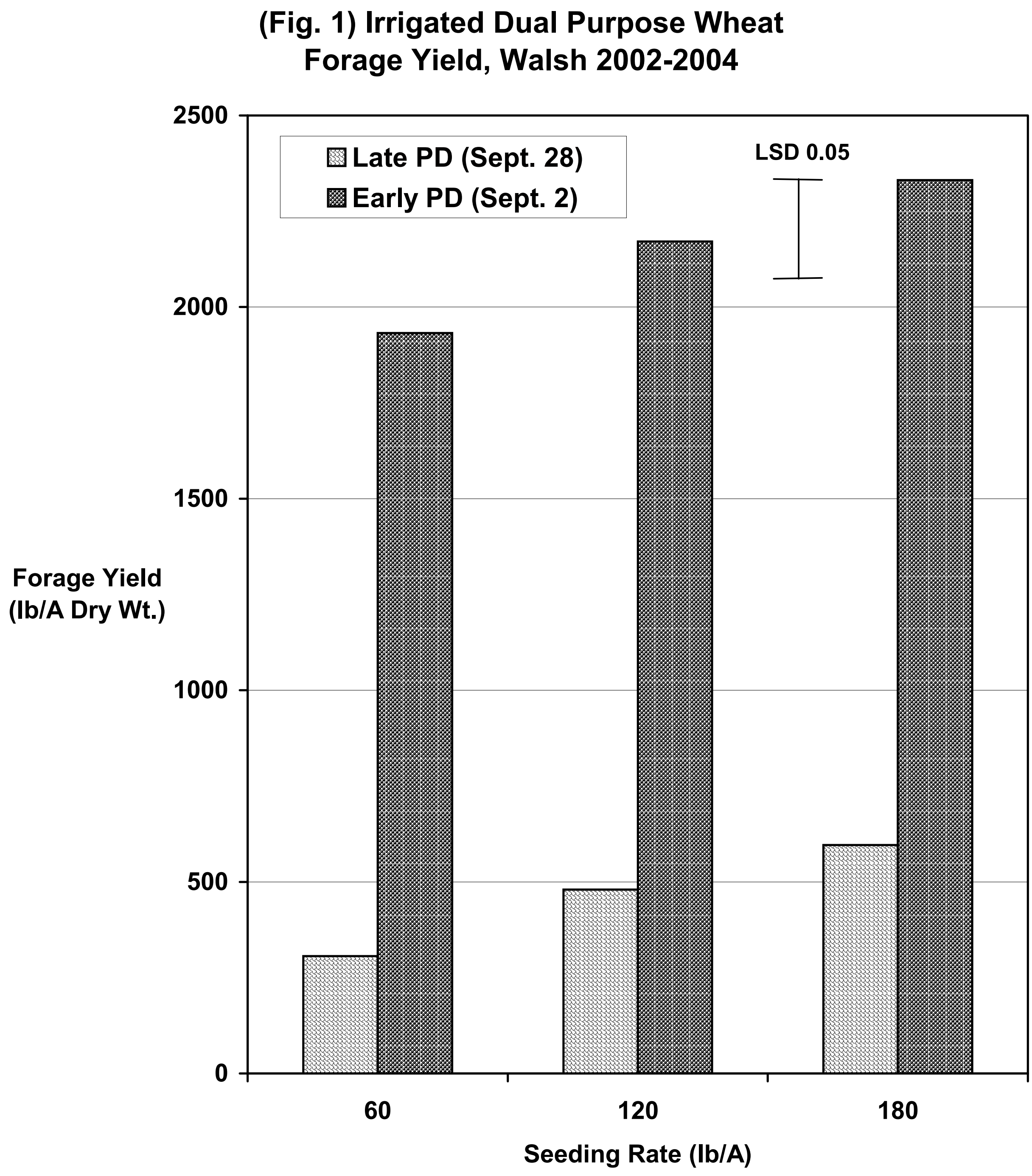

Fig. 1. Forage yield from irrigated dual purpose wheat at Walsh, 2002 to 2004. The average for the early date of planting was September 2 and the average for the late date of planting was September 28. The seeding rates were 60, 120, and 180 lb/A.

Table 1.-Irrigated Dual Purpose Wheat Forage Yields at Walsh, 2002-04.

Seeding Rate	Forage Yield Planting Date Early	Late	Seeding Rate Average
	----------------------lb/A----------------------		
	---Year 2002---		
	Aug 24	Sept 24	
60 lb/acre	2410	470	960
120 lb/acre	2930	650	1193
180 lb/acre	3070	800	1290
Average 2002	2800	640	1148
LSD 0.05	175	152	
	---Year 2003---		
	Sept 4	Oct 1	
60 lb/acre	1769	193	654
120 lb/acre	1699	342	680
180 lb/acre	2094	512	869
Average 2003	1854	349	734
LSD 0.05	341	143	
	---Year 2004---		
Seeding Rate	Sept. 9	Sept. 29	
60 lb/acre	1616	256	936
120 lb/acre	1885	448	1167
180 lb/acre	1830	477	1154
Average 2004	1777	394	1085
LSD 0.05	183	113	

Forage yields are pooled means of varieties.
Forage yields are dry weights.

Forage variable net income for the early planting date for all three years (September 2 average) provided from $36.96 to $66.61/A more than the grain only late planting date (September 28 average) (Fig. 2). Income derived from seeding rate was dependent on grazing lease rate. At the $0.25/lb gain lease rate, the 120 lb/A seeding rate produced the highest variable net income. The incomes for the 120 lb/A and 180 lb/A seeding rates were the same at the $0.30/lb lease rate. At the $0.35/b lease rate, the 180 lb/A seeding rate produced slightly more income than the 120 lb/A seeding rate. Variable net income was negative for the late planting date when using $0.25/lb gain grazing lease rate, but slightly positive when using $0.35/lb gain grazing lease rate for all seeding rates compared to grain only late planting date. These variable net incomes include grain yield loss or gain at $3.40/bu compared to grain only late planting date yield, seed cost over 60 lb/A at $0.083/lb and replacement of N removed with forage at $0.20/lb of N and $4/A fertilizer application cost.

For two of three years, there were no significant grain yield differences between seeding rates, therefore grain yields for the seeding rates were pooled for grain yield analysis. For individual years, grain yield differences for the early planting date varied from 8 bu/A less to 3 bu/A more than grain only late planting date (Table 2). Overall, the late planting date with forage removal ranged from 4 bu/A less to 2 bu/A more than the grain only late planting date. For the three years of this study, the early planting date averaged 1 bu/A more than the grain only late planting date, and the late planting date with forage removal yielded 1 bu/A less than the grain only late planting date.

TAM 107 produced significantly more grain yield than Intrada and Jagger for all three years of this study (Table 2). Hailstorms in 2003 and 2004 greatly reduced grain yields for these years. In 2004, grain yields of TAM 107 were significantly higher than Jagger, Custer, and Intrada for both planting date treatments. In 2003, grain yields of TAM 107 and Custer were significantly higher than Jagger and Intrada for both planting dates. The higher grain yields for TAM 107 were due to less seed shattering from hail compared to Jagger, Custer, and Intrada. In 2002 of the four wheat varieties tested, TAM 107 and Custer produced significantly higher grain yield than either Intrada or Jagger. Jagger had higher plant loss from freeze damage (winter-kill) than any of the other varieties tested (data not shown). Winterkill of Jagger was more evident in the early planting date than in the late planting date. Winter damage to the early planting date caused Jagger to produce significantly less grain than TAM 107, Custer, and Intrada.

Discussion:

Overall, forage yield increased with increasing seeding rates with the 180 lb/A rate producing the highest yield for both early and late planting dates. A study conducted from 2000 to 2002 at the Panhandle Research and Extension Center at Goodwell, Oklahoma (Krenzer et. al, 2003) also reported forage yields increasing with 60, 120, and 180 lb/A seeding rates.

There were no significant forage yield differences between the varieties for both planting date treatments for all three years of this study. The wheat varieties tested: TAM 107, Intrada, Custer and Jagger, produced similar amounts of forage. The study conducted at Goodwell, Oklahoma (Krenzer, et. al, 2003) found minor three-year average differences between the wheat varieties with TAM 107 and Intrada producing

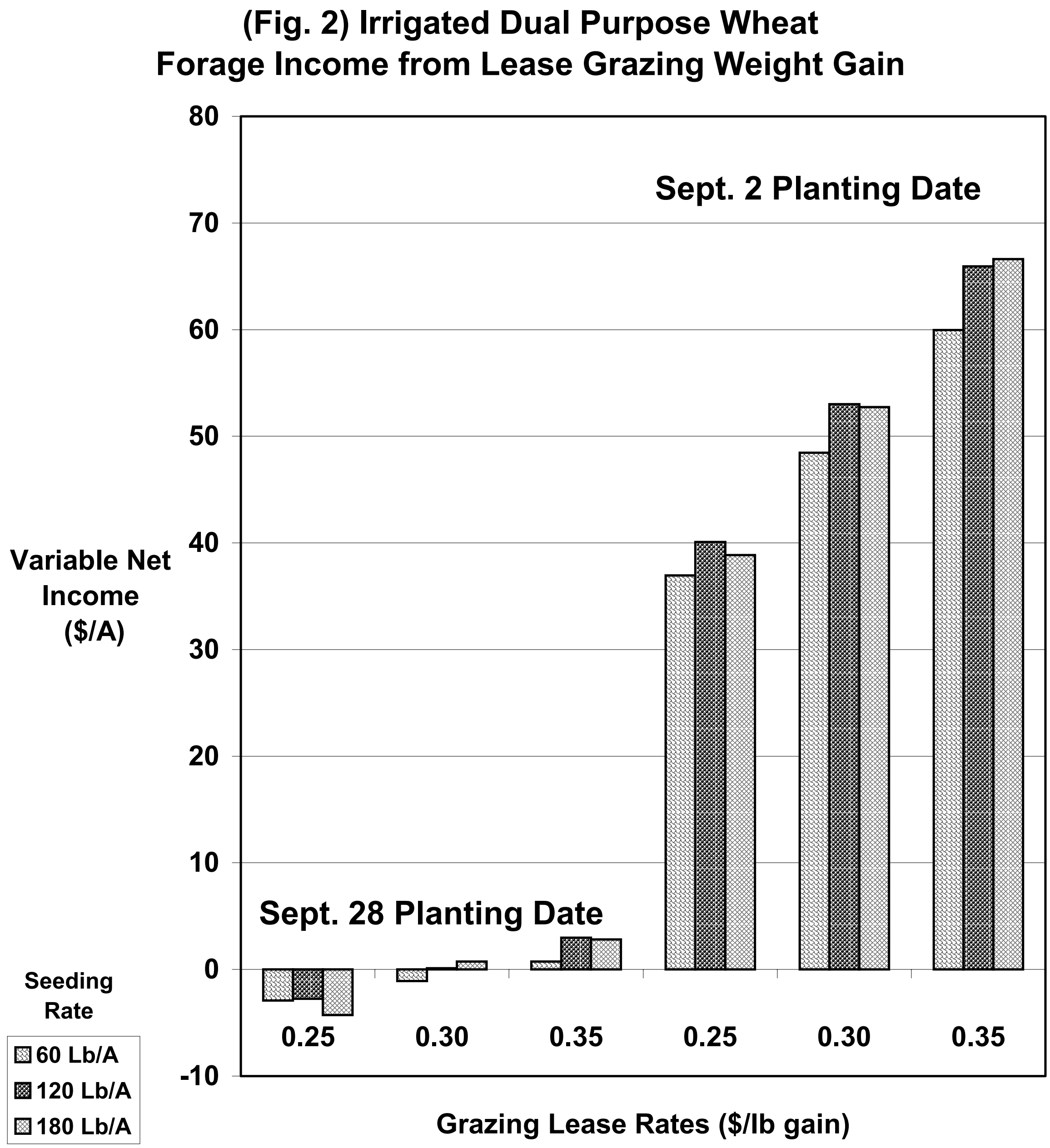

Fig. 2. Forage income from irrigated dual purpose wheat at Walsh, 2002 to 2004. The average for the early date of planting was September 2 and the average for the late date of planting was September 28. The seeding rates were 60, 120, and 180 lb/A. The forage values are on based on 2 lb/day gain from 500 lb calves grazing for two months with a price per lb gain of $0.25/lb, $0.30/lb, and $0.35/lb. Cost of forage was grain yield loss or gain at $3.40/bu compared to the average late planting date where grain yields but not forage yields were taken. Cost of forage also includes seed cost over 60 lb/A at $0.083/lb and replacement of N removed with forage ($0.20/lb of N and application cost $4/A).

Table 2.-Irrigated Dual Purpose Wheat Grain Yields at Walsh, 2002-04.

Variety	Grain Yield ------------Planting Date----------- Early	Late	Late (grain only)	Varietal Average
	------------------------bu/A------------------------			
	---Year 2002---			
	Aug 24	Sept 24	Sept 24	
TAM 107	36	43	43	41
Custer	34	42	41	39
Intrada	31	39	36	35
Jagger	25	39	37	34
Average 2002	31	41	39	37
LSD 0.05	5	5	5	
	---Year 2003---			
Variety	Sept 4	Oct 1	Oct 1	
TAM 107	38	32	33	34
Custer	32	32	35	33
Intrada	18	19	19	19
Jagger	22	18	18	19
Average 2003	28	25	26	26
LSD 0.05	7	4	5	
	---Year 2004---			
Variety	Sept 9	Sept 29	Sept 29	
TAM 107	31	21	29	27
Custer	19	15	16	17
Jagger	21	13	18	17
Intrada	18	12	15	15
Average 2004	22	15	19	19
LSD 0.05	5	2	3	

Grain yields are pooled means of seeding rates.
Grain yields are adjusted to 12% seed moisture content.

higher forage yields than Custer and Jagger, but there was no mention if these forage yield differences were significant.

The method we used to assign value for the forage was wheat forage leasing based on livestock weight gain. We consulted with David Schutz, Manager of the Eastern Colorado Research Center, who suggested using 2 lb per calf per day gain with a 3% body weight intake per day for dry wheat forage. He also stated that the standard weight gain price ranged from \$0.25 to \$0.35/lb. We made these assumptions for our lease grazing; we started with 500 lb calves and they grazed for two months. On average, the calves weighed 560 lb and ingested 3% of their body weight (16.8 lb/day) and they gain 2 lb/day. Our assumptions were similar to the results from a steer grazing management study reported by Oklahoma State University researchers (Horn et. al, 1999). They reported turning out 556 to 649 lb steers on winter wheat for 63 to 90 day grazing periods and the steers gained 2.1 to 2.2 lb/day while ingesting 15.2 to 16.4 lb/day of forage for their intensity early stocking (IES) grazing treatments.

For all years of this study, forage income using the lease grazing weight gain method had positive incomes for all the early planting date treatments and negative incomes for 2003 and 2004 early planting date treatments, regardless of the grazing lease (\$/lb gain) rate. Income from seeding rate was dependent on grazing lease rate with 120 lb/A and 180 lb/A seeding rates providing more variable net income than the 60 lb/A seeding rate for all grazing lease rates. At the lowest lease rate (\$0.25/lb gain) the 120 lb/A seeding rate produced the highest variable net income, whereas at the highest lease rate (\$0.35/lb gain) the 180 lb/A seeding rate produced the highest variable net income. For the range of grazing lease rates used, there were only minor variable net income differences (around \$1/A) between the 120 lb/A and 180 lb/A seeding rates. The only income advantage for the 180 lb/A seeding rate was at the highest lease rate; therefore, the 120 lb/A seeding rate was sufficient for achieving high income. Since the late planting date treatment averaged only marginal amounts of forage and provided only minimal variable net income, we found that there was insufficient forage to make grazing economically feasible especially for grazing lease rates below \$0.30/lb gain. Fortunately growers would not have experienced income loss from grazing the forage produced by the late planting date because growers would not have attempted to graze the limited amount of forage produced by the late planting date. The forage income for the average early planting date treatment ranged from \$36.96/A to \$66.61/A more than the grain only late planting date. This extra income from forage makes lease grazing of early-planted, dual-purpose wheat a profitable activity.

For the duration of this study, there was only limited grain yield change due to forage removal, ranging from 8 bu/A less to 3 bu/A more than the grain only planting date. The average change in grain yield was plus or minus 1 bu/A difference between the grain only late planting date and the late and early planting dates with both forage and grain harvests. Therefore, forage income was not dependent on grain yield change due to forage removal. This is in contrast to the report by Oklahoma researchers (Hossain, Epplin, and Krenzer, 2003); they found late planted wheat (September 30) produced 18% more grain and 68% less forage than early planted wheat (September 10). They concluded that planting date for dual purpose wheat grazing was dependent on expected forage and grain prices.

Grain yields were low all three years of this study due to winterkill and hail damage. TAM 107 with its tolerance to hail and winter damage produced higher yields than Intrada and Jagger each year of this study. Under the adverse conditions of this study, TAM 107 produced the highest grain yields, and since there was no varietal difference in forage production, TAM 107 was the top ranking dual purpose wheat tested.

Grain yield can be greatly reduced by environmental stresses such as the ones encountered throughout this study. Even though grain yields were low, the early planting date forage yields remain high and profitable. Grazing wheat provides additional income not realized by solely harvesting wheat for grain. We believe that growing wheat for both forage and grain is a viable economic strategy to increase income and reduce risk of wheat harvested for grain alone.

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Long Term Ripping Study at Walsh, 1997 to 2005

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PURPOSE: To evaluate the effect of ripping for dryland crop production across multiple years for a wheat-grain sorghum-fallow rotation.

METHODS AND MATERIALS: A Silty Clay Loam soil with a history of wheat-fallow tillage using one-ways and sweep plows, and no history of subsoiling, was soil sampled and demonstrated a severely compacted 4 in. to 12 in. zone. The soil-compaction zone was mapped using a hand-held Dickey-John penetrameter. We performed the first ripping treatment on February 18, 1997, the second treatment on May 18, 1998, the third treatment on February 15, 2000, and the fourth treatment on May 1, 2001. For all four ripping treatments, we used a ripper with straight shanks spaced at 30 in. apart and subsoiled to a depth of 15 in. with four replications. The first cropping season we planted a grain sorghum crop on June 4, 1997 with NORTHRUP KING KS 310 at 40,000 Seeds/A. The soil test recommendation for a 45 Bu/A grain sorghum crop was 40 Lb P_2O_5/A and no N was needed. A seedrow application of 5 Gal/A of 10-34-0 (20 Lb P_2O_5/A, 6 Lb N/A) was the only fertilizer we applied to the sorghum. The soil test recommendation for a 35 Bu/A wheat crop for the second cropping season was 25 Lb N/A and 25 Lb P_2O_5/A. We swept in 50 Lb N/A and seedrow applied 20 Lb P_2O_5/A. We planted a wheat crop on September 26, 1998 with Akron at 45 Lb Seed/A. The third cropping season we grew grain sorghum. We planted CARGILL 627 at 40,000 Seeds/A on May 22, 2000. The soil test recommendation for a 45 Bu/A grain sorghum crop was 40 Lb P_2O_5/A and no N was needed. We applied 50 Lb N/A as anhydrous with a sweep and seedrow applied 20 Lb P_2O_5/A. The 2002 wheat crop that was to follow the sorghum crop was lost to drought. In 2003 we planted grain sorghum, MYCOGEN 1482, at 38,000 Seeds/A on June 15, 2003. The soil test recommended 20 Lb P_2O_5/A and no N was required. We seedrow applied 5 Gal/A of 10-34-0 and no N was applied. In 2005 we planted grain sorghum, MYCOGEN 1482, at 35,000 Seeds/A on June 15, 2005. The soil test recommended 20 Lb P_2O_5/A and 27 Lb N/A. We applied 50 Lb N/A and seedrow applied 5 Gal/A of 10-34-0. The 20 ft. by 1000 ft. plots were harvested on November 15, 1997 for sorghum (first crop), July 5, 1999 for wheat (second crop), November 9, 2000 for sorghum (third crop), November 11, 2003 for sorghum (fourth crop), and November 10, 2005 for sorghum (fifth crop) with a self-propelled combine and weighed in a digital weigh cart. Yields were moisture corrected to 14% for sorghum and 12% for wheat.

RESULTS: In 2005, the fifth crop year, there was no significant difference in grain sorghum yield between the treatments. The check averaged 1 Bu/A more than any of the ripping treatments. In 2003, only the first ripping treatment (Ripped 1997) yielded more grain sorghum than the non-ripped check. For the grain sorghum crop in 2000, all three ripping treatments and the check produced the same 26 Bu/A yield. The yields from the 1999 wheat crop were significantly higher than the check for the first ripping treatment (Ripped 1997) but not for the second ripping (Ripped 1998) treatment ($P > 0.05$). The grain sorghum crop following the first ripping (Ripped 1997) produced significantly more yield than the non-ripped check ($P > 0.10$). For the five cropping years, the first ripping treatment is the only ripping treatment that produced higher yields that the non-ripped check. The Ripped 97 treatment averaged 8 Bu/A more grain than the non-ripped check. All the other ripping treatments for the five crop years of this study produced less grain than the non-ripped check.

DISCUSSION: This is the fifth crop of our long term ripping study. Only the first ripping treatment (Ripped 1997) produced a higher yield than the non-ripped check. The first ripping treatment yielded more than or equaled the non-ripping check for four of the five cropping years: first crop (grain sorghum) 3 Bu/A more, second crop (wheat) 5 Bu/A more, third crop (sorghum) same yield, fourth crop (sorghum) 1 Bu/A more, and the fifth crop (grain sorghum) 1 Bu/A less. Therefore, the first ripping treatment is the only ripping treatment to provide a positive variable net income, $9.98/A ($20.95/A gross crop income minus $9.00/A ripping cost with 3 Bu/A at $2.10/Bu, 5 Bu/A at $2.47/Bu, 1 Bu/A at $2.30/Bu, and 1 Bu/A less at $1.97/Bu).

Overall, ripping was not a cost effective tillage treatment for dryland grain production. We expected that there would be positive yield affects from ripping for multiple years after ripping; however, only one ripping treatment (Ripped 97) produced positive yield results compared to the non-ripped check. If time of year was critical for ripping than two ripping treatments, and not just one ripping treatment, would have produced positive yield results, since two of the ripping treatments were performed in February and two in May. We have no explanation for ripping working only in 1997 and no other year.

Table .-Long Term Ripping Study at Walsh, 1997 to 2005.

Ripping Treatment	Ripping Performed	Soil Compaction 0-4"	4-12"	12-27"	Test Weight	Grain Yield	Check Yield Difference
			Lb/In^2		Lb/Bu	Bu/A	
Grain Sorghum 1997							
Ripped 1997	2/18/97	100	250	225	57	56	3+
Non-Ripped Check	None	100	350	275	57	53	
Average 1997		100	300	250	57	55	3+
Wheat 1999							
Ripped 1997	2/18/97				60	60	5+
Ripped 1998	5/18/98				59	56	1+
Non-Ripped Check	None				60	55	
Average 1999					60	57	3+
Grain Sorghum 2000							
Ripped 1997	2/18/97				56	26	0
Ripped 1998	5/18/98				57	26	0
Ripped 2000	2/15/00				57	26	0
Non-Ripped Check	None				56	26	
Average 2000					57	26	0
Grain Sorghum 2003							
Ripped 1997	2/18/97				57	63	1+
Ripped 1998	5/18/98				57	60	2-
Ripped 2000	2/15/00				57	59	3-
Ripped 2001	5/1/01				57	58	4-
Non-Ripped Check	None				57	62	
Average 2003					57	60	2-
Orthogonal Contrast: All Ripping Treatments vs. Check						NS	
Grain Sorghum 2005							
Ripped 1997	2/18/97				58	32	1-
Ripped 1998	5/18/98				57	32	1-
Ripped 2000	2/15/00				57	32	1-
Ripped 2001	5/1/01				57	32	1-
Non-Ripped Check	None				57	33	
Average 2005					57	32	1-

Orthogonal Contrast: Significant Treatment above Non-Ripped Check, (Year, Treatment): 1997, Ripped 97; 1999, Ripped 97; 2000, NS; 2003, NS; 2005, NS.

Sweep Plow and Chisel Plow Tillage on Long Term Ripping Study at Walsh, 2005

Kevin Larson and Dennis Thompson

PURPOSE: To evaluate the effects of sweep plow and chisel plow on a previously ripped site for dryland crop production.

METHODS AND MATERIALS: A Silty Clay Loam soil with a history of wheat-fallow tillage using one-ways and sweep plows, and no history of subsoiling, was soil sampled and demonstrated a severely compacted 4 in. to 12 in. zone. The soil-compaction zone was mapped using a hand-held Dickey-John penetrameter. We performed the first ripping treatment on February 18, 1997, the second treatment on May 18, 1998, the third treatment on February 15, 2000, and the fourth treatment on May 1, 2001. For all four ripping treatments, we used a ripper with straight shanks spaced at 30 in. apart and subsoiled to a depth of 15 in. with four replications. In 2004, we decided to overlay two tillage treatments, sweep plow and chisel plow on the ripping study. We assigned each ripping block to either tillage treatment, results in two replications of either sweep plow or chisel plow. The first cropping season we planted a grain sorghum crop on June 4, 1997 with NORTHRUP KING KS 310 at 40,000 Seeds/A. The soil test recommendation for a 45 Bu/A grain sorghum crop was 40 Lb P_2O_5/A and no N was needed. A seedrow application of 5 Gal/A of 10-34-0 (20 Lb P_2O_5/A, 6 Lb N/A) was the only fertilizer we applied to the sorghum. The soil test recommendation for a 35 Bu/A wheat crop for the second cropping season was 25 Lb N/A and 25 Lb P_2O_5/A. We swept in 50 Lb N/A and seedrow applied 20 Lb P_2O_5/A. We planted a wheat crop on September 26, 1998 with Akron at 45 Lb Seed/A. The third cropping season we grew grain sorghum. We planted CARGILL 627 at 40,000 Seeds/A on May 22, 2000. The soil test recommendation for a 45 Bu/A grain sorghum crop was 40 Lb P_2O_5/A and no N was needed. We applied 50 Lb N/A as anhydrous with a sweep and seedrow applied 20 Lb P_2O_5/A. The 2002 wheat crop that was to follow the sorghum crop was lost to drought. In 2003 we planted grain sorghum, MYCOGEN 1482, at 38,000 Seeds/A on June 15, 2003. The soil test recommended 20 Lb P_2O_5/A and no N was required. We seedrow applied 5 Gal/A of 10-34-0 and no N was applied. In 2005 we planted grain sorghum, MYCOGEN 1482, at 35,000 Seeds/A on June 15, 2005. The soil test recommended 20 Lb P_2O_5/A and 27 Lb N/A. We applied 50 Lb N/A and seedrow applied 5 Gal/A of 10-34-0. The 20 ft. by 1000 ft. plots were harvested on November 15, 1997 for sorghum (first crop), July 5, 1999 for wheat (second crop), November 9, 2000 for sorghum (third crop), November 11, 2003 for sorghum (fourth crop), and November 10, 2005 for sorghum (fifth crop) with a self-propelled combine and weighed in a digital weigh cart. Yields were moisture corrected to 14% for sorghum and 12% for wheat.

RESULTS and DISCUSSION: The sweep plow and chisel plow produced the same yield, 32.2 Bu/A. At the 2004 fall field day, we brushed the first few inches of soil away to revealed a definite, flat, tabletop-like smear layer beneath the sweep plow tillage plot and friable soil beneath the chisel plow tillage plot. Although the tillage treatments left the soil visually different, there was no yield difference between sweep plow and chisel plow treatments. There were no interactions between sweep plow and chisel plow tillage and the previously ripped treatments.

Table .Long Term Dryland Ripping and Tillage Study, Grain Sorghum, Walsh, 2005.

Year Ripped	Ripping Grain Yield	Tillage Treatment	Tillage Grain Yield
	Bu/A		Bu/A
Check	33.2	Chisel Plow	32.2
Feb-97	32.3	Sweep Plow	32.2
May-98	32.1		
Feb-00	31.7		
May-01	32.1		
Average	32.2		32.2
LSD 0.05	2.7		7.1

Sweep plow with 5 ft. sweep blades.
Chisel Plow with straight points 1.25 ft apart and sweep attachments 1.5 ft. wide.

Proso Millet Harvesting Method Comparison, Towner, 2005

Scott Brase and Linly Stum

Conducted at the Linly Stum Farm with the Proso millet variety Huntsman

Harvested on Sept. 12, 2005

Method: **Swathing / Combine w/ pick-up head**

Length of test: 2,466 feet
Width of test: 97 feet
Test acreage: 5.49
Bushels harvested: 215.6
Yield: 39.2 bu/ac

Method**: Combine with stripper header**

Length of test: 2,466 feet
Width of test: 61 feet
Test acreage: 3.45
Bushels harvested: 110.2
Yield: 31.94 bu/ac

Method: **Combine with Conventional header**

Length of test: 2,466 feet
Width of test: 58 feet
Test acreage: 3.28
Bushels harvested: 115.9
Yield: 35.34 bu/ac

Table 1. Proso Millet Harvesting Method Comparison, 2005.

Harvesting Method	Grain Yield
	Bu/A
Swathed and Combined with Pickup head	39.2
Combined with Conventional head	35.3
Combined with Stripper head	31.9
Average	35.5

Grain yields adjusted to 14% seed moisture content.

Conclusion:

Swathing and then using the combine will harvest the most grain and is most profitable.
Swathing cost an additional $7.00/ac but the procedure nets an additional 3.86 bu/ac over conventional harvesting. This results in an additional $8.44 after swathing expense.
($4.00/bu millet x 3.86bu gain = $15.44 - $7.00 swathing exp. = $8.44/acre net gain)

Early Maturing Dryland Grain Sorghum Hybrid Performance Trial at Walsh, 2005

COOPERATORS: Plainsman Agri-Search Foundation, and Kevin Larson, Superintendent, Plainsman Research Center, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids, when planted late in the season (June 24), under dryland conditions with 2700 sorghum heat units in Silty Loam soil.

PLOT: Four rows with 30” row spacing, 50’ long. SEEDING DENSITY: 43,600 Seed/A. PLANTED: June 24. HARVESTED: November 2.

EMERGENCE DATE: 7 days after planting. SOIL TEMP: 75 F.

PEST CONTROL: Preemergence Herbicides: Roundup 20 Oz/A, 2,4-D 0.5 Lb/A, Atrazine 1.0 Lb/A. Post Emergence Herbicides Banvel 4 Oz/A, LoVol 5 Oz/A. CULTIVATION: Once. INSECTICIDES: None.

Summary: Growing Season Precipitation and Temperature \1
Walsh, Baca County.

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
June	0.01	179	6	2	6
July	1.01	878	26	8	37
August	1.90	763	17	3	68
September	0.24	642	15	0	98
October	1.06	276	3	0	122
Total	4.22	2738	67	13	122

\1 Growing season from June 24 (planting) to October 24 (first freeze, 24 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

FIELD HISTORY: Last Crop: Wheat. FIELD PREPARATION: No-till.

COMMENTS: Planted in good soil moisture. Weed control was very good. Below normal precipitation for the growing season with very warm temperatures throughout the season. No greenbug infestation. Only a few hybrids lodged. Late freeze date. Yields and test weights were very good considering the dry season.

SOIL: Silty Loam for 0-8” and Silty Loam 8”-24” depths from soil analysis.

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8”	7.7	0.5	1.9	14	6.2	490	1.0	5.8
8”-24”				16				
Comment	Alka	VLo	Hi	Hi	Lo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------Lb/A------------------			
Recommended	0	20	0	0
Applied	0	20	0.3	0

Yield Goal: 45 Bu/A.
Actual Yield: 62 Bu/A.

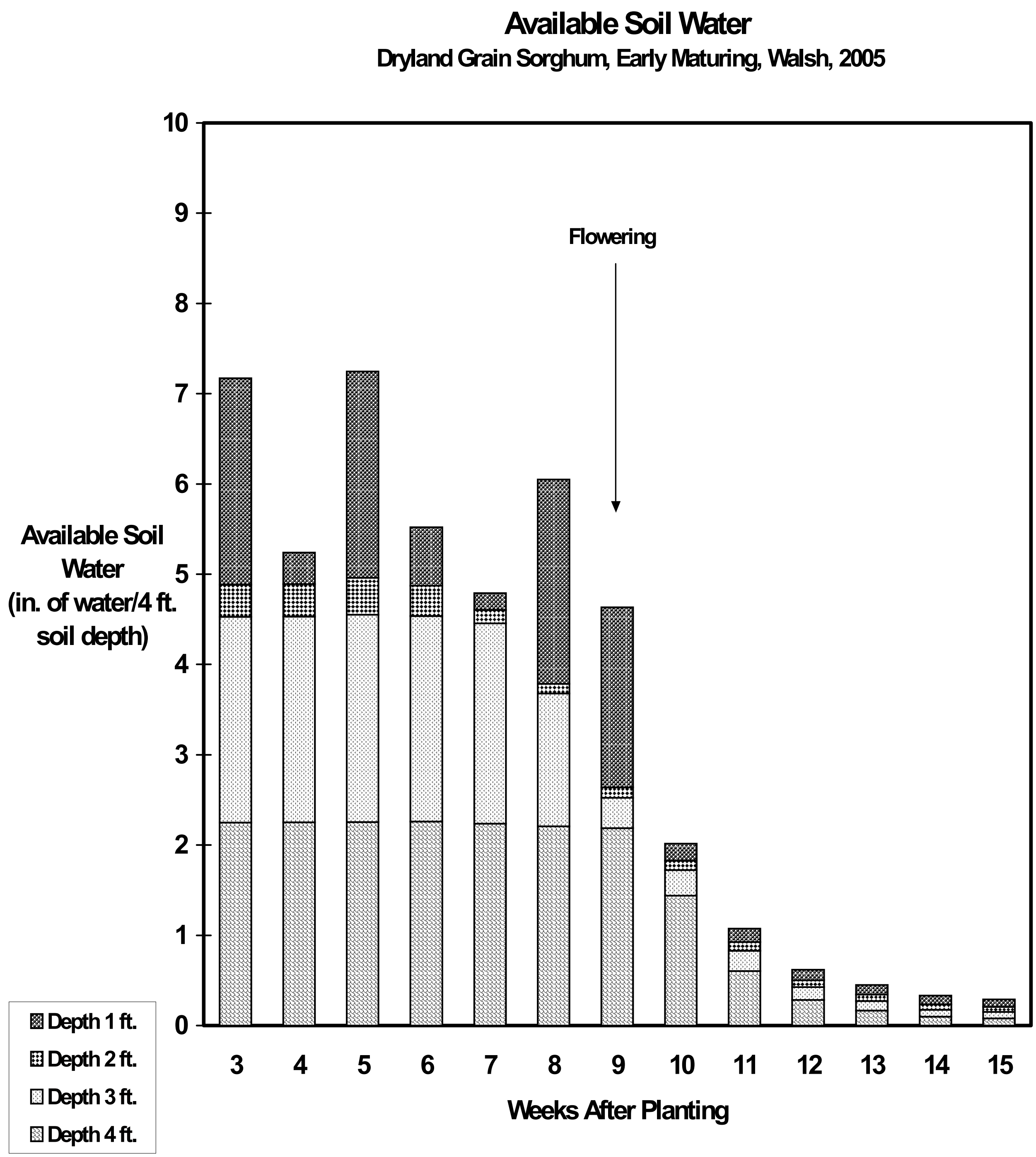

Fig. 1. Available soil water in dryland grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 4.22 in. Any increase in available soil water between weeks is from rain.

Table 2.--Dryland Grain Sorghum Early Maturing Hybrid Performance Test at Walsh, 2005. \1

Brand	Hybrid	Days to Emerge	50% Bloom DAP	50% Bloom GDD	50% Mature DAP	50% Mature Group	Plant Ht.	Harvest Density	Lodged Plants	Test Wt.	Grain Yield	Yield % of Test Average
							In	Plants/A (1000 X)	%	Lb/Bu	Bu/A	%
DEKALB	DK-28E	7	53	1441	101	E	36	32.9	0	59	74	119
ASGROW	Reward	6	56	1524	104	E	34	31.8	4	58	70	112
DEKALB	DKS 29-28	7	56	1524	104	E	35	33.7	0	58	69	110
FONTANELLE	GE 2413	6	55	1494	102	E	36	29.8	3	57	61	98
TRIUMPH	TR 433	7	60	1616	108	ME	40	33.3	9	58	53	86
(Check)	399 X 2737	6	72	1899	HD	ML	40	32.1	0	54	47	75
Average		7	59	1583	104	E	37	32.3	3	57	62	
LSD 0.20											9.6	

\1 Planted: June 24; Harvested: November 2.

Yields are corrected to 14.0% seed moisture content.

DAP: Days After Planting or maturation of seed at first freeze (24 F, October 24).

Seed Maturation: PM, pre-milk; EM, early milk; MM, mid-milk; LM, late milk; ED, early dough; SD, soft dough; HD, hard dough; DAP, mature.

GDD: Growing Degree Days for sorghum.

Maturity Group: E, early; ME, medium early; M, medium; ML, medium late; L, late.

Table 3.--Summary: Grain Sorghum Early Maturing Hybrid Performance Tests, 2003-2005.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2003	2004	2005	2-Year Avg	3-Year Avg	2003	2004	2005	2-Year Avg	3-Year Avg
		Bu/A					%				
ASGROW	Reward	123	100	70	85	98	105	116	112	114	111
DEKALB	DK-28E	122	93	74	84	96	104	108	119	114	110
DEKALB	DKS 29-28	134	97	69	83	100	114	113	110	112	112
SORGHUM PARTNERS	KS 310	128	93	--	111	74	109	108	--	109	--
SORGHUM PARTNERS	K35-Y5	123	77	--	100	67	105	89	--	97	--
SORGHUM PARTNERS	251	102	97	--	100	66	87	113	--	100	--
(Check)	399 X 2737	88	37	47	42	57	75	43	75	59	64
Average		117	86	62	74	88					

Grain Yields were corrected to 14.0 % seed moisture content.
Irrigated at Walsh for 2003 and 2004, dryland for 2005.

Dryland Grain Sorghum Hybrid Performance Trial at Vilas, 2005

COOPERATORS: Terrill Swanson Farm, Vilas, and Kevin Larson, Superintendent, Plainsman Research Center, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under dryland conditions with 3150 sorghum heat units in a Sandy Clay soil.

PLOT: Four rows with 30” row spacing, 50’ long. SEEDING DENSITY: 43,600 Seed/A. PLANTED: June 6. HARVESTED: November 4.

EMERGENCE DATE: 7 days after planting. SOIL TEMP: 67 F.

PEST CONTROL: Preplant Herbicides: Gylphosate 26 Oz/A, Banvel 2 Oz/A, 2,4-D 6 Oz/A. Post Emergence Herbicides: Banvel 4 Oz/A, 2,4-D 5 Oz/A. CULTIVATION: Once. INSECTICIDE: None.

FIELD HISTORY: Last Crop: Wheat. FIELD PREPARATION: No-till.

Summary: Growing Season Precipitation and Temperature \1
Walsh, Baca County.

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
June	0.81	592	17	2	24
July	1.01	878	26	8	55
August	1.90	763	17	3	86
September	0.24	642	15	0	116
October	1.06	276	3	0	140
Total	5.02	3151	78	13	140

\1 Growing season from June 6 (planting) to October 24 (first freeze, 24 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in good soil moisture. Weed control was very good. Below normal precipitation for the growing season. Temperatures were quite warm throughout the season. Late freeze date. No greenbug infestation. None of the hybrids lodged. Grain yields were very good considering the dry weather.

SOIL: Sandy Loam for 0-8” and Sandy Clay 8”-24” depths from soil analysis.

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8”	7.2	0.3	0.7	4	0.9	151	0.5	7.8
8”-24”				3				
Comment	Alka	Vlo	Lo	Lo	VLo	Hi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------Lb/A------------------			
Recommended	27	40	0	0
Applied	50	20	0	0

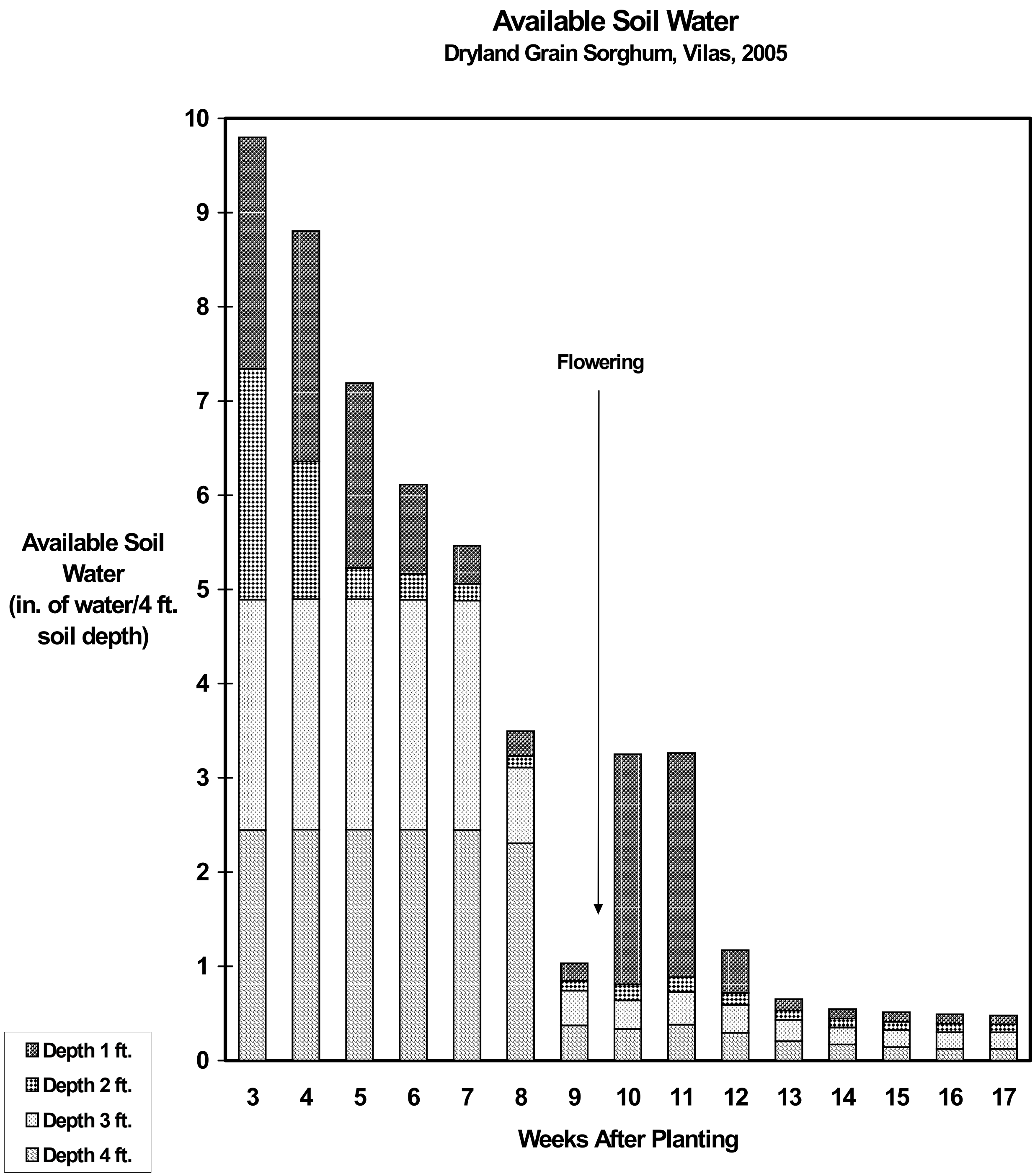

Fig. 2. Available soil water in dryland grain sorghum at Vilas. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 5.02 in. Any increase in available soil water between weeks is from rain.

Table 4.--Dryland Grain Sorghum Hybrid Performance Test at Vilas, 2005. \1

Brand	Hybrid	Days to Emerge	50% Bloom DAP	50% Bloom GDD	50% Mature DAP	50% Mature Group	Plant Ht.	Harvest Density	Plants Lodged	Test Wt.	Grain Yield	Yield % of Test Average
							In	Plants/A (1000 X)	%	Lb/Bu	Bu/A	%
FONTANELLE	GE 3245	8	57	1551	103	E	33	22.5	0	61	66	101
FONTANELLE	GE 4532	7	68	1816	113	ME	41	25.6	0	61	72	110
ASGROW	Seneca	7	69	1842	115	ME/M	39	25.2	0	61	71	108
DEKALB	DK-44	7	68	1816	114	ME/M	41	24.0	0	60	69	105
DEKALB	DKS 37-07	8	61	1618	110	ME	39	20.5	0	62	68	104
ASGROW	Pulsar	8	63	1673	108	ME	34	18.4	0	61	59	90
(Check)	399 X 2737	7	83	2259	132	ML	38	22.8	0	57	57	87
Average		7	67	1796	114	ME	38	22.7	0	60	66	
LSD 0.20											5.2	

\1 Planted: June 6; Harvested: November 4.
Yields are corrected to 14.0% seed moisture content.
DAP: Days After Planting or maturation of seed at first freeze.
Seed Maturation: EM, early milk; MM, mid milk; LM, late milk; ED, early dough; SD, soft dough; HD, hard dough; mature (DAP).
GDD: Growing Degree Days for sorghum.
Maturity Group: E, early; ME, medium early; M, medium; ML, medium late; L, late.

Table 5.--Summary: Dryland Grain Sorghum Hybrid Performance Tests at Vilas, 2003-2005.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2003	2004	2005	2-Year Avg	3-Year Avg	2003	2004	2005	2-Year Avg	3-Year Avg
		Bu/A					%				
ASGROW	Seneca	17	33	71	52	40	107	116	108	112	110
ASGROW	Pulsar	21	24	59	42	35	129	85	90	88	101
DEKALB	DK-44	20	31	69	50	40	124	110	105	108	113
PIONEER	85G01	26	35	--	31	--	159	126	--	143	--
SORGHUM PARTNERS	NK 7633	20	35	--	28	--	122	123	--	123	--
(Check)	399 X 2737	15	15	57	20	29	94	73	87	80	85
Average		16	28	66	47	37					

Grain Yields were corrected to 14.0 % seed moisture content.

Dryland Grain Sorghum Hybrid Performance Trial at Walsh, 2005

COOPERATORS: Plainsman Agri-Search Foundation, and Kevin Larson, Superintendent, Plainsman Research Center, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under dryland conditions with 3300 sorghum heat units in a Silty Loam soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 43,600 Seed/A. PLANTED: May 26. HARVESTED: November 2.

EMERGENCE DATE: 10 days after planting. SOIL TEMP: 66 F.

PEST CONTROL: Preemergence Herbicides: Roundup, 20 Oz/A; 2,4-D, 0.5 Lb/A, Atrazine 1.0 Lb/A. Post Emergence Herbicides: Banvel 4.0 Oz/A, LoVol 5 Oz/A. CULTIVATION: Once. INSECTICIDES: None.

FIELD HISTORY: Last Crop: Wheat. FIELD PREPARATION: No-till.

Summary: Growing Season Precipitation and Temperature \1
Walsh, Baca County.

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
May	1.28	57	0	0	5
June	1.16	679	17	2	35
July	1.01	878	26	8	66
August	1.90	763	17	3	97
September	0.24	642	15	0	127
October	1.06	276	3	0	151
Total	6.65	3295	78	13	151

\1 Growing season from May 26 (planting) to October 24 (first freeze, 24 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in good soil moisture. Weed control was very good. Below normal precipitation for the growing season with very warm temperatures throughout the season. No greenbug infestation. None of the hybrids lodged. Late freeze date. Yields and test weights were very good considering the dry season.

SOIL: Silty Loam for 0-8" and Silty Loam 8"-24" depths from soil analysis.

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8"	7.7	0.5	1.9	14	6.2	490	1.0	5.8
8"-24"				16				
Comment	Alka	Vlo	Hi	Hi	Lo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------Lb/A------------------			
Recommended	0	20	0	0
Applied	0	20	0.3	0

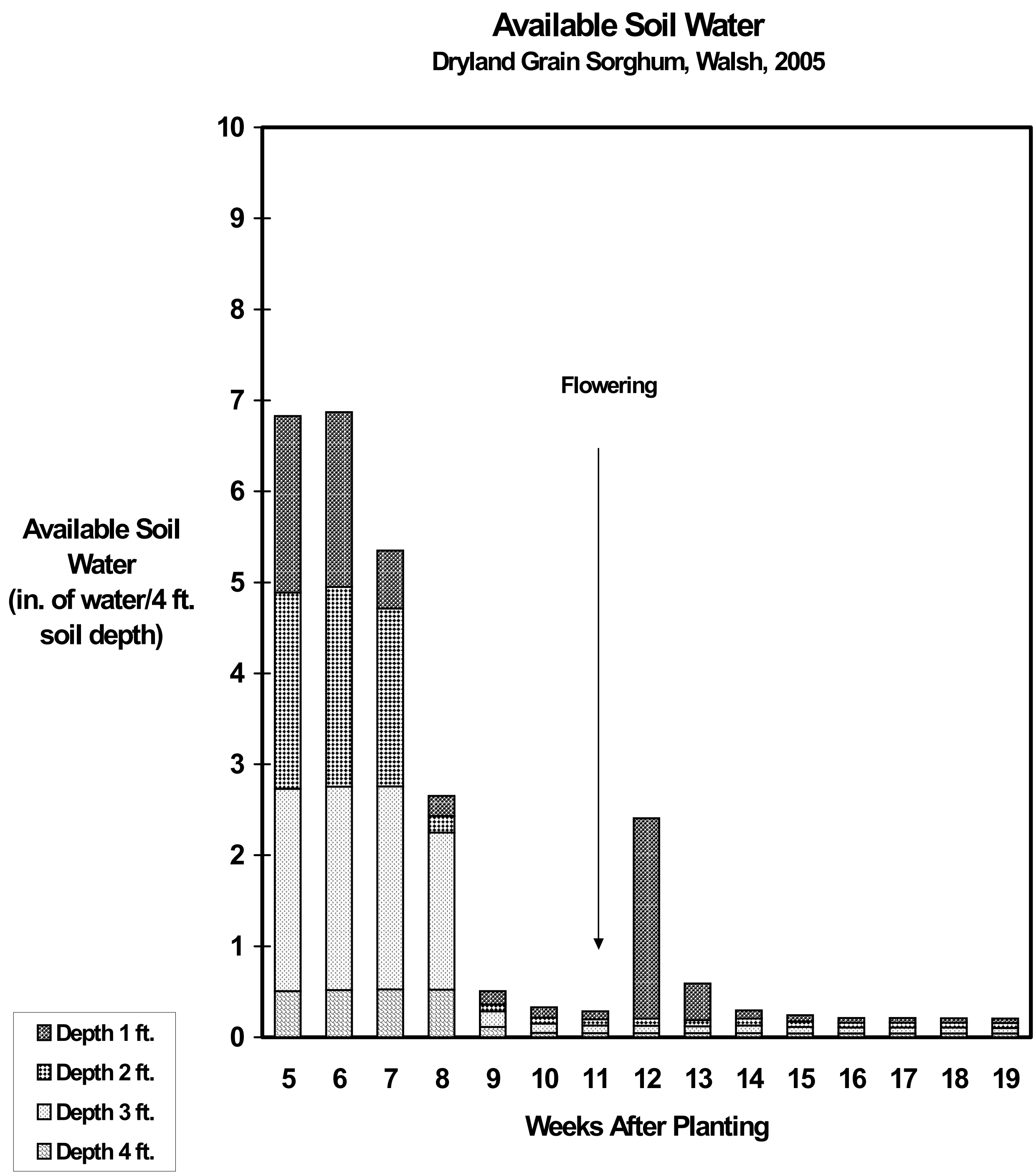

Fig. 3. Available soil water in dryland grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 6.65 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table 6.--Dryland Grain Sorghum Hybrid Performance Test at Walsh, 2005. \1

Brand	Hybrid	Days to Emerge	50% Bloom DAP	50% Bloom GDD	50% Mature DAP	50% Mature Group	Plant Ht.	Harvest Density	Plants Lodged	Test Wt.	Grain Yield	Yield % of Test Average
							In	Plants/A (1000 X)	%	Lb/Bu	Bu/A	%
FONTANELLE	GE 3245	11	65	1582	108	E	32	22.5	0	59	58	101
DEKALB	DKS 37-07	11	70	1743	115	ME	35	19.6	0	60	68	117
DEKALB	DK-44	10	72	1778	119	ME/M	36	21.9	0	60	61	105
ASGROW	Pulsar	11	70	1743	112	ME	32	20.3	0	60	60	104
FONTANELLE	GE 4532	10	73	1804	119	ME	38	26.1	0	60	58	100
ASGROW	Seneca	9	73	1804	120	ME/M	34	25.7	0	60	56	97
(Check)	399 X 2737	9	89	2173	138	ML	34	25.9	0	57	44	76
Average		10	73	1804	119	ME	34	23.1	0	59	58	
LSD 0.20											6.2	

\1 Planted: May 26; Harvested: November 2.
Yields are corrected to 14.0% seed moisture content.
DAP: Days After Planting or maturation of seed at first freeze.
Seed Maturation: EM, early milk; MM, mid milk; LM, late milk; ED, early dough; SD, soft dough; HD, hard dough; mature (DAP).
GDD: Growing Degree Days for sorghum.
Maturity Group: E, early; ME, medium early; M, medium; ML, medium late; L, late.

Table 7.--Summary: Dryland Grain Sorghum Hybrid Performance Tests at Walsh, 2003-2005.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2003	2004	2005	2-Year Avg	3-Year Avg	2003	2004	2005	2-Year Avg	3-Year Avg
		------------------Bu/A---------------------					----------------------%----------------------				
ASGROW	Seneca	36	66	56	61	53	144	107	97	102	116
ASGROW	Pulsar	34	64	60	62	53	135	105	104	105	115
DEKALB	DK-44	23	52	61	57	45	94	85	105	95	95
PIONEER	85G01	31	81	--	56	--	125	131	--	128	--
SORGHUM PARTNERS	NK 7633	36	55	--	46	--	146	90	--	118	--
TRIUMPH	TR 438	25	79	--	52	--	98	129	--	114	--
(Check)	399 X 2737	15	43	44	44	34	58	70	76	73	68
Average		26	61	58	60	48					

Grain Yields were corrected to 14.0 % seed moisture content.

Irrigated Grain Sorghum Hybrid Performance Trial at Walsh, 2005

COOPERATORS: Plainsman Agri-Search Foundation, and Kevin Larson, Superintendent, Plainsman Research Center, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under irrigated conditions with 3200 sorghum heat units in a Silty Loam soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 87,100 Seed/A. PLANTED: June 2. HARVESTED: November 3.

EMERGENCE DATE: 9 days after planting. SOIL TEMP: 65 F.

IRRIGATION: Drip irrigated for 15 weeks with 12.6 A-in./A.

PEST CONTROL: Preemergence Herbicides: Roundup 20 Oz/A, 2,4-D 0.5 Lb/A, Atrazine 1.0 Lb/A. Post Emergence Herbicides: Banvel 4 0z/A, LoVol 5 Oz/A. CULTIVATION: Once. INSECTICIDES: None.

Summary: Growing Season Precipitation and Temperature \1
Walsh, Baca County.

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
June	1.16	677	17	2	28
July	1.01	878	26	8	59
August	1.90	763	17	3	90
September	0.24	642	15	0	120
October	1.06	276	3	0	148
Total	5.37	3236	78	13	148

\1 Growing season from June 2 (planting) to October 24 (first freeze, 24 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

FIELD HISTORY: Last Crop: Grain sorghum. FIELD PREPARATION: Disc.

COMMENTS: Planted in good soil moisture. Weed control was good. Below normal precipitation for the growing season with very warm temperatures throughout the season. Late freeze date. No greenbug infestation. None of the hybrids lodged. Grain yields were good.

SOIL: Silty Loam for 0-8" and Silty Loam 8"-24" depths from soil analysis.

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8"	7.7	0.5	1.9	5	0.9	368	1.1	6.2
8"-24"				5				
Comment	Alka	VLo	Hi	Lo	VLo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------Lb/A------------------			
Recommended	59	40	0	0
Applied	140	20	0.3	0

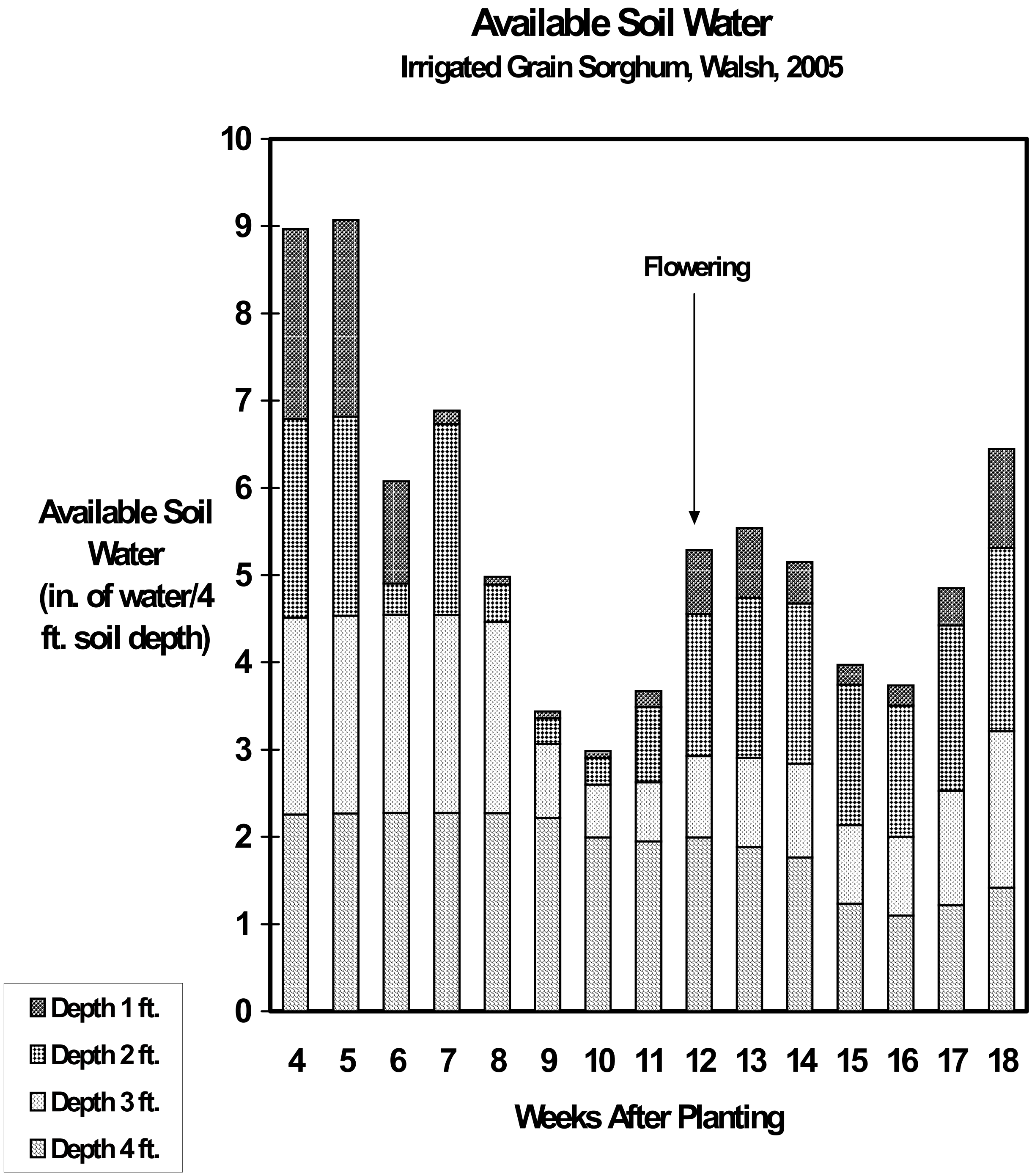

Fig. 4. Available soil water in irrigated grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 5.37 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table 8.--Irrigated Grain Sorghum Hybrid Performance Test at Walsh, 2005. \1

Brand	Hybrid	Days to Emerge	50% Bloom DAP	50% Bloom GDD	50% Mature DAP	50% Mature Group	Plant Ht.	Harvest Density	Lodged Plants	Test Wt.	Grain Yield	Yield % of Test Average
							In	Plants/A (1000 X)	%	Lb/Bu	Bu/A	%
ASGROW	A 567	10	75	1914	124	M/ML	50	36.0	0	59	117	103
DEKALB	DKS 54-00	9	82	2089	131	ML	51	33.7	0	57	128	112
ASGROW	A 571	8	87	2222	137	ML	51	36.8	0	55	117	103
DEKALB	DKS 53-11	10	77	1967	127	ML	49	37.6	0	60	113	100
(Check)	399 X 2737	8	85	2167	134	ML	44	35.2	0	56	102	90
Average		9	81	2072	131	ML	49	35.9	0	57	115	
LSD 0.20											7.9	

\1 Planted June 2; Harvested: November 3.
Yields are corrected to 14.0% seed moisture content.
DAP: Days After Planting or maturation of seed at first freeze.
Seed Maturation: LM, late milk; ED, early dough; SD, soft dough; HD, hard dough; mature (DAP).
GDD: Growing Degree Days for sorghum.
Maturity Group: E, early; ME, medium early; M, medium; ML, medium late; L, late.

Table 9.--Summary: Irrigated Grain Sorghum Hybrid Performance Tests at Walsh, 2003-2005.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2003	2004	2005	2-Year Avg	3-Year Avg	2003	2004	2005	2-Year Avg	3-Year Avg
		--------------------Bu/A--------------------					----------------------%----------------------				
ASGROW	A 567	--	117	117	117	--	--	105	103	104	--
ASGROW	A 571	132	107	117	112	119	106	96	103	100	102
DEKALB	DKS 54-00	135	107	128	118	123	108	96	112	104	105
DEKALB	DKS 53-11	119	119	113	116	117	96	107	100	104	101
PIONEER	84G62	139	131	--	135	--	111	118	--	115	--
SORGHUM PARTNERS	NK 5418	122	115	--	119	--	98	103	--	101	--
SORGHUM PARTNERS	NK 7633	127	99	--	113	--	102	89	--	96	--
SORGHUM PARTNERS	NK 7655	120	117	--	119	--	96	105	--	101	--
(Check)	399 X 2737	125	109	102	106	112	100	98	90	94	96
Average		125	111	115	113	117					

Grain Yields were corrected to 14.0 % seed moisture content.

Limited Sprinkler Irrigated Grain Sorghum Hybrid Performance Trial at Walsh, 2005

COOPERATORS: Plainsman Agri-Search Foundation, and Kevin Larson, Superintendent, Plainsman Research Center, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under limited sprinkler irrigated conditions with 3200 sorghum heat units in a Silty Loam soil.

PLOT: Four rows with 30” row spacing, at least 1000’ long. SEEDING DENSITY: 58,000 Seed/A. PLANTED: June 2. HARVESTED: November 7.

EMERGENCE DATE: 9 days after planting. SOIL TEMP: 65 F.

IRRIGATION: Sprinkler irrigated with 7.5 A-in./A, applied with five rotations.

PEST CONTROL: Preemergence Herbicides: Roundup 20 Oz/A, 2,4-D 0.5 Lb/A, Atrazine 1.0 Lb/A. Post Emergence Herbicides: Banvel 4 0z/A, LoVol 5 Oz/A. CULTIVATION: Once. INSECTICIDES: None.

Summary: Growing Season Precipitation and Temperature \1
Walsh, Baca County.

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
June	1.16	677	17	2	28
July	1.01	878	26	8	59
August	1.90	763	17	3	90
September	0.24	642	15	0	120
October	1.06	276	3	0	148
Total	5.37	3236	78	13	148

\1 Growing season from June 2 (planting) to October 24 (first freeze, 24 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

FIELD HISTORY: Last Crop: Corn. FIELD PREPARATION: Disc.

COMMENTS: Planted in good soil moisture. Weed control was good. Below normal precipitation for the growing season with very warm temperatures throughout the season. Late freeze date. No greenbug infestation. None of the hybrids lodged. Grain yields were poor because irrigation caused late tillers to develop that did not produce mature seed.

SOIL: Silty Loam for 0-8” and Silty Loam 8”-24” depths from soil analysis.

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8”	7.6	0.5	2.0	11	5.3	428	1.1	6.6
8”-24”				13				
Comment	Alka	VLo	Hi	Hi	Lo	VHi	Marg	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------Lb/A------------------			
Recommended	0	20	0	0
Applied	130	40	0	0

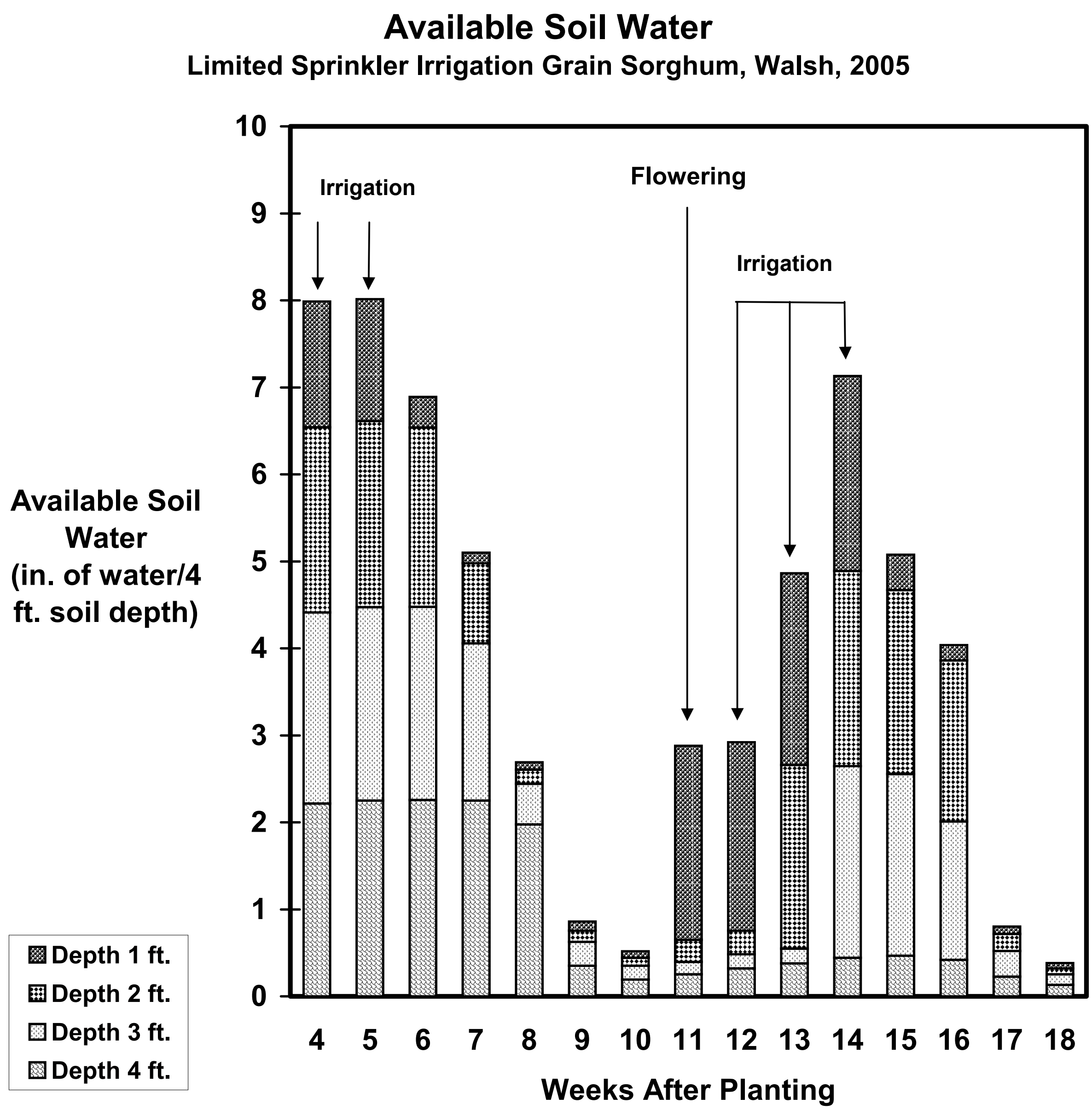

Fig. 5. Available soil water in irrigated grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 5.37 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table 10.--Limited Sprinkler Irrigated Grain Sorghum Hybrid Performance Test at Walsh, 2005. \1

Brand	Hybrid	Days to Emerge	50% Bloom DAP	50% Bloom GDD	50% Mature DAP	50% Mature Group	Plant Ht.	Harvest Density	Lodged Plants	Test Wt.	Grain Yield	Yield % of Test Average
							In	Plants/A (1000 X)	%	Lb/Bu	Bu/A	%
FONTANELLE	GE 3245	9	70	1861	114	E	34	36.0	0	56	62	105
TRIUMPH	TR 442	8	80	2025	126	ME	45	37.2	0	56	73	124
FONTANELLE	GE 4532	9	76	1937	121	ME	42	34.2	0	57	56	94
MYCOGEN	1482	8	73	1890	118	ME	37	38.0	0	56	53	90
MYCOGEN	M 3838	9	77	1967	124	ME	40	35.0	0	57	52	87
Average		9	75	1936	121	ME	40	36.1	0	56	59	
LSD 0.20											2.8	

\1 Planted: June 2; Harvested: November 7.
Yields are corrected to 14.0% seed moisture content.
DAP: Days After Planting or maturation of seed at first freeze (24 F, October 24).
Seed Maturation: PM, pre-milk; EM, early milk; MM, mid-milk; LM, late milk; ED, early dough; SD, soft dough; HD, hard dough; DAP, mature.
GDD: Growing Degree Days for sorghum.
Maturity Group: E, early; ME, medium early; M, medium; ML, medium late; L, late.

Irrigated Forage Sorghum Hybrid Performance Trial at Walsh, 2005

COOPERATORS: Plainsman Agri-Search Foundation, and Kevin Larson, Superintendent, Plainsman Research Center, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under irrigated conditions with 2800 sorghum heat units in a Silty Loam soil.

PLOT: Four rows with 30” row spacing, 50’ long. SEEDING DENSITY: 113,250 Seed/A. PLANTED: May 26. HARVESTED: September 20.

EMERGENCE DATE: 9 days after planting. SOIL TEMP: 66 F.

IRRIGATION: Three furrow irrigations: June 28, August 3, and August 18, total applied 17 A-in./A.

PEST CONTROL: Preemergence Herbicides: Roundup 20 Oz/A, 2,4-D 0.5 Lb/A. Post Emergence Herbicides: Banvel 4 Oz/A, LoVol 5 Oz/A. CULTIVATION: Once. INSECTICIDES: None.

Summary: Growing Season Precipitation and Temperature \1
Walsh, Baca County.

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
May	1.28	57	0	0	5
June	1.16	679	17	2	35
July	1.01	878	26	8	66
August	1.90	763	17	3	97
September	0.12	445	11	0	117
Total	5.47	2822	71	13	117

\1 Growing season from May 26 (planting) to September 20 (harvest).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

FIELD HISTORY: Last Crop: Wheat. FIELD PREPARATION: No-till.

COMMENTS: Planted in good soil moisture. Weed control was good. The growing season was very wet and very cool. No greenbug infestation. Two hybrids had 20% or more lodging. Forage yields were good.

SOIL: Silty Loam for 0-8” and Silty Loam 8”-24” depths from soil analysis.

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8”	7.7	0.5	1.9	14	6.2	490	1.0	5.8
8”-24”				16				
Comment	Alka	VLo	Hi	Hi	Lo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------Lb/A------------------			
Recommended	0	20	0	0
Applied	120	20	0	0

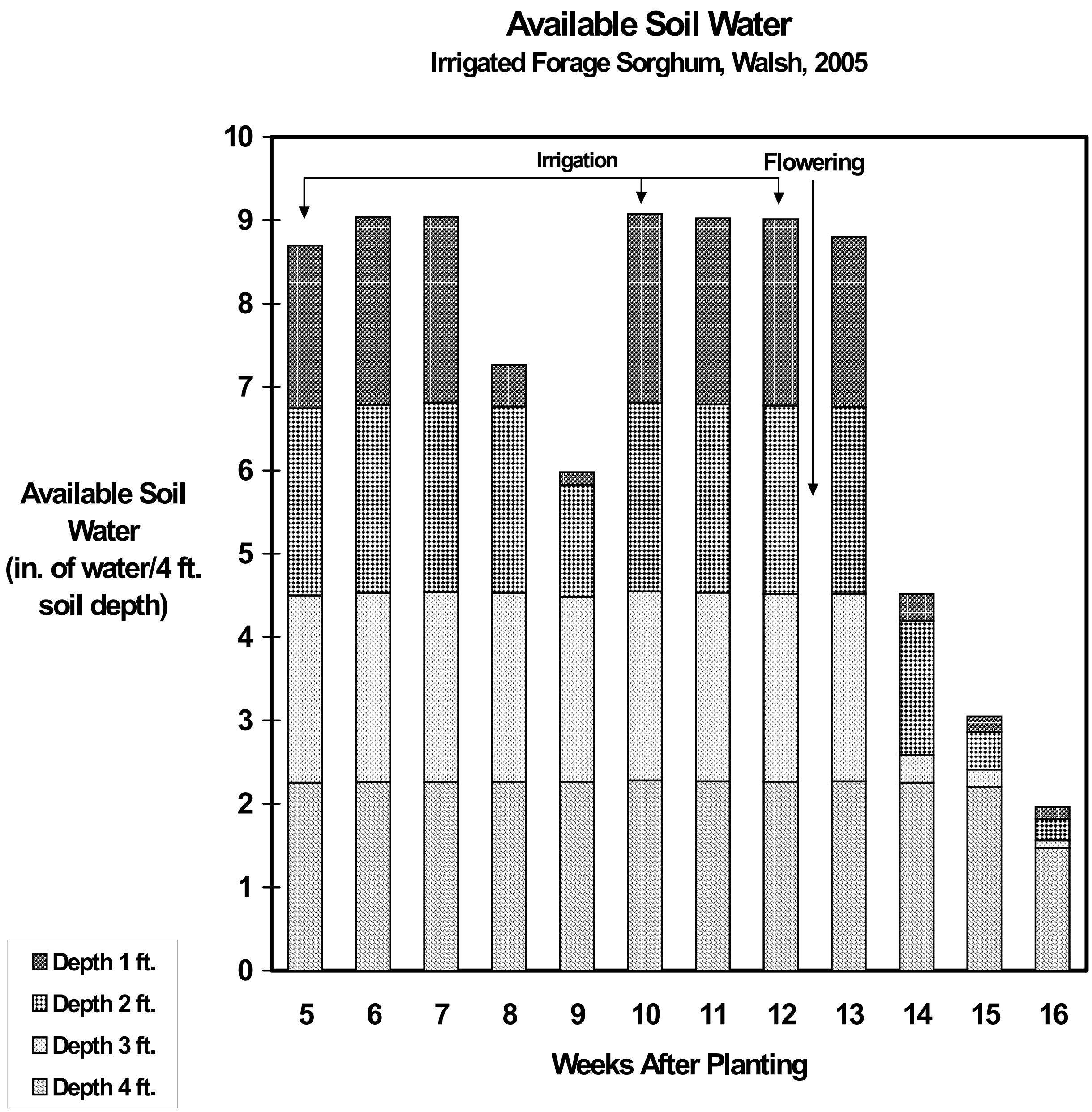

Fig. 6. Available soil water in irrigated forage sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 5.47 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table 11.--Irrigated Forage Sorghum Hybrid Performance Test at Walsh, 2005. \1

Brand	Hybrid	Forage Type \2	Days to Emerge	Days to 50% Bloom	Harvest Density	Plant Ht.	Stage \3 at Harvest	Stem Sugar	Plant Lodg	Forage Yield	Yield % of Test Avg.
					Plants/A (1000 X)	In.		%	%	Tons/A	%
DEKALB	FS-25E	FS	9	109	38.3	104	PM	7	0	22.0	125
DEKALB	FS-5	FS	9	96	38.3	102	LM	7	0	21.5	123
RICHARDSON SEEDS	Dairy Master BMR	FS	10	96	44.9	100	MM	9	35	17.9	102
DEKALB	DKS 59-09	FS	9	84	32.2	77	SD	4	1	17.8	102
RICHARDSON SEEDS	Bundle King BMR	FS	10	113	40.7	100	FL	8	20	16.4	93
(Check)	NB 305F	FS	11	95	34.1	106	MM	14	0	15.9	91
RICHARDSON SEEDS	Pacesetter BMR	FS	11	Veg	35.6	93	Veg	6	0	15.3	87
RICHARDSON SEEDS	Sweeter 'N Honey II	SS	8	107	50.3	112	PM	9	0	18.3	104
CAL/WEST SEEDS	CW 4-67-6	SS	9	80	43.4	91	HD	5	2	17.5	100
RICHARDSON SEEDS	Honey Graze BMR	SS	9	84	44.5	105	ED	9	0	17.4	99
CAL/WEST SEEDS	CW 2-62-6	SS	9	79	45.7	93	HD	6	2	16.2	92
RICHARDSON SEEDS	Sweeter 'N Honey BMR	SS	9	92	37.2	97	LM	7	4	16.0	91
CAL/WEST SEEDS	CW 2-61-6	SS	9	79	43.0	86	HD	7	2	15.8	90
CAL/WEST SEEDS	CW 2-63-6	SS	10	78	43.8	87	MT	7	0	13.0	74
MYCOGEN	2T801 (Bt/RR)	Corn	7	75	31.0	78	SD	4	0	21.9	125
Sorghum Average		FS	9	86	40.2	95	LM	7	4	17.5	
LSD 0.20										2.12	

\1 Planted: May 26; Harvested: September 20.

\2 Forage Type: FS, Forage Sorghum; SS, Sorghum Sudangrass.

\3 Seed Maturation: PM, premilk; EM, early milk; MM, midmilk; LM, late milk; ED, early dough; SD, soft dough; HD, hard dough; MT, mature.

Forage Yield corrected to 70% moisture content based on oven-dried sample.

Table 12.--Summary: Irrigated Forage Sorghum Hybrid Performance Tests at Walsh, 2003-2005.

		Forage Yield					Yield as % of Test Average				
Brand	Hybrid	2003	2004	2005	2-Year Avg	3-Year Avg	2003	2004	2005	2-Year Avg	3-Year Avg
		-----------------Tons/A-------------------									
AERC	AERC SSH 35	19.8	7.3	--	13.6	--	102	48	--	75	--
BUFFALO BRAND	Canex	19.8	16.4	--	18.1	--	102	107	--	105	--
BUFFALO BRAND	Canex BMR 208	16.6	15.3	--	16.0	--	86	100	--	93	--
BUFFALO BRAND	Canex BMR 310	18.0	14.2	--	16.1	--	93	93	--	93	--
BUFFALO BRAND	Canex BMR 248	19.6	14.4	--	17.0	--	101	94	--	98	--
BUFFALO BRAND	Grazex BMR 727	20.8	13.4	--	17.1	--	107	88	--	98	--
DEKALB	FS-5	24.0	21.0	21.5	21.3	22.2	124	137	123	130	128
DEKALB	FS-25E	23.6	13.3	22.0	17.7	19.6	122	87	125	106	111
DEKALB	DKS 59-09	17.4	20.7	17.8	19.3	18.6	90	136	102	119	109
DRUSSEL SEED	DSS Dividend BMR	24.1	17.8	--	21.0	--	124	116	--	120	--
SORGHUM PARTNERS	NK 300	21.9	16.2	--	19.1	--	113	106	--	110	--
SORGHUM PARTNERS	SS 405	20.6	13.1	--	16.9	--	106	86	--	96	--
SORGHUM PARTNERS	Sordan Headless	19.9	19.7	--	19.8	--	103	129	--	116	--
(Check)	NB 305F	20.0	17.2	15.9	21.8	17.7	113	112	91	102	105
(Check)	Corn	19.3	18.7	21.9	20.3	20.0	99	122	125	124	115
Average		19.4	15.3	17.5	16.4	17.4					

Forage Yields were corrected to 70% moisture content based on oven-dried sample.

Table 13.--Irrigated Forage Sorghum Hybrid Dry Matter Analysis at Walsh, 2005.

Brand	Hybrid	Forage Type \1	Days to Boot	Plant Height at Boot	CP	ADF	NDF	IVTD	TDN	RFQ	Net Energy Main.	Net Energy Gain	Net Energy Lact.
				In	---------------%-------------------						-----MCal/lb-----		
DEKALB	DKS 59-09	FS	77	53	10.7	36.8	57.4	83.0	65.0	147	0.60	0.34	0.67
DEKALB	FS-25E	FS	100	95	10.1	37.2	58.8	80.0	62.6	134	0.60	0.34	0.64
RICHARDSON SEEDS	Pacesetter BMR	FS	Veg	96	9.3	38.3	60.3	80.7	62.1	132	0.58	0.32	0.64
(Check)	NB 305F	FS	87	80	9.4	38.4	60.6	79.2	62.6	130	0.58	0.32	0.64
RICHARDSON SEEDS	Dairy Master BMR	FS	88	84	5.6	40.4	64.1	79.0	63.1	128	0.54	0.29	0.65
RICHARDSON SEEDS	Bundle King BMR	FS	103	92	6.8	38.9	62.8	78.0	62.3	125	0.57	0.31	0.64
DEKALB	FS-5	FS	88	80	6.2	43.2	65.5	76.3	59.6	114	0.49	0.24	0.61
RICHARDSON SEEDS	Honey Graze BMR	SS	77	66	10.4	37.7	57.2	82.9	64.6	147	0.59	0.33	0.66
CAL/WEST SEEDS	CW 2-61-6	SS	72	53	9.6	35.7	58.2	81.1	64.1	140	0.62	0.36	0.66
CAL/WEST SEEDS	CW 2-63-6	SS	71	58	8.2	37.1	60.4	80.4	64.7	137	0.60	0.34	0.67
CAL/WEST SEEDS	CW 4-67-6	SS	73	53	8.2	37.7	60.4	80.3	64.6	137	0.59	0.33	0.66
RICHARDSON SEEDS	Sweeter 'N Honey BMR	SS	85	65	9.9	38.7	60.7	81.3	62.7	135	0.57	0.31	0.64
CAL/WEST SEEDS	CW 2-62-6	SS	71	59	7.8	38.1	60.9	79.8	63.4	133	0.58	0.32	0.65
RICHARDSON SEEDS	Sweeter 'N Honey II	SS	97	89	10.2	40.7	59.4	79.0	61.3	128	0.54	0.28	0.63
MYCOGEN	2T801 (Bt/RR)	Corn	71	68	10.4	36.2	59.3	77.3	61.5	124	0.61	0.35	0.63
Sorghum Average		FS	83	73	8.9	38.3	60.4	79.9	62.9	133	0.58	0.32	0.65

\1 Forage Type: FS, Forage Sorghum; SS, Sorghum Sudangrass.

Infrared analysis performed on whole plant samples taken at boot.

CP, Crude Protein; ADF, Acid Detergent Fiber; NDF, Neutral Detergent Fiber; TDN, Total Digestible Nutrients;

IVTD, In Vitro True Digestibility; RFQ, Relative Forage Quality; Net Energy: Maintenance, Gain, Lactation..

Sandbur Control, Grain Yield and Net Return of Microencapsulated Herbicides in Dryland Grain Sorghum

Kevin Larson and Dennis Thompson

Weed control is an essential component of grain sorghum production. In order to evaluate economic return of herbicide applications, it is important to consider chemical costs and grain yields. We tested three microencapsulated grass herbicides with Atrazine. Microencapsulated herbicides are advertised as providing slow release of herbicide that prolongs herbicide activity. We tested three microencapsulated grass herbicides and Atrazine on sandbur, the most prevalent grassy weed in grain sorghum in Southeastern Colorado.

Materials and Methods

We applied four pre-emergence herbicide treatments: Bicep Lite II Magnum 1.5 Qt/A, G-Max Lite 1.5 Qt/A, Micro-Tech 2.5 Qt/A with Atrazine 1.0 Lb/A, and Atrazine 1.0 Lb/A with three replications on Richfield Silty Loam soil. All herbicide treatments had 1.0 Lb/A of Atrazine and all were applied on June 8 at 10 Gal/A with 110^{o} flat fan nozzles spaced 18 in. apart. We had planned to incorporate the herbicide with sprinkler irrigation immediately after spraying, but the sprinkler was down and the herbicides were not incorporated until three days later with 0.70 inches of rain. The 20 ft. by 1250 ft. plots were planted June 2 with Mycogen M3838 at 58,000 Seeds/A. To control broadleaf weeds, we sprayed Banvel 4 Oz/A and LoVol 5 Oz/A and cultivated once.

Results and Discussion

All three microencapsulated herbicide treatments had significantly higher sandbur control than the Atrazine check (Table 15). Bicep Lite II Magnum was the only treatment that produced significantly higher yields than the Atrazine check (4 Bu/A more). The Atrazine check generated the highest variable net income producing at least $9.21 more than any of the microencapsulated herbicide treatments. The microencapsulated herbicide treatments cost $13.76/A to $17.68/A more than the Atrazine only treatment. The meager yield increase of the microencapsulated herbicide treatments did not justify the higher cost of these treatments compared to Atrazine alone. Since all of microencapsulated herbicide treatments produced greater sandbur control than the Atrazine check, demonstrates that not all of the herbicide was lost to the three-day incorporation delay. Herbicide efficacy would have been higher if we were able to incorporate with sprinkler irrigation immediately after herbicide application, as the Bicep II Magnum label states, “If irrigation is not possible and rain does not occur within 2 days after planting and application, weed control may be decreased.” Waiting three days after herbicide application for rain to incorporate the treatments allowed volatilization to occur and some weed control was lost. Last year when we were able to rotary-hoe incorporate after herbicide application, we produced significantly higher yields and variable net incomes than the Atrazine check (Larson, Berrada, Thompson, 2005).

Literature Cited

Larson, K.J., A. Berrada, D.L. Thompson. 2005. Sorghum hybrid performance trials in Colorado, 2004. Technical Report TR05-03. AES, Dept. of Soil and Crop Sciences, CSU, 49p.

Table 15.-Sandbur Control in Dryland Grain Sorghum at Walsh, 2005.

Herbicide Treatment	Rate	Sandbur Control	Test Weight	Grain Yield	Chem. Cost	Var. Net Income
	*/A	%	Lb/Bu	Bu/A	$/A	$/A
Atrazine	1.0 lb	53	57	59	2.38	109.65
Bicep Lite II Magnum (rate applied 1.0 lb atrazine)	1.5 qt	75	56	63	20.06	100.44
Micro Tech & Atrazine	2.5 qt 1.0 lb	82	56	60	16.14	98.85
G-Max Lite (rate applied 1.0 lb atrazine)	1.5 qt	72	57	61	19.85	97.11
Average		71	57	61	14.61	101.51
LSD 0.20		18.0		3.3		

Planted: June 2, Mycogen M 3838 at 58,000 Seeds/A; Harvested: November 7.
Herbicide Treatments applied June 8.
Variable Net Income: Treatment Yield x $1.97/Bu - Chemical Cost - Application Cost ($4/A). All treatments were cultivated.

Zn Fertilization of Irrigated Grain Sorghum in Southeastern Colorado

Kevin Larson, Dennis Thompson, and Bill Brooks

Soil test recommendations for Southeastern Colorado typically recommend banding 2 Lb Zn/A to both dryland and irrigated grain sorghum. From our previous studies, we reported yield increases with Zn fertilization for dryland corn, but only once did dryland grain sorghum respond positively to applied Zn (Larson, Schweissing, Thompson, 2001). The one time dryland grain sorghum yields did increase with Zn fertilization was an exceptionally high rainfall, high yielding year. Since Zn increased yields under a high production environment, we decided to study the effects of Zn under irrigation. This is the fourth year of our continuing study to determine the optimum Zn rate for irrigated grain sorghum under high yielding conditions.

Materials and Methods

This year we tested six seedrow Zn rates: 0, 0.2, 0.4, 0.6, 0.8, and 1.0 Lb Zn/A as Zn chelate with three replications. We mixed the Zn with 5 Gal 10-34-0/A prior to application. The site was subsurface drip irrigated with 11.8 A-in./A. We planted Mycogen 1482 on June 15 at 87,100 Seeds/A. We applied 140 Lb N/A and 20 Lb P_2O_5/A to the site. For weed control, we sprayed Roundup 20 Oz/A, 2,4-D 0.5 Lb/A and Atrazine 1.0 Lb/A pre-emergence, and Banvel 4 Oz/A and LoVol 5 Oz/A post-emergence. We cultivated one time. The 10 ft. X 650 ft. plots were harvested with a self-propelled combine and weighed in a digital weigh cart. For each plot at harvest, we took a sample for moisture and test weight.

Results and Discussion

This year there was no yield response to seedrow Zn (Fig. 7). The near zero linear response indicates there was no significant yield or test weight trends with increasing Zn rates. The lack of yield and test weight response to increasing Zn rates under these high yielding irrigated production conditions suggests that there was sufficient time for the crop to mature. The test weight results from this year ranged from 57.3 to 58.2 Lb/Bu confirming that the seed fully matured. Results from our Vilas study two years ago (Larson, Schweissing, Thompson, 2004) suggested that Zn was not needed if the growing season was long enough for full seed maturation. The results from this year confirm our explanation of the role of Zn in seed maturation. Last year seedrow Zn increased both grain yield and test weight with a maximum rate of 0.8 Lb/A for grain yield and 0.6 Lb/A for test weight (Larson, Berrada, Thompson, 2005). Last year we expected a yield response to Zn because of the late planting date (July 2) and the suggested Zn role of maturity acceleration observed two years ago. In 2003, we observed maturity acceleration with increasing Zn rate; however, there was no yield response to applied Zn on irrigated grain sorghum at either of the Zn sites (Larson, Schweissing, Thompson, 2004). For the last three years of this study, we had late freeze dates (October 26, 25, and 24, respectively); however, the yield response to Zn rates varied. Planting date was the determinate factor to the response to applied Zn and seed maturation. In the years when we had a typical planting date (late May to mid June), there was no response to applied Zn. Last year when we had a late planting date (July 2) grain yields and test weights were optimized at 0.6 to 0.8 Lb Zn/A. In

2003, with typical planting dates (late May to mid June), we suggested that the late freeze date (October 26, 22 F) allowed all Zn rates to mature. Last year, we again had a late freeze date (October 25, 29 F), but because of our late planting date (July 2), the maturity acceleration gained with applied Zn increased both yield and test weight. The low test weights we recorded indicate that none of the Zn rates fully matured, but test weight increased with Zn rate from 51.5 Lb/Bu for the 0 lb/A Zn rate to 53.5 Lb/Bu for the 0.6 Lb/A rate. The optimum seedrow Zn rate of 0.8 Lb/A with a yield of 83 Bu/A is similar to the Zn response we recorded from the 2002 Vilas site with an optimum rate around 0.6 Lb Zn/A and a yield of 98 Bu/A (Larson, Schweissing, Thompson, 2003).

This is the fourth year of our multi-year irrigated grain sorghum Zn study. The lack of Zn response we obtained this year suggests that Zn fertilizer may not be needed for high grain sorghum production when planted as late as mid June with a late first freeze date. If the growing season is long enough for full seed maturation, Zn fertilization is not necessary under high yielding irrigated conditions. If the growing season is not long enough for full maturation, seedrow Zn may increase both grain yield and test weight. In the years that we observed Zn responses, applying seedrow Zn to irrigated, high production grain sorghum produced a optimum response from 0.5 Lb/A with a typical planting date and an early first freeze date, and 0.6 to 0.8 Lb/A of Zn with a late planting date and a late first freeze date.

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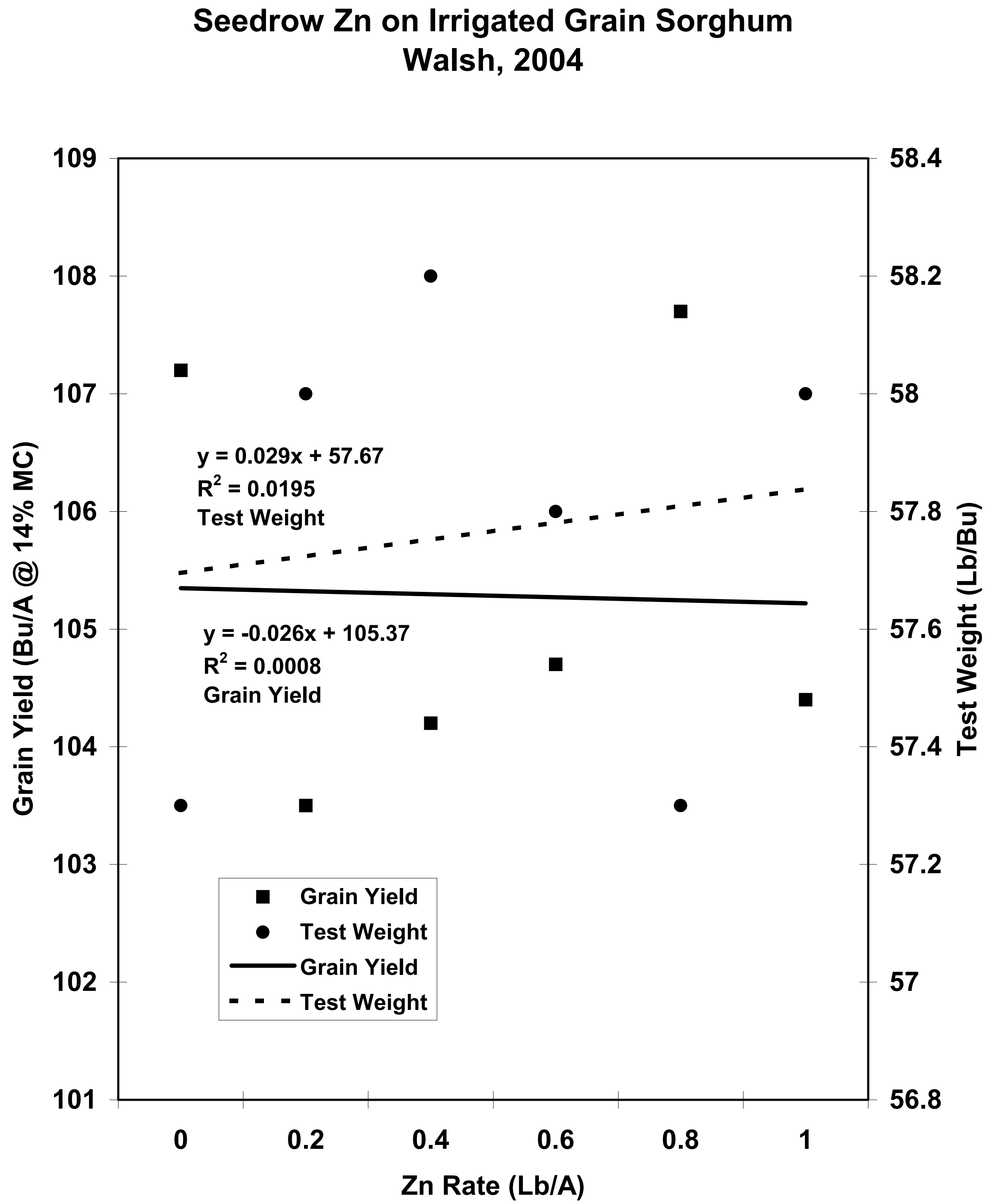

Fig. 7. Seedrow Zn rate on subsurface drip irrigated grain sorghum at Walsh. The Zn rates were 0, 0.2, 0.4, 0.6, 0.8 and 1.0 Lb Zn/A as Zn chelate. The grain sorghum hybrid was Mycogen 1482 planted at 87,100 Seeds/A on June 15.

Long-Term, Low-Rate, Seedrow P on Dryland Grain Sorghum

Kevin Larson, Dennis Thompson and Calvin Thompson

Banding P fertilizer with the seed at planting (seedrow placement) has proven to be a very effective P fertilizing method for dryland grain sorghum in the high lime, high alkaline soils of Southeastern Colorado. For these alkaline soils, the P fertilizer of choice for seedrow placement is liquid 10-34-0. The most common seedrow P rate for dryland grain sorghum is 5 Gal/A of 10-34-0 which contains 20 Lb P_2O_5 and 6 Lb N/A. High rates of seedrow N are reported to cause N salt toxicity, which lowers germination (Mortvedt, 1976). Nonetheless, a low to moderate, nontoxic level of seedrow N is reported to increase yields (Larson, Schweissing, Thompson, 2000). This is the third crop year of our long-term study testing low seedrow P rates to determine if low rates applied on the same site for multiple years will maintain high grain sorghum yields.

Materials and Methods

We tested four rates of poly ammoniated phosphate (10-34-0) fertilizer banded with the grain sorghum seed (seedrow applied) on 30 in. row spacing in an alkaline Silty Clay Loam soil. The four rates were 0, 1.25, 2.5, and 5.0 gallons of 10-34-0/A, corresponding to 0, 5, 10, and 20 Lb P_2O_5/A. The fertilizer was applied with a squeeze pump at 5 Gal/A and all fertilizer rates were diluted with water to their appropriate levels. These seedrow P treatments were applied to the same plot site for all three years of the study. The study was design as a continuous grain sorghum rotation; however, dry weather prevented planting during 2002 and 2004. Therefore, the study resembled a sorghum-fallow rotation because of the dry years. Prior to planting, the soil was sampled at six random locations at 0 to 8 in. (surface) and 8 to 24 in. (subsurface) depths. The soil was sent to Colorado State University Soil Testing Lab for analysis. Their soil test recommendation for all three years for 50 Bu/A yield goal was banding 20 Lb P_2O_5/A. For the first year, the grain sorghum hybrid was CARGILL 627 planted at 40,000 Seed/A on June 7, 2001. For the second year and third years, the grain sorghum hybrid was MYCOGEN 1482 planted at 40,000 Seed/A on June 17, 2003 or June 15, 2005. We harvested the 10 ft. by 500 ft. plots from early October to mid November with a self-propelled combine with a four-row crop header, and we weighed the grain in a digital scale cart. Grain yields were adjusted to 14% seed moisture content.

Results and Discussion

The first year of our long-term, low-rate seedrow P study (2001) there was no significant yield difference from any of the fertilizer treatments (Fig.). The check, without seedrow applied P fertilizer, produced the highest yield. In fact, there was a nonsignificant trend of reduced yields with increasing seedrow P rates (R^2 = 0.561 NS). The low, nonsignificant, coefficient of variation (R^2) indicates a random yield response to seedrow applied P. For the second crop year (2003), all seedrow P treatments produced higher yields than the no P check (Fig. 10). There was a significant trend toward an optimum seedrow P rate of around 10 Lb P_2O_5/A, one half the recommended banded P rate ($P > 0.10$). For the third crop year (2005), there was a linear trend of increasing yield with increasing seedrow P rates ($P > 0.10$). By the third crop year, the highest yield occurred at the highest P rate, 20 Lb P_2O_5/A, the recommended banded rate, which we interpreted as the end year for low P rates in maintaining highest grain sorghum yield. Results from this study suggest that applying the same P rates to the same plots provides high grain sorghum yields for two crop years with applied P rates lower than the recommended banded P rate. We found that the first crop year no seedrow P was needed, the second crop year only half the recommended banded P rate was needed, but by the third crop year the recommended P rate was needed for optimum grain sorghum yields. Throughout the three crop years of this study, there has been an increase in yield response to applied P rates (Fig.). This P rate yield response indicates a continual decline of soil P. One of the objectives of this study was to determine how long low rates of seedrow P could maintain high grain sorghum yields. It appears that only two grain sorghum crops can produce high crop yields with seedrow P rates less than the recommended banded P rate. By the third crop year, the recommended banded P rate must be applied to maintain high crop yields.

The efficacy of low P seedrow rates obtained from the first two crop years indicates that low P rates are effective, at least in the short term; however, by the third crop year, the recommended banded P rate is required for optimum grain sorghum yields. More P is removed with grain than is added from rates below 20 Lb P_2O_5/A level: a 40 Bu/A sorghum grain crop removes about 18 Lb P_2O_5/A (extrapolated from Leonard and Martin, 1963). Since more P is removed with grain than is added using these low P rates, after two crop years the use of low P rates did not maintain high yields because the available soil P pool in these low P soils was depleted.

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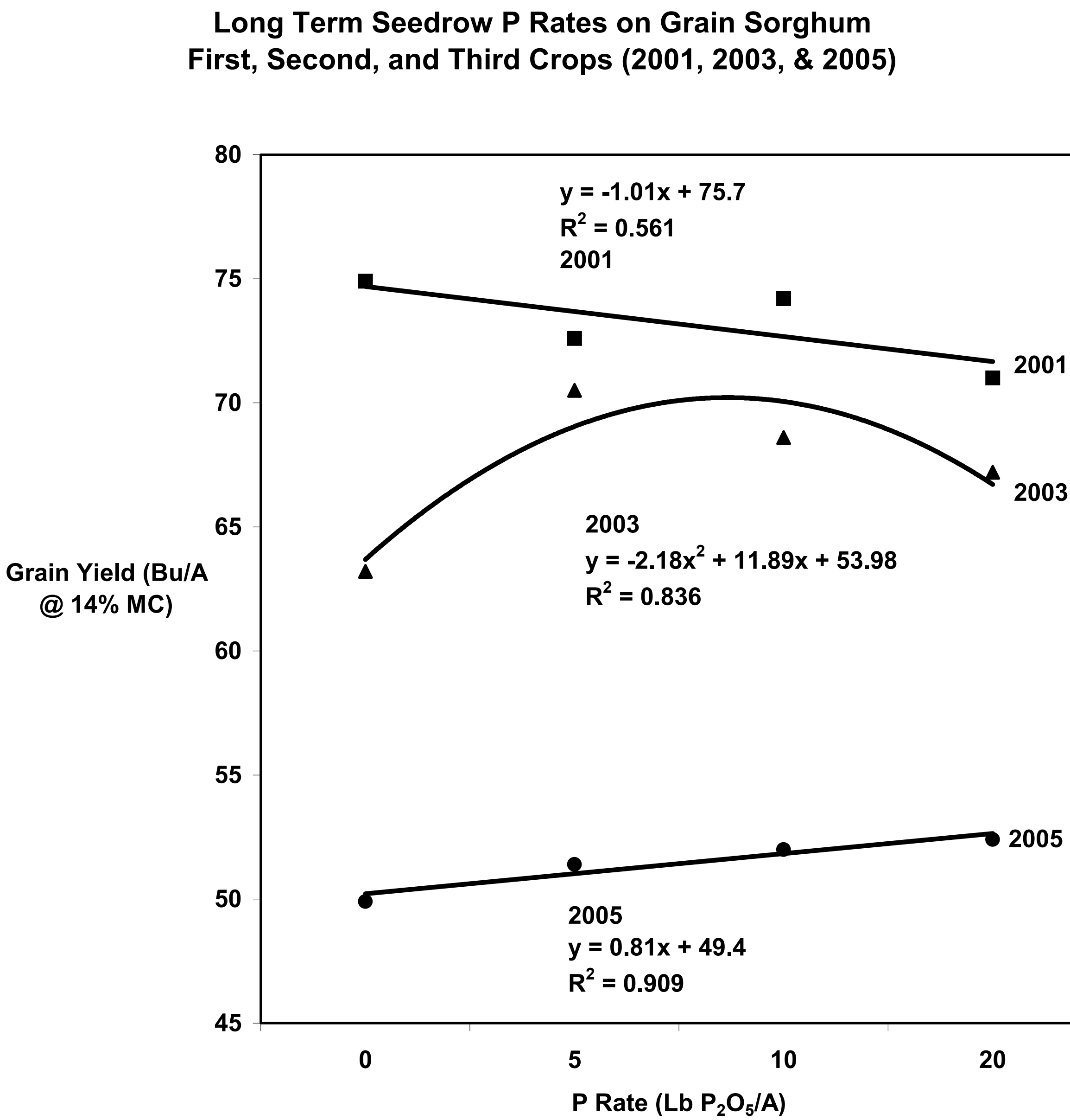

Fig. 8. Grain yield from three crop years of long term, low seedrow P rates on a dryland grain sorghum-fallow rotation at Walsh. The P rates were applied to the same plots all three crop years: 2001, 2003, and 2005.

Skip-Row Planting for Dryland Grain Sorghum and Corn Production

Kevin Larson and Dennis Thompson

Skip-row planting is an old idea that is being revitalized for dryland row crop production in the drier areas of the High Plains. The two main advantages of skip-row planting compared to solid planting are reported to be late-season water availability from water stored in the skip-row (Klein, et al., 2005) and less down the row input costs (Jost and Brown, 2001). The crop emphasis for skip-row has shifted from cotton and grain sorghum to glyphosate-resistant corn and soybean crops, because the glyphosate-resistant crops provide simple weed management and moisture conservation of the skip-row area.

Materials and Methods

The site used for this study was previously in a wheat-grain sorghum-fallow rotation. Our three skip-row treatments were: 1) all rows planted (sorghum, 35,000 Seeds/A; corn, 16,000 Seeds/A), 2) skip row/plant row (sorghum, 17,500 Seeds/A; corn, 8,000 Seeds/A), and 3) skip row/plant two rows (sorghum, 21,900 Seeds/A; corn, 10,000 Seeds/A). We planted the corn hybrid, Mycogen 2K541, on May 17 and the grain sorghum hybrid, Mycogen M3838, on June 17. We applied N at 70 Lb/A and we seedrow applied P at 20 Lb P_2O_5/A to the grain sorghum and corn studies. For preplant weed control, we sprayed Roundup Ultra at 24 Oz/A and Atrazine 1.0 Lb/A to both the corn and grain sorghum sites, and for post emergence control we applied Roundup Ultra at 24 Oz/A to the corn site and Banvel 4 Oz/A and LoVol 5 Oz/A to the grain sorghum site. We harvested the grain sorghum on November 16 and the corn on September 27 with a self-propelled combine and weighed them in a digital scale cart. Grain yields were adjusted to 14% seed moisture for grain sorghum and 15.5% seed moisture for corn.

Results and Discussion

For sorghum, the skip row/plant two rows treatment produced significantly more yield than planting all rows, and the skip row/plant row treatment was not quite significantly higher than planting all rows (Table 20). For corn, the skip row/plant row treatment produced significantly more than planting all rows (Table 21). There was no difference between skip row/plant two rows and all rows planted for corn. Even though there was a significant difference between skipping alternate rows and planting all rows for corn, the low yield (3.2 Bu/A was the highest yield obtained for corn) would not justify harvest cost. This is contrary to the results from a dryland skip-row corn study conducted in Western Nebraska were they reported a 13 Bu/A increase with the skip two/plant two treatment compared to the all rows planted check (Klein, et al., 2005).

For our corn study, skipping alternate rows helped; however, there was insufficient moisture in July to mid August to produce a profitable grain harvest even with the additional moisture stored in the skip row. This suggests than dryland corn is dependent on July to mid August rainfall. If July to mid August rains are inadequate, then corn production suffers regardless of stored moisture at planting. There was approximately 9 to 11 inches of water available for corn growth from stored moisture and rainfall from planting through July (flowering). Apparently, corn uses approximately

9 to 11 inches of rain to reach its vegetative threshold since the corn crop had just enough moisture to begin grain production (11.3” if all rainfall and stored moisture is available and 9.04” if 80% of the moisture is available: May 2.22”, June 1.16”, July 1.01”; and stored estimated at 6.9”). The 20 Bu/A yield average for the grain sorghum demonstrates that grain sorghum has a lower water requirement for its vegetative threshold than corn. The moisture stored with skip-row contributed to higher grain sorghum yields: the skip row/plant two rows treatment produced 3 Bu/A more than planting all rows. Seeding density was also decrease with skip-row compared to planting all rows, 21,900 Seeds/A for skip row/plant two rows compared to 35,000 Seeds/A for all rows planted. Some of the yield increase with skip-row may be attributed to adjusting population density to moisture conditions. Seeding density manipulation may be as important as skip-row patterns for sustaining yields during dry weather. Next year we will lower the seeding densities of solid planting to the seeding densities obtained with skip-row.

Skip-row planting is not a new idea. For many years, cotton growers in Texas have used skip-row to take advantage of government programs. The skip-row area was considered set-aside acres and only the cotton in the planted rows was counted as production acres. This has caused a potential insurance problem with skip-row plantings for other row crops because only 20 inches on each side of the planted row is considered planted area (Little, 2002). Only the crop area that is considered planted is insurable; therefore, insurance coverage is dependent on growers’ skip-row planting patterns. With an alternate skip row pattern on 40 in. rows, only 50% of the field is considered planted and insurable. Before planting row crops in a skip-row pattern, we recommend that growers consult with their FSA office for further details on this issue.

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Table 20.-Dryland Grain Sorghum Skip-Row Study, Walsh 2005.

Skip Row Treatment	No. of Rows Harvested	Seeding Density	Seed Moisture	Test Weight	Grain Yield
		Seeds/A (1000 X)	%	Lb/Bu	Bu/A
Plant all rows	8	35.0	10.6	57.0	18
Skip row, plant two rows	5	21.9	12.2	59.5	21
Skip row, plant row	4	17.5	12.5	60.0	20
Average		24.8	11.8	58.8	20
LSD 0.20					2.1

Planted: June 17 with Mycogen M 3838; Harvested: November 16.

Table 21.-Dryland Corn Skip-Row Study, Walsh 2005.

Skip Row Treatment	No. of Rows Harvested	Seeding Density	Seed Moisture	Test Weight	Grain Yield
		Seeds/A (1000 X)	%	Lb/Bu	Bu/A
Plant all rows	8	16.0	15.1	51.0	0.4
Skip row, plant two rows	5	10.0	16.1	52.2	0.6
Skip row, plant row	4	8.0	16.8	52.0	3.2
Average		11.3	16.0	51.7	1.4
LSD 0.20					0.22

Planted: May 17 with Mycogen 2K541; Harvested: September 27.

Strip-Till for Dryland Grain Sorghum Production, 2005

Kevin Larson and Dennis Thompson

Growers are converting to strip-till at a rapid rate for both irrigated and dryland row crop production in Southeastern Colorado. Strip-till is a modified no-till system where a single tillage operation is used to knife in fertilizers. Since fertilizers are inserted into the soil, anhydrous, the least expensive form of N, can be used. The deep placement of fertilizers also allows greater availability throughout the growing season for immobile nutrients such as P. We have studied the effects of strip-till placement of fertilizers on irrigated row crops, but this is our first study with strip-till on dryland row crops.

Materials and Methods

For the Strip-Till N and P treatment, Dick Gerber used an eight-row with 30 in. row spacing, DMI strip-till implement and applied 70 Lb N/A as anhydrous and 5 Gal/A of 10-34-0 six inches deep on March 4 into a wheat stubble field. Four strips were left untilled. To these untilled strips, we streamed on 28-0-0 at 70 Lb N/A with 18 in. spacings on March 22 and planter applied 5 Gal 10-34-0/A on March 30 to a depth of 3 to 4 inches for the Surface N and Planter P treatment. We planted the site with Mycogen 1482 at 35,000 Seeds/A on June 3. For weed control, we sprayed Atrazine 1.0 Lb/A, Banvel 3 Oz/A, LoVol 6 at 4 Oz/A, and COC 32 Oz/A and we cultivated once. We harvested the study on November 11 with a self-propelled combine and weighed the plots in a digital scale cart. We adjusted the grain yields to 14% seed moisture content.

Results and Discussion

The Strip-Till N and P treatment produced significantly more yield than the Surface N and Planter P treatment ($P > 0.20$). However, the yields for this study were very low (10 to 12 Bu/A), too low to compensate for the fertilizer expense. We cannot explain the low yields obtained in this study. This is not the first time that we have been disappointed by the production from this field. We have tried ripping with the thought that compaction was limiting production in this field. Ripping did not help. We thought that strip-till would raise the yield level in this field. It raised it some, but not enough to pay for the expense. This winter, we applied 15 tons/A of feedlot manure hoping the manure would act as the needed soil amendment and raise the production level of this field. We hope we are right; we will keep posted.

Table .Strip-Till N and P and Surface N and Planter P on Dryland Grain Sorghum, 2005.

N Placement	P_2O_5 Placement	Test Weight	Grain Yield
		Lb/Bu	Bu/A
Strip-Till, 70 Lb/A	Strip-Till, 20 Lb/A	54.8	12
Surface, 70 Lb/A	Planter, 20 Lb/A	55.5	10
LSD 0.20			1.4

Grain Yield adjusted to 14% seed moisture content.

Strip-Till N and P and Surface N and Planter P Comparison for Sprinkler Irrigated Grain Sorghum and Corn Production

Kevin Larson and Dennis Thompson

Strip-till is a new tillage system being adopted by many row crop producers in Southeastern Colorado. It is a modified no-till system with one tillage operation used for fertilizer placement. The crop is planted into the same rows where tillage occurred and where the fertilizer was placed. In this study we compared strip-till placement of anhydrous N and liquid P to surface applied liquid N and planter P for both sprinkler irrigated grain sorghum and corn production.

Materials and Methods

The previous crop at this site was corn. We applied N at 130 Lb/A and P at 40 Lb P2O5/A to the grain sorghum, and 160 Lb N/A and 60 Lb P2O5/A to the corn for both the Strip-till N and P and Surface N and Planter P treatments. The N for the strip-till treatment was anhydrous, and for the surface-applied treatment we used liquid 32-0-0. The P treatment was applied 6 inches deep with the strip-till implement and 3 inches deep with a planter before planting. We strip-tilled the N and P for the Strip-till N and P treatment on March 4. For the Surface N and Planter P treatment, we surface applied N on March 18 in 18-inch spaced streams, and on March 30 we applied the P with a planter into the untilled strips. We planted two corn hybrids, Pioneer 33B54 and Mycogen 2T801, at 29,000 Seeds/A on May 5, and we planted two grain sorghum hybrids, Mycogen M3838 and Triumph TR 442, at 58,000 Seeds/A on June 2. For weed control, we sprayed preplant Balance 2.0 Oz/A and Atrazine 1.0 Lb/A to the corn site, and preplant Atrazine 1.0 Lb/A and post emergence Banvel 4 Oz/A and LoVol 5 Oz/A to the grain sorghum site. The site was sprinkler irrigated with the corn receiving 18.0 in./A of water and the grain sorghum receiving 7.5 in./A of water. We harvested the grain sorghum on November 8 and the corn on October 17 with a self-propelled combine and weighed them in a digital scale cart. Grain yields were adjusted to 14% seed moisture for grain sorghum and 15.5% seed moisture for corn.

Results

For both grain sorghum and corn, Strip-till N and P produced significantly more yield than Surface N and Planter P ($P > 0.20$) (Table 16 and Table18). There was a significant yield difference between the grain sorghum hybrids (Table 17), and the corn hybrids (Table 19). There was no interaction between the hybrids and the N and P placement treatments: both the hybrids for the corn and grain sorghum responded similarly to Strip-till N and P and Surface N and Planter P treatments. Plant densities were similar between hybrids and between N and P fertilizer placements.

Discussion

The advantages of strip-till compared to no-till are the use of anhydrous N fertilizer (the least expensive form of N fertilizer), deeper and more readily available placement of immobile nutrients, potential compaction alleviation, and early planting from enhanced soil warming (Jasa, 2003). The disadvantages of strip-till compared to no-till are the horsepower and fuel use requirements for injecting fertilizers with knives or subsoiler shanks and the potential of drying the soil when planting and the strip-till operations are temporally close.

This is the second year of our study on strip-till. This year we applied both N and P with a strip-till implement and compared it to surface applied N and planter applied P. Last year we investigated N only and compared strip-till placement of N to surface-applied N. Last year the strip-till N produced the same yield as surface N for grain sorghum, while corn produced more yield with surface N than with strip-till N. This year the strip-till placement of both N and P produced significantly higher yield than surface N and planter P placement for both corn and grain sorghum. Since we observed no grain sorghum yield difference between strip-till N and surface N last year and this year there was a significant yield increase with strip-till when both N and P were applied together, we conclude that the deep placement of P obtained with strip-till may be responsible for the yield increase.

Last year we believed that one of the disadvantages of strip-till, drying of the soil, caused the corn yield reduction of strip-till N compared to surface applied N. There was only about 18 in. of moisture in the soil profile at corn planting and the extra soil moisture loss from strip-tilling may have lowered corn yield. The short temporal space between the strip-till application and the corn planting date (three weeks) did not allow sufficient time and moisture to occur. A report comparing spring strip-till N, performed in April, to no-till N found no significant difference between corn yields; however, there was a significant yield difference between winter strip-till N, performed in January, to no-till N (Olsen, 2004). Last year we expected that corn and grain sorghum yields would be unaffected by N placement since N is a mobile nutrient. Therefore, it was no surprise that grain sorghum yields were identical for both strip-till N and surface applied N. The lack of yield response of grain sorghum to strip-till N and surface applied N was also reported for dryland grain sorghum in Northwest Kansas (Olsen, 2004).

The yield advantage obtained this year with deep placement of N and P using strip-till compared to surface N and planter P placement demonstrates the importance of P availability with deep placed P. With shallow P placement, such as seedrow placement, P fertilizer is only available when the surface is wet, such as after a rain or irrigation. With deep placement of P fertilizer, available moisture and thus P availability trends to be greater with soil depth. There appears to be no benefit from strip-till placement of N compared to surface applied N, but making P (and other immobile nutrients) more available throughout the season with strip-till placement appears to increase yield.

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Table 16. -Sprinkler Irrigated Grain Sorghum, Strip-Till vs. Surface N and Planter P, 2005.

N and P Placement	50% Flowering Date	Plant Density	Test Weight	Grain Yield
		Plants/A X 1000	Lb/Bu	Bu/A
Strip-Till (knifed N and P)	19-Aug	34.7	57	65
Surface N and Planter P	19-Aug	37.5	56	60
Average	19-Aug	36.1	56.5	63
LSD 0.20				2.2

Strip-Till N (130 Lb/A) and P (40 Lb P2O5/A) applied March 4.
Surface N (130 Lb/A) applied March 18; Planter P (40 Lb P2O5/A) applied March 30.
Planted: June 2 at 58,000 Seeds/A; Harvested: November 8.
Total applied sprinkler irrigation: 7.5 in./A.

Table 17.-Sprinkler Irrigated Grain Sorghum Response to Fertilizer Placement, 2005.

Hybrid	50% Flowering Date	Plant Density	Test Weight	Grain Yield
		Plants/A X 1000	Lb/Bu	Bu/A
TRIUMPH TR 442	21-Aug	37.2	57	74
MYCOGEN M 3838	18-Aug	35.0	56	52
Average	19-Aug	36.1	56.5	63
LSD 0.20				1.1

N at 130 Lb/A applied strip-till and surface streamed.
P at 40 Lb P2O5/A applied strip-till and planter.
Planted: June 2 at 58,000 Seeds/A; Harvested: November 8.
Total applied sprinkler irrigation: 7.5 in./A.

Table 18.-Sprinkler Irrigated Corn, Strip-Till vs. Surface N and Planter P, 2005.

N and P Placement	50% Silking Date	Plant Density	Test Weight	Grain Yield
		Plants/A X 1000	Lb/Bu	Bu/A
Strip-Till (knived N and P)	24-Jul	26.0	59	125
Surface N and Planter P	24-Jul	27.4	59	117
Average	24-Jul	26.7	59	121
LSD 0.20				8.3

Strip-Till N (160 Lb N/A) and P (60 Lb P2O5/A) applied March 4.
Surlace N (160 Lb N/A) applied March 18; Planter P (60 Lb P2O5/A) applied March 30.
Planted: May 5 at 29,000 Plants/A; Harvested: October 17.
Total applied sprinkler irrigation: 18.0 in./A.

Table 19.-Sprinkler Irrigated Corn, Hybrid Response to N and P Placement, 2005.

Hybrid	50% Silking Date	Plant Density	Test Weight	Grain Yield
		Plants/A X 1000	Lb/Bu	Bu/A
PIONEER 33B54	24-Jul	26.4	60	129
MYCOGEN 2T801	24-Jul	27.0	58	113
Average	24-Jul	26.7	59	121
LSD 0.20				3.8

N at 160 Lb/A applied strip-till and surface streamed.
P at 60 Lb P2O5/A applied strip-till and planter.
Planted: May 5 at 29,000 Plants/A; Harvested: October 17.
Total applied sprinkler irrigation: 18.0 in./A.

Limited Sprinkler Irrigation Corn Study at Walsh, 2005

COOPERATORS: Plainsman Agri-Search Foundation; K. Larson, D. Thompson, D. Harn, C. Thompson, Plainsman Research Center, Walsh, Colorado.

PURPOSE: Identify corn hybrids that produce highest sprinkler limited irrigation yields.

RESULTS: Of the 15 hybrids tested, Dekalb DKC 63-52 was the highest yielding hybrid with 148 Bu/A. For this limited irrigation trial we applied 18 in./A of water, 8 in./A more than our normal limited irrigation corn study, because we were 4 in. short on rainfall and 4 in. short on stored moisture. No corn borer lodging was observed.

PLOT: Four rows with 30" row spacing, at least 600' long. SEEDING DENSITY: 28,000 Seeds/A. PLANTED: May 5. HARVESTED: October 17.

IRRIGATION: Twelve sprinkler rotations applied 18.0 acre-in/A of total water.

PEST CONTROL: Pre Herbicides: Balance 2.0 Oz/A, Atrazine 1.0 Lb/A, Glystar Plus 24 Oz/A, LoVol 0.5 Lb/A; Post Herbicides: None. CULTIVATION: Once. INSECTICIDE: Capture for mite control.

FIELD HISTORY: Last Crop: Sorghum. FIELD PREPARATION: Sweep plow.

Summary: Growing Season Precipitation and Temperature \1
Walsh, Baca County.

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
May	2.22	428	3	0	26
June	1.16	679	17	2	56
July	1.01	878	26	8	87
August	1.90	763	17	3	118
September	0.24	642	15	0	148
October	1.06	276	3	0	172
Total	7.59	3666	81	13	172

\1 Growing season from May 5 (planting) to October 24 (first freeze).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in good soil moisture. Weed control was good. The growing season was dry and hot, especially for the month of July. There was no corn borer lodging, but there was a heavy infestation of mites that we controlled with Capture. The Capture would have controlled the few corn borer larvae present. Grain yields were good considering the hot, dry weather.

SOIL: Silty Clay Loam for 0-8" and Silty Clay Loam 8"-24" depths from soil analysis.

Summary: Soil Analysis from Sprinkler Site.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------PPM----------------				
0-8"	7.6	0.5	2.0	11	5.3	428	1.1	6.6
8"-24"				13				
Comment	Alka	VLo	Hi	Hi	Lo	VHi	Marg	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization for Sprinkler Site.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------Lb/A------------------			
Recommended	74	20	0	0
Applied	160	60	0.3	0

Yield Goal: 150 Bu/A.
Actual Yield: 137 Bu/A.

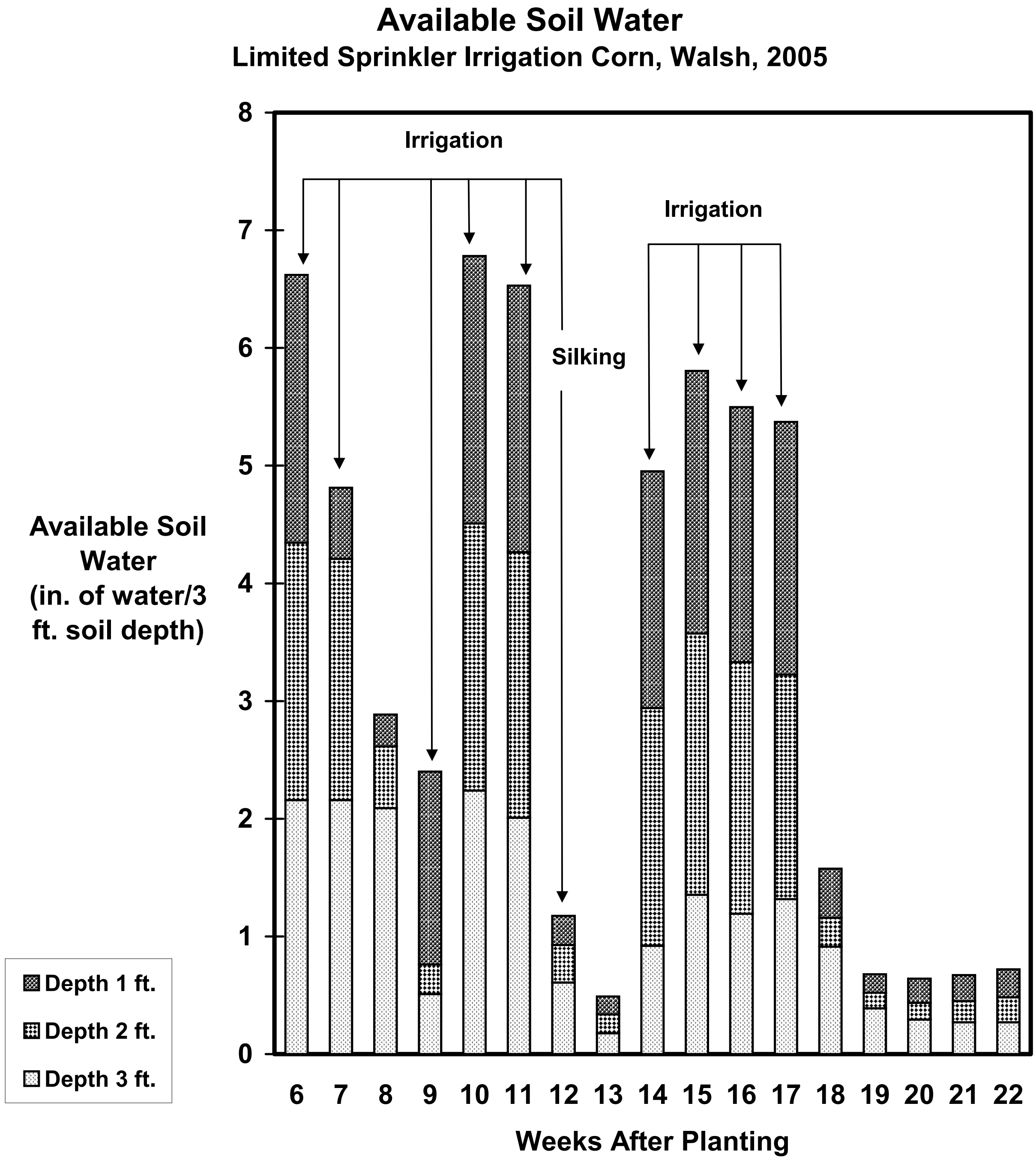

Fig. . Available soil water in limited sprinkler irrigation corn at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 7.59 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .Limited Sprinkler Irrigation Corn, Plainsman Research Center, Walsh, 2005.

Firm	Hybrid	50% Silking Date	Plant Density	Seed Moisture	Test Weight	Grain Yield
			Plants/A (X 1000)	%	Lb/Bu	Bu/A
DEKALB	DKC 63-52	22-Jul	27.0	13.9	58	148
PIONEER	33B54	24-Jul	26.4	13.6	59	147
PIONEER	33H25 (Non Bt)	22-Jul	27.2	13.9	59	145
DEKALB	DKC 60-19	18-Jul	26.8	13.9	59	144
MYCOGEN	2T780	22-Jul	28.0	14.0	58	143
MYCOGEN	2P682 (Non Bt)	23-Jul	28.2	13.7	59	143
GARST	8377 YG1/RR	23-Jul	28.6	14.1	58	139
FONTANELLE	HC 7951 YGCB	23-Jul	26.6	13.3	58	137
NK BRAND	N70-T9	21-Jul	27.8	14.1	58	136
MYCOGEN	2T801	24-Jul	27.0	13.3	57	133
TRIUMPH	1416 Bt	23-Jul	28.8	13.7	58	132
GARST	7663 YG1/RR	20-Jul	24.8	13.3	57	131
ASGROW	RX 752 RR2/YGPL	19-Jul	24.0	14.0	59	130
TRIUMPH	1536 CBRR	21-Jul	27.6	12.9	58	128
NK BRAND	N73-F7	22-Jul	28.4	13.1	58	119
Average		21-Jul	27.1	13.7	58	137
LSD 0.20						11.9

Planted: May 5; Harvested: October 17.
Grain Yield adjusted to 15.5% moisture content.
Total applied water: 18.0 acre-in./A.

Corn Borer Resistant and Nonresistant Hybrid Comparisons, Walsh, 2005

K. Larson, D. Thompson, D. Harn, C. Thompson

PURPOSE: To evaluate corn borer resistant hybrids (Bt gene insertion) and nonresistant hybrids under limited sprinkler irrigation.

RESULTS: Only the nonresistant corn borer hybrids displayed any corn borer damage. The only corn borer damage observed was first generation shot hole damage and it was very minor. There was no second-generation damage on any of the hybrids. This is the first year that we have observed no stock holes or corn borer lodging on any of the hybrids. The application of Capture to control a late infestation of mites, no doubt, contributed to the absence of second-generation corn borer damage. One of the nonresistant hybrids, Pioneer 33H25, was the third highest yielding hybrid tested, which confirms that Southwest Corn Borer was not a yield limiting factor. We recorded high levels of lodging that were not caused by corn borer damage. While investigating some of this non corn borer lodging, we found that stock rot was present in many of the lodged plants. Non corn borer lodging apparently did not affect yield extensively, since the hybrid with the highest level of lodging, Dekalb DKC 63-52, also produced the high yield.

DISCUSSION: All 13 Bt hybrids tested showed excellent resistance to corn borer. However, there was only mild first generation corn borer damage observed and no second-generation corn borer damage was observed on the nonresistant hybrids. The mild first generation infestation may be attributed to extensive area-wide use of Bt hybrids. The lack of second-generation damage is undoubtedly attributed to an application of Capture to control a late outbreak of mites. Although corn borer was not a yield limiting factor this year (probably because our Capture application controlled both mites and corn borers), corn borer resistant Bt hybrids continue to be a very effective tool against corn borer damage. Therefore, to keep Bt hybrids effective in controlling corn borer, always remember to plant nonresistant hybrids as a mating refuge to help delay corn borer resistance to the Bt events. Non corn borer lodging appeared severe; however, lodging up to 55% apparently did not lower grain yield significantly. The hybrid with the highest lodging also had the highest yield. This non corn borer lodging, tentatively identified as stock rot, did not lower yields like lodging associated with Southwestern Corn Borer. Southwestern Corn Borer often girdle the corn stocks causing the plant to detach and lay flat, making harvest of lodged plants difficult and yield limiting. On the other hand, with the non corn borer lodging plants remained attached and harvestable. Harvesting non corn borer lodged plants slowed harvest, but yields remained high.

Table .Limited Sprinkler Irrigated Corn, Corn Borer Ratings, Plainsman Research Center, 2005.

Firm	Hybrid	50% Silking Date	Plant Density	1st Gen Shot Holes	2nd Gen Stock Holes	2nd Gen Plant Lodging	Non Corn Borer Lodging	Test Wt.	Grain Yield
			Plants/A (X 1000)	%	%	%	%	Lb/Bu	Bu/A
DEKALB	DKC 63-52	22-Jul	27.0	0	0	0	55	58	148
PIONEER	33B54	24-Jul	26.4	0	0	0	8	59	147
PIONEER	33H25 (Non Bt)	22-Jul	27.2	5	0	0	0	59	145
DEKALB	DKC 60-19	18-Jul	26.8	0	0	0	18	59	144
MYCOGEN	2T780	22-Jul	28.0	0	0	0	30	58	143
MYCOGEN	2P682 (Non Bt)	23-Jul	28.2	3	0	0	0	59	143
GARST	8377 YG1/RR	23-Jul	28.6	0	0	0	0	58	139
FONTANELLE	HC 7951 YGCB	23-Jul	26.6	0	0	0	0	58	137
NK BRAND	N70-T9	21-Jul	27.8	0	0	0	10	58	136
MYCOGEN	2T801	24-Jul	27.0	0	0	0	0	57	133
TRIUMPH	1416 Bt	23-Jul	28.8	0	0	0	0	58	132
GARST	7663 YG1/RR	20-Jul	24.8	0	0	0	15	57	131
ASGROW	RX 752 RR2/YGPL	19-Jul	24.0	0	0	0	0	59	130
TRIUMPH	1536 CBRR	21-Jul	27.6	0	0	0	0	58	128
NK BRAND	N73-F7	22-Jul	28.4	0	0	0	13	58	119
Average		21-Jul	25.5	1	0	0	10	58	137
LSD 0.20				2.0			9.6		11.9

Planted: May 5; Harvested: October 17.
Grain Yield corrected to 15.5% moisture content.
Twelve sprinkler rotations applied a total of 18.0 acre-in./A of water.
The lack of 2nd generation corn borer damage may be attributed to an application of Capture to control a late outbreak of mites.
Some of the non corn borer lodging was vistually identified as stock rot.

High and Low Input Comparison for Subsurface Drip Irrigated Corn

Kevin Larson and Dennis Thompson

Subsurface drip irrigation is a new irrigation technology for Colorado. Water use efficiency (lb of grain produced/in. of water applied) of grain sorghum is reported to be15% to 30% higher with subsurface drip compared to center pivot sprinkler and furrow irrigation (Dainello, Stein, Valdez, and White, 2002). In this irrigated study, we tested high and low inputs on Subsurface Drip Irrigated corn.

Materials and Methods

We planted corn, Mycogen 2T801, on May 11 at 27,000 Seeds/A for the low input treatment and 34,000 Seeds/A for the high input treatment, under subsurface drip irrigation. The subsurface drip lines are 60 inches apart with emitters every foot and buried 12 in. to 14 in. deep. Our 25 gpm well supplies each zone with 0.12 in. per day when equally distributed to all zones. We fully irrigated the high input treatment with 16 in./A and apply 30% less irrigation to the low input treatment (11 in./A). The soil test recommendation for 200 Bu/A crop was 180 Lb N/A and 40 Lb P_2O_5/A. We planter applied 48 Lb P_2O_5/A with 0.5 Lb Zn/A for the high input treatment and 24 Lb P_2O_5/A with 0.25 Lb Zn/A for the low input treatment. We injected 200 Lb N/A for the high input treatment and 140 Lb N/A to the low input treatment through the drip system during the growing season. We applied Balance 2 Oz/A and Atrazine 1.0 Lb/A for pre-emergence weed control and two applications of Roundup Ultra Max 20 Oz/A for postemergence weed control. We harvested the 10 ft. by 650 ft. plots on October 18 with a self-propelled combine and weighed them in a digital scale cart. Grain yields were adjusted to 15.5% seed moisture content.

Results and Discussion

The high input yield average was 160 Bu/A and the low input yield average was 148 Bu/A. Nonetheless, the low input treatment produced significantly higher income than the high input treatment, $58.78/A more ($P > 0.20$).

Even though the low input treatment yielded significantly less than the high input treatment, the cost savings from lowering inputs of seed, fertilizer, and irrigation gave the low input treatment the income advantage. As a general rule, when input expenses are high and commodity prices are low, low input will be more profitable than high input. This rule is reversed when commodity prices are high. This year, however, the corn price would have to be $6.25/Bu before the high input became more profitable. Increasing income by lowering inputs may not get you coffee shop bragging rights, but it does make economic sense.

Literature Cited

Dainello, F.J., L. Stein, M. Valdez, and K. White. 2002. Irrigation and rainfall water management and conservation. Dept of Horticultural Sciences, Texas A & M Univ. College Station, Texas. http://www.trwi.tamu.edu/soil_water_grants/2001-02/dainello_report.pdf. 4p.

Table .-Drip Irrigated Corn, High and Low Input Comparison, Walsh 2005.

Treatment	Plant Density	Silking Date	Grain Moisture	Test Weight	Grain Yield	Variable Net Income
	Plants/A (X1000)		%	Lb/Bu	Bu/A	$/A
High Input	33.0	5-Aug	14.6	59	160	67.51
Low Input	26.2	5-Aug	14.2	59	148	126.29
Average	29.6	5-Aug	14.4	59	154	96.90
LSD 0.20					4.6	2.89

Planted: May 11 with Mycogen 2T801; Harvested: October 18.
Low Input received 27,000 Seeds/A and 11 in./A of water.
High Input received 34,000 Seeds/A and 16 in./A of water.
Low Input fertilizer: 140 Lb N/A, 6 gal 10-34-0/A (24 Lb P2O5/A), 0.25 Lb Zn/A.
High Input fertilizer: 200 Lb N/A, 12 gal 10-34-0/A (48 Lb P2O5/A), 0.5 lb Zn/A.
Seed cost $1.50/1000 seeds; water cost $8/in.; N cost $0.38/lb; Zn cost $8/Lb; 10-34-0 cost $1.44/gal.
Variable Net Income: grain yield x corn price ($2.15/bu) - seed cost - water cost - fertilizer cost.

The New Subsurface Drip Irrigation Installation at the Plainsman Research Center

Kevin Larson

Many people have heard reports that we had a crop failure with our new drip system at the Plainsman Research Center. This rumor is true. Our corn crop failed with our new drip system. This does not mean that Subsurface Drip Irrigation is a failure. Instead, the crop failure indicates that our design was flawed. Our most glaring design flaw was the lack of a contingency plan in case the capacity of our well dropped. Our drip system was designed for our 60 gpm well with all the water from the well going to one zone at a time. I was confident that our well would maintain at least 60 gpm even in the middle of the irrigation season since our sprinkler was nozzled for 60 gpm and it maintained adequate pressure throughout the irrigation season. I was wrong. In the middle of the irrigation season, our well capacity dropped to 40 gpm. Our drip system would have pressured up with as little as 53 gpm, but 40 gpm was not enough water to uniformly open the emitters. There was insufficient water getting to the corn plants at pollination. The weather during this critical developmental stage was hot and dry, further stressing the corn plants. This caused pollen shed and silking to become out-of-sync. About a week after pollen shed, the corn plants began to silk. Without adequate pollination, there was no grain development.

It is difficult to adapt a Subsurface Drip Irrigation system when well capacity drops below its design parameters and all the water goes to a single zone. With a sprinkler, when the well capacity drops, you can simply renozzle the sprinkler or eliminate towers. With a subsurface drip system, where all the water goes to a single zone at a time, the options to solve a drop in well capacity are severe and expensive. To solve this well capacity drop, we could: 1) make the zones shorter by cutting the field in half and eliminate the bottom half of the field, 2) make the zones narrower by retrofitting valves in the center of the zone supply lines, or 3) find additional water from another well to offset the water drop.

To avoid these expensive and radical solutions, we suggest having a contingency plan in case of well capacity decline. The easiest plan is to have multiple zones, instead of a single zone, irrigated at a time. If the well capacity drops, then open up fewer zones.

Again, the crop failure was not the fault of drip irrigation; it was my shortsightedness.

Irrigated Sunflower Hybrid Performance Trial at Walsh, 2005

COOPERATORS: Plainsman Agri-Search Foundation, and Kevin Larson, Superintendent, Plainsman Research Center, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under irrigated conditions with 2700 sorghum heat units in a Silty Loam soil.

PLOT: Four rows with 30” row spacing, 650’ long. SEEDING DENSITY: 24,000 Seed/A. PLANTED: June 24. HARVESTED: October 28.

IRRIGATION: Subsurface Drip Irrigated: total water applied 10.9 A-in./A.

PEST CONTROL: Preemergence Herbicides: Glyphosate 20 Oz/A, Select 8 Oz/A, Spartan 2.0 Oz/A, Prowl 48 Oz/A. Post Emergence Herbicides: None. CULTIVATION: Once. INSECTICIDES: None.

Summary: Growing Season Precipitation and Temperature \1
Walsh, Baca County.

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
June	0.10	149	6	2	6
July	1.01	878	26	8	37
August	1.90	763	17	3	68
September	0.24	642	15	0	98
October	1.06	276	3	0	122
Total	4.31	2708	67	13	122

\1 Growing season from June 24 (planting) to October 24 (first freeze, 24 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

FIELD HISTORY: Last Crop: Corn. FIELD PREPARATION: Disc.

COMMENTS: Planted in good soil moisture. Weed control was good. The growing season was dry and hot, especially for the month of July. No insecticides were applied to control head moth because of the late planting date. Seed yields were good.

SOIL: Silty Loam for 0-8” and Silty Loam 8”-24” depths from soil analysis.

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8”	7.7	0.5	1.9	5	0.9	368	1.1	6.2
8”-24”				5				
Comment	Alka	VLo	Hi	Lo	VLo	VHi	Marg	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------Lb/A------------------			
Recommended	115	40	0	0
Applied	130	40	0	0

Yield Goal: 2500 Lb/A.
Actual Yield: 2268 Lb/A.

Table .-Drip Irrigated Sunflower, NuSun Variety Trial, PRC, Walsh, 2005.

Firm	Hybrid	50% Flowering	Plant Density	Plant Ht.	Test Wt.	Oil	Seed Yield	Oil Yield
		Date	Plants/A (X1000)	In	Lb/Bu	%	Lb/A	Lb/A
MYCOGEN	8N352	8/19	21.6	55	32	40.6	2371	963
TRIUMPH	S-675	8/22	19.6	37	32	39.2	2370	929
FONTANELLE	902 NS	8/19	21.2	58	29	38.5	2303	887
TRIUMPH	S-672	8/20	21.2	38	31	38.8	2200	854
MYCOGEN	8377 NS	8/18	22.4	61	30	36.5	2157	787
PIONEER	63M91	8/19	19.2	65	31	35.6	2208	786
Average		8/19	20.9	52	31	38.2	2268	868
LSD 0.20							97.6	37.4

Planted: June 24; Harvested: October 28.
Seed Yield adjusted to 10% seed moisture content.
Total water applied with subsurface drip irrigation was 10.9 in.

Banded P Rate for Dryland Sunflower Production

Kevin Larson and Dennis Thompson

Banding P fertilizer is the recommended fertilizing method for crops in the high lime, high alkaline soils of Colorado. For these alkaline soils, the P fertilizer of choice is liquid 10-34-0. A common P banded range for dryland crops is 5 to 10 Gal/A of 10-34-0, which supplies 20 to 40 Lb P2O5/A and 6 to 12 Lb N/A. High P fertilization may be required for high oil yields in sunflowers, since P is needed to produce phospholipids. However, high rates of seedrow N are reported to cause N salt toxicity, which lowers germination (Mortvedt, 1976); moreover, we have found that applying even a low rate of P with seedrow 10-34-0 caused sunflower stand loss. To provide sufficient P for high oil yields of sunflower, we used banded placement of P and not seedrow placement of P. This study was conducted to determine the optimum P rate of banded 10-34-0 for dryland sunflower.

Materials and Methods

We tested four rates of poly ammoniated phosphate (10-34-0) fertilizer banded with a planter prior to planting on 30 in. row spacing in an alkaline Silty Clay Loam soil. The four rates were 0, 5, 10, and 15 gallons of 10-34-0/A, corresponding to phosphate levels of 0, 20, 40, and 60 Lb P_2O_5/A with nitrogen levels of 0, 6, 12, and 18 Lb N/A, respectively. We applied the P rates on June 24 and planted Mycogen 8377NS at 18,000 Seeds/A on June 28. We harvested the 10 ft. by 300 ft. plots on October 25 with a self-propelled combine equipped with a four-row crop header. Seed yields were adjusted to 10% seed moisture content.

Results and Discussion

The highest seed yield was obtained with the highest banded P rate, 15 Gal 10-34-0/A. There was very little yield response to increasing P rates until the highest P rate. Even at the highest P rate, there was only a 25 Lb/A seed yield increase by increasing the P rate from 10 to 15 Gal/A of 10-34-0. The meager yield increase was insufficient to offset the cost of the P fertilizer (5 Gal/A of 10-34-0 costs \$7.20/A and 25 Lb/A of sunflower seed is worth \$2.30/A at the loan rate of \$9.19/cwt). There was no response of seed oil content with increasing P rate. The seed oil content response was flat and low, averaging only 19.5%, the lowest seed oil content we have ever recorded. This first year of banding P rates on dryland sunflower indicates that P fertilizer is not required for dryland sunflower production. Moreover, results from our N rates on wheat-sunflower-fallow rotation study suggest that N is not required for dryland sunflower production. Sunflowers are such good miners of soil nutrients that fertilization may not be needed for dryland sunflower production. The role of sunflowers in our dryland crop rotations may be to extract residual nutrients left by other crops. Single year economics of sunflower production is good, however, having sunflowers in dryland crop rotations is problematic. Results from our Crop Rotation Sequencing study suggest that sunflower leaves little residual moisture for subsequent crops.

Literature Cited

Mortvedt, J. J. 1976. Band fertilizer placement - how much and how close? Fert. Solns. 20(6): 90-96.

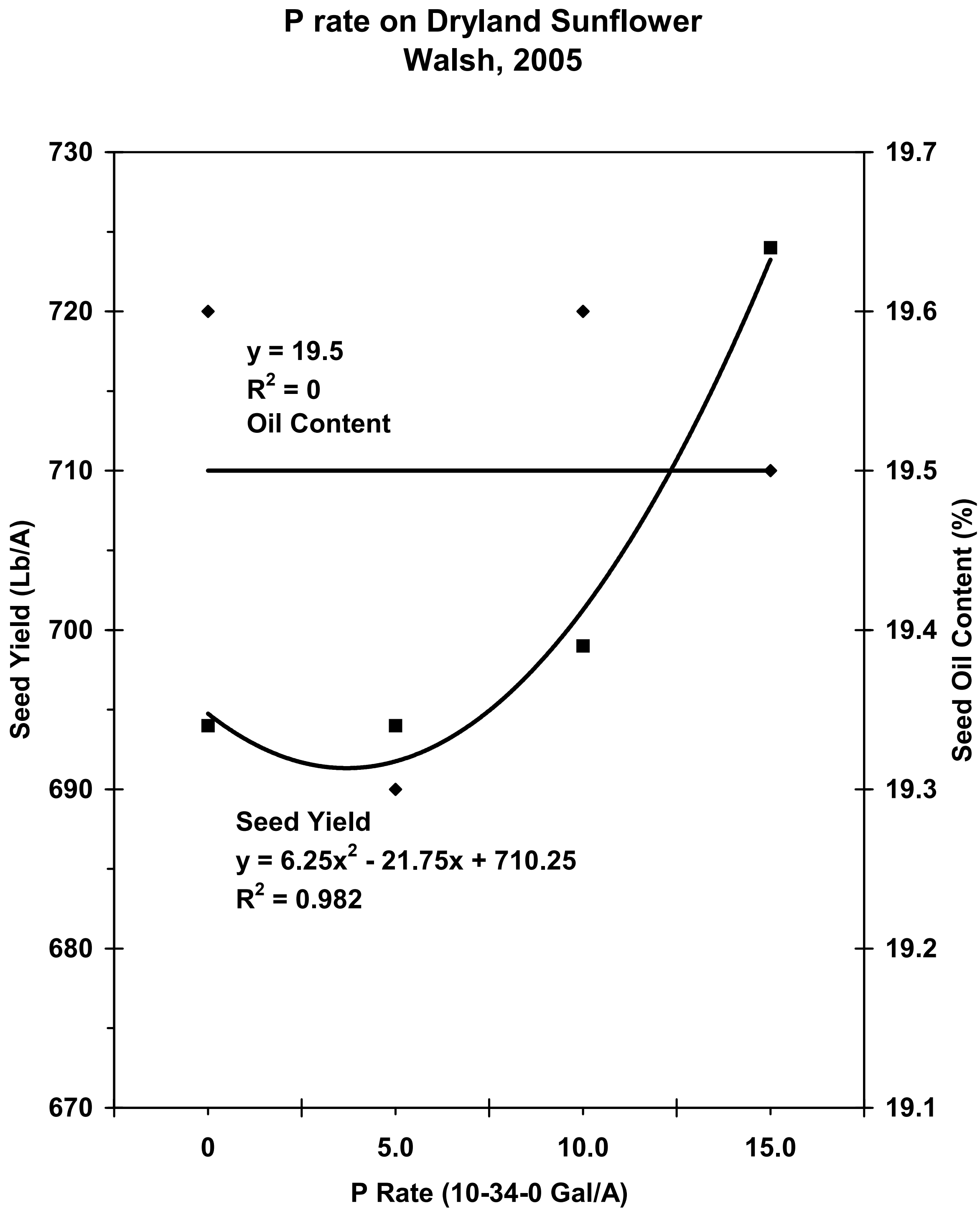

Fig. . Seed yield and oil content of banded 10-34-0 on dryland sunflower at Walsh. The P rates were applied with a planter on 30 in. rows prior to planting. Mycogen 8377NS was planted at 18,000 Seeds/A. The P fertilizer was 10-34-0, which contains 4 Lb P_2O_5/Gal and 1.2 Lb N/Gal.

Long-Term N Effects on Wheat-Sunflower-Fallow Rotation, Walsh, 2005

K. Larson, D. Thompson, D. Harn, and C. Thompson

Purpose: To study the long-term N fertilizer effects on a wheat-sunflower-fallow rotation where N is applied to the same treatment site for multiple years.

Materials and Methods: We planted wheat, Above, at 50 Lb Seed/A on October 6, 2004, and sunflower on June 28, 2005 at 17,000 Seeds/A using MYCOGEN 8377NS. We banded liquid N (28-0-0 or 32-0-0) at 0, 30, 60, and 90 Lb N/A to the treatment plots with two replications to both N and N residual sides on March 7, 2005 for wheat and to only the N side July 20, 2005 for sunflower. The N fertilizer treatments were applied to both sides of the wheat plots and only one side of the sunflower plots to test the response of sunflower to residual N left by the wheat. We seedrow applied 20 Lb P_2O_5/A at planting to the wheat but not the sunflowers. For weed control in the wheat, we applied pre-emergence Glystar Plus 24 Oz/A and postemergence Express, 0.33 Oz/A and 2,4-D, 0.38 Lb/A. For weed control in the sunflower, we applied pre-emergence Glystar Plus 24 Oz/A, Spartan 2 Oz/A, and Prowl 48 Oz/A. We harvested two replications of the 20 ft. by 1045 ft. plots on June 30 for wheat and October 27 for sunflower with a self-propelled combine and weighed them in a digital weigh cart. Yields were adjusted to 12.0% for wheat and 10% for sunflower.

Results: There was no yield response of wheat to increasing N rates. Only 2 Bu/A separated the lowest and highest wheat yields. Wheat yields were fair, ranging from 24 Bu/A to 26 Bu/A. There was a slight, nonsignificant trend for sunflower yields to decrease with increasing applied N rates. Sunflower yield response to residual N left from the wheat crop was flat and not significant. Sunflower yields were good, 970 to 1190 Lb/A. For both wheat and sunflower, the no N fertilizer treatments produced high yields.

Discussion: This is the fifth year of this long-term N on wheat-sunflower-fallow rotation study. We started this study to test reports of no yield response from applied N on dryland sunflower (Vigil and Bowman, 1998).

This is the fifth year that the dryland wheat yields did not response to applied N. The non-response of wheat yields to increasing N rates for the first four years can be explained by sufficient residual N for the first year and low yields for the next three years. With the average wheat yields produced this year, it is more difficult to explain the lack of yield response to applied N. For the three previous years, moisture was the primary yield-limiting factor, not N. This year, there was adequate moisture to produce a decent wheat crop, but there was no yield response to applied N. Perhaps the yields are still to low for N to be a limiting factor.

This year the sunflower yields were good, but sunflower yields did not respond to increasing N rates. Sunflower displayed a similar flat yield response to both residual and applied N. Neither applied nor residual N contributed to sunflower yield. With only flat yield responses to N rates, N was a costly expense without benefit for both wheat and sunflower.

We have reported no wheat yield response to N rate since establishing this wheat-sunflower-fallow rotation study. For the previous three years, wheat yields in this rotation were very low, 6 to 15 Bu/A and this last season they were fair. The low to fair wheat yields can be attributed to the lack of moisture remaining after sunflower extracted all available soil water and little soil water replenishment due to dry conditions during fallow. For wheat production in this wheat-sunflower-fallow rotation, moisture was probably the limiting factor, not N.

Most years sunflower yields increased with increasing N rates; however the yield response failed to offset the cost of the N fertilizer. The no N fertilizer treatment produced the highest income every year of sunflower production (there was no sunflower crop in 2002 because of drought). This year, the no fertilizer treatment produced sunflower yields only a few pounds less than the highest yield obtained with applied N. This lack of N response suggests that N fertilizer is not needed for dryland sunflower production if the expected yield is 1200 Lb/A or less.

Seed oil content tends to decrease with increasing N rates. Results from seed analysis in 2004 demonstrate this decline: 39.7%, 37.8%, 38.7%, and 35.9% for 0, 30, 60, and 90 Lb N/A, respectively. This negative correlation of oil content with N rate has been previously reported (Vigil and Bowman, 1998).

<u>Literature Cited</u>

Vigil, M.F., R.A. Bowman. 1998. Nitrogen response and residue management of sunflowers in a dryland rotation. 1998 Annual Report, Central Great Plains Research Station. ARS, USDA.

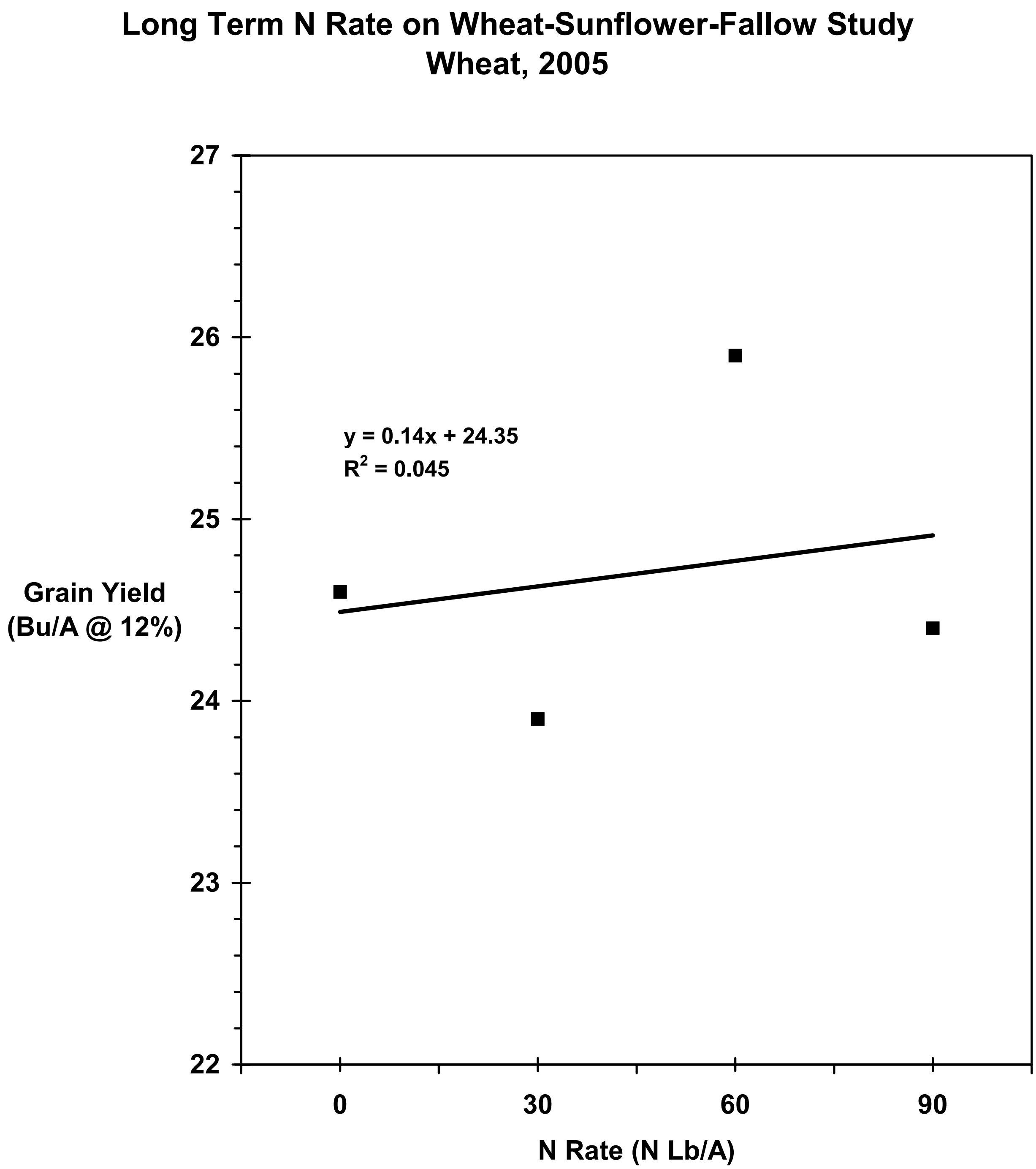

Fig. . N rate on dryland wheat in Wheat-Sunflower-Fallow rotation at Walsh. The N rates were 0, 30, 60, and 90 Lb N/A as 32-0-0. The wheat variety was Above sown at 50 Lb/A.

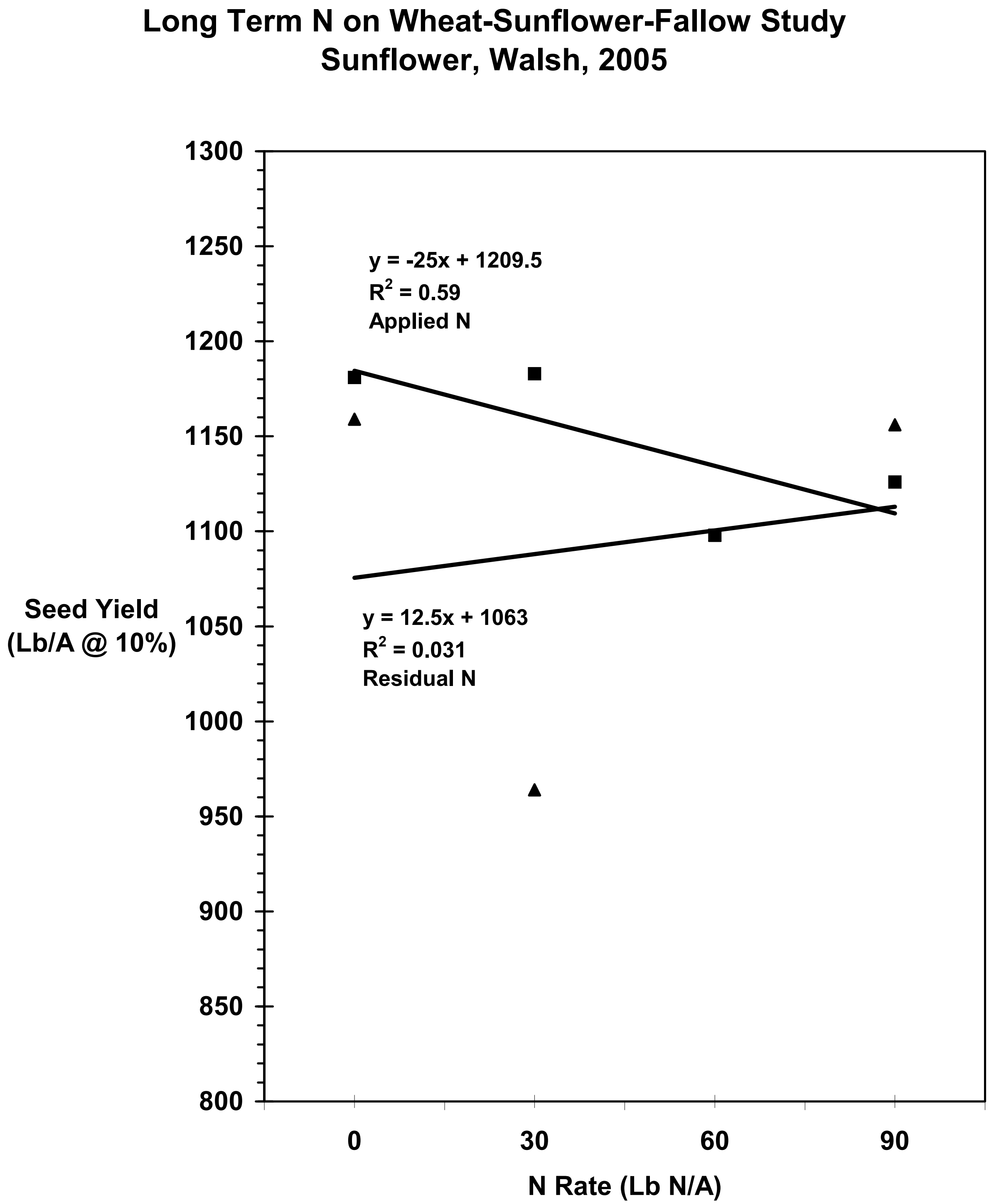

Fig. . N rate on dryland sunflower in Wheat-Sunflower-Fallow rotation at Walsh. The N rates were 0, 30, 60, and 90 Lb N/A as 32-0-0. Applied N is N applied to the sunflowers in the current season. Residual N is N applied to the wheat the previous season. The sunflower hybrid was MYCOGEN 8377NS planted at 17,000 Seeds/A.

Bindweed Control in Sunflower, 2005

Kevin Larson, Calvin Thompson, and Dennis Thompson

Bindweed has become a serious production problem in many fields. Recently, bindweed appears more prevalent with larger more numerous areas. The recent drought may have contributed to the bindweed infestations. Even in the very dry year of 2002 when crops and most weeds failed to grow, bindweed continued to thrive. We conducted this study to increase crop production and income of bindweed infested sunflower fields. We tested preplant herbicides to control bindweed in sunflower. To determine residual effects of the herbicide treatments on sunflower with bindweed and without bindweed interference, we applied the herbicide treatments to both a bindweed infested site and a non-bindweed site. To determine residual longevity of the herbicide treatments on sunflower, we planted both bindweed and non-bindweed sites with multiple planting dates.

Materials and Methods

The study was conducted on a 25-acre, Silty Clay Loam field with a history of heavy bindweed infestation in the middle of the field (bindweed site) and with very little bindweed on the north side of the field (non-bindweed site). We applied nine herbicide treatments: Hi Dep (16 oz/A) 0.5 lb/A, LandMaster BW 54 oz/A, 2,4-D LoVol 6 (16 oz/A) 0.75 lb/A, Banvel 8 oz/A, Spartan 2 oz/A, Paramount 5.33 oz/A and COC 32 oz/A, Starane 16 oz/A, Saber (16 oz/A) 0.5 lb/A, and control (no bindweed herbicide) with a 40 ft. boom sprayer at 10 gal/A on June 8, 2005 to both sites. Before the bindweed herbicide treatments were applied, we sprayed the entire field with glyphosate 24 oz/A and Prowl 48 oz/A. We planted sunflower (Mycogen 8N352) at 18,000 seeds/A on five planting dates: June 9, June 17, June 27, July 6, and July 18 (the July 18 planting date had very poor emergence and was abandoned). Bindweed control ratings were performed on June 22, July 8, July 27, and August 5. Percentage of plant stand was taken for each planting date as an indication of residual damage (crop injury) from herbicide treatments. The 20 ft. by 40 ft. plots were harvested on October 24 and 25 with a self-propelled combine equipped with a digital scale. Yields were adjusted to 10% seed moisture content.

Results

All herbicide treatments in the bindweed site produced significantly higher sunflower yields and incomes than the no herbicide control ($P > 0.20$). Hi Dep produced significantly higher income in the bindweed site than all the other herbicide treatments, except Saber. Hi Dep and Saber are both 2,4-D amines. In fact, the four highest incomes were from herbicide treatments were forms of 2,4-D or had 2,4-D as one of the main components: Hi Dep, Saber, LoVol, and LandMaster BW. These four herbicide treatments had the highest initial and seasonal bindweed control ratings of the nine treatments tested. For each individual planting date, these four 2,4-D herbicide treatments were consistently the top four highest income producers. The planting date income rankings for the bindweed site were: PD2 and PD1 > PD3 > PD4. There was a large yield and income drop between PD3 and PD4.

For the non-bindweed site, only LandMaster BW produced significantly more net income than the no herbicide control ($P > 0.20$). Starane produced significantly less net income than the control. The herbicide treatments that produced the highest net incomes also had high pigweed control ratings, except Spartan. Spartan had a high pigweed control rating, but its net income was only a few cents higher than the control. For each individual planting date, none of the herbicide treatments were consistently high ranking for net income between planting dates. There were no significant income differences between the planting dates for the non-bindweed site; only $5.60/A separated the highest and lowest planting date incomes.

Discussion

Bindweed control was absolutely crucial for sunflower production. There was almost no yield and income without bindweed control. In fact, there was less than $2/A difference in net income between the bindweed and non-bindweed sites when the control is not included. The poor yields and incomes from the last planting dates in the bindweed site may be attributed to bindweed regrowth and subsequent utilization of water and nutrients. The first two planting dates averaged 22% higher bindweed control than the last two planting dates. Moreover, the planting delay between the first two planting dates and the last two planting dates provided an average of 14 days growth of bindweed which, no doubt, lowered water and nutrient levels. For bindweed control in sunflower, the four treatments containing 2,4-D (Hi Dep, Saber, LoVol, and LandMaster BW) produced the highest initial control and the highest residual control of bindweed. These four herbicides produced significantly higher net incomes than the other four herbicide treatments and control. The herbicides containing 2,4-D had low sunflower injury (high plant stands) and high short and long term efficacy on bindweed.

LandMaster BW was the only treatment in the non-bindweed site that significantly produced higher net income than the no herbicide control. The primary weed in the non-bindweed site was pigweed. The LandMaster BW treatment completely controlled the pigweed even up to 49 days after application. On the other hand, Starane had only slightly better pigweed control than the no herbicide control and had significantly lower net income than the control. This suggests that residual pigweed control was important for high yields and incomes in the non-bindweed site. There was no significant seed yield difference between the planting dates in the non-bindweed site. The lack of seed yield difference suggests that dryland sunflower has a large planting window for achieving high yields.

It took only 9 days after application for 8 oz/A of Banvel (1.1 days per oz) to produce higher yield and income than the control. Nine days after application Banvel had the same plant stand as the control. Typically, we expect to delay planting 3 to 4 days per ounce of Banvel applied. For Banvel at 8 oz/A, we expected a sunflower planting delay between 24 and 32 days. This year, the reason Banvel had such a short residual crop injury period this was probably due to rains occurring shortly after herbicide application that diluted herbicide concentrations.

We found that sunflower production was almost nonexistent without bindweed control. Controlling bindweed with herbicides containing 2,4-D provided high yields and incomes comparable to sunflower yields and incomes produced from non-bindweed areas.

Table .-Chemical Control of Bindweed in Sunflower (Bindweed Site), Walsh 2005.

Treatment	Rate	Chemical Cost	Initial Bindweed Control	Seasonal Bindweed Control	Plant Stand	Seed Yield	Variable Net Income
	*/A	$/A	%	%	%	Lb/A	$/A
Hi Dep	16 oz	2.31	88	73	85	952	81.18
Saber	16 oz	2.22	85	68	80	837	70.70
2,4-D LoVol 6	16 oz	2.12	84	67	76	774	65.01
LandMaster BW	54 oz	5.65	99	79	83	777	61.76
Spartan	2 oz	5.84	45	24	53	551	40.80
Starane	16 oz	11.63	63	45	56	577	37.40
Banvel	8 oz	4.06	65	54	62	457	33.94
Paramount + COC	5.33 oz/1 qt	15.75	73	38	48	582	33.74
Control	----	0.00	0	0	4	27	2.48
Average		5.51	67	50	61	615	47.44
LSD 0.20			11.3	4.1	7.7	116.1	11.24

Variable Net Income: Seed Yield x Sunflower Price ($0.0919/lb) - Chemical Cost - Application ($4/A).
Herbicide Treatments were applied June 8, 2005.

Table .-Planting Dates for Bindweed Control in Sunflower (Bindweed Site), Walsh 2005.

Planting Date	Days After Application	50% Flowering Date	Plant Stand	Bindweed Control	Test Weight	Seed Yield	Gross Income
			%	%	Lb/Bu	Lb/A	$/A
PD2 June 17	9	13-Aug	66	55	27.0	786	72.23
PD1 June 9	1	3-Aug	74	67	29.0	720	66.17
PD3 June 27	19	23-Aug	60	38	25.2	619	56.89
PD4 July 6	28	2-Sep	43	39	27.5	334	30.69
Average	14	18-Aug	61	50	27.2	615	56.50
LSD 0.20			11.2	3.6		75.2	6.91

Gross Income: Seed Yield x Sunflower Price ($0.0919/lb).
Herbicide Treatments were applied June 8, 2005.

Table .-Chemical Control of Bindweed in Sunflower (Non Bindweed Site), Walsh 2005.

Treatment	Rate	Chemical Cost	Pigweed Control Rated 7/27	Plant Stand	Test Weight	Seed Yield	Variable Net Income
	*/A	$/A	%	%	Lb/Bu	Lb/A	$/A
LandMaster BW	54 oz	5.65	100	84	27.0	867	70.03
Saber	16 oz	2.22	90	78	26.5	817	68.86
2,4-D LoVol 6	16 oz	2.12	88	79	27.4	776	65.19
Hi Dep	16 oz	2.31	90	81	27.6	762	63.72
Banvel	8 oz	4.06	85	74	27.5	767	62.43
Spartan	2 oz	5.84	92	74	27.5	744	58.53
Control	----	0.00	35	77	27.3	635	58.36
Paramount + COC	5.33 oz/1 qt	15.75	70	77	27.0	846	58.00
Starane	16 oz	11.63	40	68	26.8	689	47.69
Average		5.51	77	77	27.2	767	61.42
LSD 0.20			9.9	6.6	134.8	134.8	10.80

Gross Income: Seed Yield x Sunflower Price ($0.0919/lb).
Variable Net Income: Gross Income- Chemical Cost - Application Cost ($4/A).
Herbicide Treatments were applied June 8, 2005.

Table .-Planting Dates for Bindweed Control in Sunflower (Non Bindweed Site), Walsh 2005.

Planting Date	Days After Application	50% Flowering Date	Plant Stand	Seed Moisture	Test Weight	Seed Yield	Gross Income
			%	%	Lb/Bu	Lb/A	$/A
PD3 June 27	19	23-Aug	74	Below 8	25.2	801	73.61
PD1 June 9	1	3-Aug	82	Below 8	29.0	778	71.50
PD2 June 17	9	13-Aug	81	Below 8	27.0	749	68.83
PD4 July 6	28	2-Sep	71	Below 8	27.5	740	68.01
Average	14	18-Aug	77	Below 8	27.2	767	70.49
LSD 0.20			7.4			96.9	8.91

Gross Income: Seed Yield x Sunflower Price ($0.0919/lb).
Herbicide Treatments were applied June 8, 2005.

Table .-Bindweed Control in Sunflower (Bindweed Site), June 9 Planting Date (PD1), Walsh 2005.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/22	Bindweed Control Rated 8/05	Plant Stand Rated 6/22	Seed Yield	Variable Net Income
	*/A	$/A	%	%	%	Lb/A	$/A
2,4-D LoVol 6	16 oz	2.12	84	50	90	1022	87.80
Hi Dep	16 oz	2.31	88	65	90	1010	86.51
Saber	16 oz	2.22	85	60	85	850	71.90
LandMaster BW	54 oz	5.65	99	65	93	850	68.47
Paramount + COC	5.33 oz/1 qt	15.75	73	23	83	920	64.80
Starane	16 oz	11.63	63	30	78	763	54.49
Spartan	2 oz	5.84	45	20	88	630	48.06
Banvel	8 oz	4.06	65	40	55	391	27.87
Control	----	0.00	0	0	5	48	4.41
Average		5.51	67	39	74	720	57.14
LSD 0.20			11.3	10.6	11.9	275.3	21.23

Variable Net Income: Seed Yield x Sunflower Price ($0.0919/lb) - Chemical Cost -Application ($4/A).
Herbicide Treatments were applied June 8, 2005.
June 9 Planting Date (PD1) was planted 1 day after herbicide treatments were applied.

Table .-Bindweed Control in Sunflower (Bindweed Site), June 17 Planting Date (PD2), Walsh 2005.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 7/08	Bindweed Control Rated 8/05	Plant Stand Rated 7/08	Seed Yield	Variable Net Income
	*/A	$/A	%	%	%	Lb/A	$/A
Hi Dep	16 oz	2.31	80	65	85	1137	98.18
2,4-D LoVol 6	16 oz	2.12	80	50	85	1013	86.97
LandMaster BW	54 oz	5.65	83	65	88	1021	84.18
Saber	16 oz	2.22	65	60	85	954	81.45
Spartan	2 oz	5.84	20	20	60	810	64.60
Paramount + COC	5.33 oz/1 qt	15.75	40	23	55	802	53.95
Starane	16 oz	11.63	63	30	60	751	53.39
Banvel	8 oz	4.06	68	40	70	566	43.96
Control	----	0.00	0	0	5	26	2.39
Average		5.51	55	39	66	787	63.23
LSD 0.20			4.6	10.6	19.8	331.4	26.63

Variable Net Income: Seed Yield x Sunflower Price ($0.0919/lb) - Chemical Cost -Application ($4/A).
Herbicide Treatments were applied June 8, 2005.
June 17 Planting Date (PD2) was planted 9 days after herbicide treatments were applied.

Table .-Bindweed Control in Sunflower (Bindweed Site), June 27 Planting Date (PD3), Walsh 2005.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 7/27	Bindweed Control Rated 8/05	Plant Stand Rated 7/27	Seed Yield	Variable Net Income
	*/A	$/A	%	%	%	Lb/A	$/A
Hi Dep	16 oz	2.31	60	65	88	946	80.63
Saber	16 oz	2.22	58	60	78	858	72.63
2,4-D LoVol 6	16 oz	2.12	58	50	75	757	63.45
LandMaster BW	54 oz	5.65	68	65	83	794	63.32
Spartan	2 oz	5.84	13	20	50	619	47.05
Banvel	8 oz	4.06	43	40	68	555	42.94
Paramount + COC	5.33 oz/1 qt	15.75	15	23	45	538	29.69
Starane	16 oz	11.63	25	30	48	473	27.84
Control	----	0.00	0	0	8	34	3.12
Average		5.51	38	39	60	619	47.85
LSD 0.20			7.2	10.6	13.8	164.7	12.73

Variable Net Income: Seed Yield x Sunflower Price ($0.0919/lb) - Chemical Cost -Application ($4/A).
Herbicide Treatments were applied June 8, 2005.
June 27 Planting Date (PD3) was planted 19 days after herbicide treatments were applied.

Table .-Bindweed Control in Sunflower (Bindweed Site), July 6 Planting Date (PD4), Walsh 2005.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 8/05	Bindweed Control Rated 6/22	Plant Stand Rated 8/05	Seed Yield	Variable Net Income
	*/A	$/A	%	%	%	Lb/A	$/A
Hi Dep	16 oz	2.31	65	88	78	717	59.58
Saber	16 oz	2.22	60	85	73	686	56.82
LandMaster BW	54 oz	5.65	65	99	68	442	30.97
2,4-D LoVol 6	16 oz	2.12	50	84	53	307	22.09
Banvel	8 oz	4.06	40	65	55	316	20.98
Starane	16 oz	11.63	30	63	38	321	13.87
Spartan	2 oz	5.84	20	45	15	146	3.58
Control	----	0.00	0	0	0	0	0.00
Paramount + COC	5.33 oz/1 qt	15.75	23	73	10	68	-13.50
Average		5.51	39	67	43	334	21.60
LSD 0.20			10.6	11.3	19.3	186.9	12.73

Variable Net Income: Seed Yield x Sunflower Price ($0.0919/lb) - Chemical Cost -Application ($4/A).
Herbicide Treatments were applied June 8, 2005.
July 6 Planting Date (PD4) was planted 28 days after herbicide treatments were applied.

Table .Sunflower (Non Bindweed Site), June 9 Planting Date (PD1), Walsh 2005.

Treatment	Rate	Chemical Cost	Plant Stand Rated 6/22	Pigweed Control Rated 7/27	Seed Yield	Variable Net Income
	*/A	$/A	%	%	Lb/A	$/A
2,4-D LoVol 6	16 oz	2.12	88	88	839	70.98
LandMaster BW	54 oz	5.65	85	100	847	68.19
Control	----	0.00	97	35	757	65.57
Paramount + COC	5.33 oz/1 qt	15.75	80	70	906	63.51
Banvel	8 oz	4.06	63	85	765	62.24
Spartan	2 oz	5.84	88	92	757	59.73
Saber	16 oz	2.22	75	90	681	56.36
Hi Dep	16 oz	2.31	78	90	681	56.27
Starane	16 oz	11.63	85	40	768	54.95
Average		5.51	82	77	778	61.98
LSD 0.20			7.8	9.9	173.2	13.80

Variable Net Income: Seed Yield x Sunflower Price ($0.0919/lb) - Chemical Cost.
Herbicide Treatments were applied June 8, 2005.
June 9 Planting Date (PD1) was planted 1 day after herbicide treatments were applied.

Table .Sunflower (Non Bindweed Site), June 17 Planting Date (PD2), Walsh 2005.

Treatment	Rate	Chemical Cost	Plant Stand Rated 7/08	Pigweed Control Rated 7/27	Seed Yield	Variable Net Income
	*/A	$/A	%	%	Lb/A	$/A
Saber	16 oz	2.22	83	90	861	72.91
Spartan	2 oz	5.84	80	92	887	71.68
LandMaster BW	54 oz	5.65	83	100	797	63.59
Paramount + COC	5.33 oz/1 qt	15.75	78	70	889	61.95
Banvel	8 oz	4.06	80	85	735	59.49
2,4-D LoVol 6	16 oz	2.12	85	88	678	56.19
Starane	16 oz	11.63	75	40	746	52.93
Hi Dep	16 oz	2.31	88	90	630	51.59
Control	----	0.00	80	35	521	43.88
Average		5.51	81	77	749	59.35
LSD 0.20			13.1	9.9	196.7	13.80

Variable Net Income: Seed Yield x Sunflower Price ($0.0919/lb) - Chemical Cost.
Herbicide Treatments were applied June 8, 2005.
June 17 Planting Date (PD2) was planted 9 days after herbicide treatments were applied.

Table .Sunflower (Non Bindweed Site), June 27 Planting Date (PD3), Walsh 2005.

Treatment	Rate	Chemical Cost	Plant Stand Rated 7/08	Pigweed Control Rated 7/27	Seed Yield	Variable Net Income
	*/A	$/A	%	%	Lb/A	$/A
Hi Dep	16 oz	2.31	80	90	979	83.66
2,4-D LoVol 6	16 oz	2.12	78	88	929	79.26
Saber	16 oz	2.22	83	90	900	76.49
LandMaster BW	54 oz	5.65	83	100	872	70.49
Control	----	0.00	70	35	721	62.26
Banvel	8 oz	4.06	70	85	720	58.11
Spartan	2 oz	5.84	78	92	723	56.60
Starane	16 oz	11.63	55	40	667	45.67
Paramount + COC	5.33 oz/1 qt	15.75	70	70	695	44.12
Average		5.51	74	77	801	64.07
LSD 0.20			13.2	9.9	219.1	17.53

Variable Net Income: Seed Yield x Sunflower Price ($0.0919/lb) - Chemical Cost.
Herbicide Treatments were applied June 8, 2005.
June 27 Planting Date (PD3) was planted 19 days after herbicide treatments were applied.

Table .Sunflower (Non Bindweed Site), July 6 Planting Date (PD4), Walsh 2005.

Treatment	Rate	Chemical Cost	Plant Stand Rated 8/05	Pigweed Control Rated 7/27	Seed Yield	Variable Net Income
	*/A	$/A	%	%	Lb/A	$/A
LandMaster BW	54 oz	5.65	88	100	951	77.75
Saber	16 oz	2.22	70	90	828	69.87
Banvel	8 oz	4.06	85	85	847	69.78
Hi Dep	16 oz	2.31	78	90	757	63.26
Paramount + COC	5.33 oz/1 qt	15.75	80	70	895	62.50
2,4-D LoVol 6	16 oz	2.12	68	88	659	54.44
Spartan	2 oz	5.84	50	92	608	46.04
Control	----	0.00	63	35	540	45.63
Starane	16 oz	11.63	55	40	574	37.12
Average		5.51	71	77	740	58.49
LSD 0.20			19.8	9.9	134.1	10.60

Variable Net Income: Seed Yield x Sunflower Price ($0.0919/lb) - Chemical Cost.
Herbicide Treatments were applied June 8, 2005.
July 6 Planting Date (PD4) was planted 28 days after herbicide treatments were applied.

Crop Rotation Sequencing

Kevin Larson and Dennis Thompson

Crops differ in their utilization of water and nutrients. Some crops, such as sunflower, are believed to mine nearly all available soil water and nutrients and leave little for subsequent crops. Whereas, other crops, such as millet, use only a portion of the available water and nutrients, leaving residual water and nutrients for subsequent crops. There are other advantages from crop rotation, including abatement of weeds, insects and diseases. The purpose of this study is to determine the crop rotation sequences that produce highest yields and incomes.

Materials and Methods

We tested fallow and five spring crops: sunflower, grain sorghum, corn, millet, and mung bean. Annually, each crop follows itself and every other crop. We planted corn (Mycogen 2K541 Bt/RR) on May 17 at 16,000 Seed/A, sunflower (Mycogen 8377NS) on June 25 at 17,000 Seed/A, grain sorghum (Mycogen 1482) on June 2 at 35,000 Seed/A, mung bean (Berkins) on June 17 at 17 Lb/A, and proso millet (Huntsman) on June 17 at 18 Lb/A. Before planting we sprayed two applications of Glystar Plus at 20 Oz/A each. For in-season weed control, we chose short-residual herbicides that should not interfere with crop rotations: millet and grain sorghum, Banvel 4 Oz/A, 2,4-D amine (Saber) 11 Oz/A, and Penetrant II 4 Oz/A; corn, Roundup Ultra Max 20 Oz/A and Choice 4 Oz/A (two applications); mung bean, Beyond 4 Oz/A, Basagran 16 Oz/A, Choice 4 Oz/A, and Penetrant II 4 Oz/A; sunflower, Prowl 48 Oz/A and Spartan 2 Oz/A; and fallow, Glystar Plus 24 Oz/A and 0.5 Lb LoVol (three applications). We harvested the crops with a self-propelled combine equipped with a digital scale: millet, September 16; grain sorghum, November 9; corn, September 27; mung bean, September 26; and sunflower, October 25.

Results and Discussion

This is the third year of this dryland crop rotation sequencing study. In 2003, the first year the rotations were started, all crops were planted in fallow. The second year, 2004, the crops were planted into the five crop stubbles and fallow. Last year, 2005, we decided to change the rotations, based on the 2004 results, to obtain the highest potential yield and income, and still have all five crops and fallow represented. We planted the 2005 crops in the different locations where the 2003 crops were originally planted: 2005 grain sorghum in 2003 millet, 2005 millet in 2003 mung bean, 2005 corn in 2003 fallow, 2005 mung bean in 2003 corn, 2005 sunflower in 2003 grain sorghum, and 2005 fallow in 2003 sunflower.

The three-year crop sequence with the highest variable net income was grain sorghum-millet-sunflower with a three-year total variable net income of $313.63/A. In fact, all three-year crop sequences ending with sunflower provided high variable net incomes, averaging $202.87. However, crops planted in sunflower stubble performed the worst in two-year rotations. To produce high sustained yields and incomes, the 2004 and 2005 crops following grain sorghum, millet, and fallow performed best in the rotations.

In 2004, millet following grain sorghum had the highest total variable net income for the 2003 and 2004 crops, $281/A. A close second was millet following millet (continuous millet) with a two-year total net variable income of $275/A. In 2003, the first year of this dryland crop rotation sequencing study, all the crops followed fallow. The first year millet produced the highest viable net income, $126.83/A. After the first year, we stated that rotations with millet would have an economic advantage. After reviewing the results from 2004, we decided that the 2005 grain sorghum crop would be planted in the 2003 millet location. This sequence change provided yield and income advantages to grain sorghum. The sunflower crop was also given a yield and economic advantage by planting the 2005 sunflower crop in the 2003 grain sorghum location.

The growing season for 2005 was very dry, particularly in for the month of July. Lack of adequate moisture in July and early August produced very low grain yields for corn. The best corn yield occurred following double summer fallow; however, the yield was only 3 Bu/A. Crops that were able to utilize the stored soil moisture, such as millet, grain sorghum, and sunflower performed well. The crop stubbles and fallow with the highest stored soil moisture were fallow, grain sorghum, and millet. These are the same three crops that produce high sustained yields and incomes in the crop rotations.

Table .-Stored Soil Moisture of Crop Rotation Sequence Study Prior to Planting from Soil Probe, Walsh, 2005.

Previous Crop	Depth of Soil Moisture Probe
	ft.
Fallow	5.5
Grain Sorghum	4.5
Millet	4.3
Bean	4.0
Corn	3.0
Sunflower	2.5
Average	4.0

Table .-Crop Rotation Sequence, Variable Net Income Summary for 2003, 2004, and 2005.

	Total Variable Net Income for 2003, 2004, and 2005 Crops						
	2003 Millet	2003 Mung Bean	2003 Fallow	2003 Corn	2003 Grain Sorghum	2003 Sunflower	
2004 Crop	2005 Grain Sorghum	2005 Millet	2005 Corn	2005 Mung Bean	2005 Sunflower	2005 Fallow	Average Variable Net Income
	---$/A---						
Millet	285.93	213.69	92.71	169.03	313.63	117.38	198.73
Sunflower	210.57	143.99	65.31	108.73	92.93	16.84	106.40
Grain Sorghum	205.11	127.14	13.44	58.18	216.86	-4.63	102.68
Fallow	174.23	72.09	-63.20	27.95	277.77	-24.56	77.38
Mung Bean	152.19	74.70	-29.44	26.86	155.73	0.91	63.49
Corn	138.30	51.05	-2.57	19.53	160.27	-30.86	55.95
Average	194.39	113.78	12.71	68.38	202.87	12.51	100.77

Variable Net Income: Gross Income - Seed Cost - Weed Control Cost.
All 2005 crops planted in 2003 crop locations: 2005 grain sorghum in 2003 millet, 2005 millet in 2003 Mung bean, 2005 corn in 2003 fallow, 2005 Mung bean in 2003 corn, 2005 sunflower in 2003 grain sorghum, and 2005 fallow in 2003 sunflower.

Table .-Two-Year Crop Rotation Sequence, Variable Net Income Summary for 2004 and 2005.

	Total Variable Net Income for 2004 and 2005 Crops 2005 Crop						
2004 Crop	Grain Sorghum	Millet	Corn	Mung Bean	Sunflower	Fallow	Average Variable Net Income
	---$/A---						
Grain Sorghum	107.98	231.60	-0.47	48.28	151.86	41.66	96.82
Fallow	129.57	214.80	15.86	43.78	167.48	-40.33	88.53
Millet	72.37	184.56	-35.35	20.78	125.12	121.25	81.46
Mung Bean	56.56	201.36	-43.99	-9.32	104.93	-0.90	51.44
Corn	36.80	171.12	-39.75	10.68	102.72	26.05	51.27
Sunflower	-2.77	144.24	-70.21	-0.82	21.30	94.15	30.98
Average	66.75	191.28	-28.98	18.90	112.24	40.31	66.75

Variable Net Income: Gross Income - Seed Cost - Weed Control Cost.

Table .-Crop Rotation Sequence Study, Yield Summary 2005.

	2005 Crop						2005 Average
Previous Crop	Grain Sorghum	Millet	Corn	Mung Bean	Sunflower	Fallow	Total Production
	Lb/A						
Grain Sorghum	767	1126	35	319	499	0	549
Millet	627	767	27	376	639	0	487
Mung Bean	431	868	27	153	243	0	344
Corn	213	605	25	229	343	0	283
Sunflower	67	459	19	248	217	0	202
Fallow	1865	1193	179	482	716	0	887
Average	662	836	52	301	443	0	459
LSD 0.20	446.9	243.6	106.4	122.2	302.0		

Table .-Mung Bean: Two Year Crop Rotation Sequencing, Walsh, 2005.

Previous Crop	Mung Bean Seed Yield	Mung Bean Gross Income	2005 Mung Bean Variable Net Income	2004 Mung Bean Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A
Grain Sorghum	319	31.90	-4.81	53.09	48.28
Fallow	482	48.20	11.49	32.29	43.78
Millet	376	37.60	0.89	19.89	20.78
Corn	229	22.90	-13.81	24.49	10.68
Sunflower	248	24.80	-11.91	11.09	-0.82
Mung Bean	153	15.30	-21.41	12.09	-9.32
Average	301	30.12	-6.59	25.49	18.90
LSD 0.20	122.2	12.22	2.67	7.13	

Planted: Mung Bean (Berkins) on June 17, 2005 at 17 Lb/A.
Mung Bean Seed Cost: $6.80/A ($40/cwt).
Harvested: Mung Bean on September 26, 2005.
Millet Market Price $0.10/Lb.
Weed Control: Raptor, 4 oz; Basagran, 16 oz; Choice, 4 oz; Penetrant II, 4 oz.
Chemical Cost: $25.91/A; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.

Table .-Mung Bean: Three-Year Crop Rotation Sequencing Study, Walsh, 2005.

2004 Crop	2005 Mung Bean Seed Yield	2005 Mung Bean Gross Income	2005 Mung Bean in 2004 Crop Stubble Variable Net Income	2004 Crop in Corn Stubble Variable Net Income	2003 Corn Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A	$/A
Millet	376	37.60	0.89	144.36	23.78	169.03
Sunflower	248	24.80	-11.91	96.86	23.78	108.73
Grain Sorghum	319	31.90	-4.81	39.21	23.78	58.18
Mung Bean	153	15.30	-21.41	24.49	23.78	26.86
Fallow	482	48.20	11.49	-14.38	23.78	20.89
Corn	229	22.90	-13.81	9.56	23.78	19.53
Average	301	30.12	-6.59	50.02	23.78	67.20
LSD 0.20	122.2	12.22	2.67	7.13		

Planted: Mung Bean (Berkins) on June 17, 2005 at 17 Lb/A.
Mung Bean Seed Cost: $6.80/A ($40/cwt).
Harvested: Mung Bean on September 26, 2005.
Millet Market Price $0.10/Lb.
Weed Control: Raptor, 4 oz; Basagran, 16 oz; Choice, 4 oz; Penetrant II, 4 oz.
Chemical Cost: $25.91/A; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.
The 2005 bean crop was planted in the 2003 corn location: for millet the rotation was corn-millet-bean.

Table .-Corn: Two-Year Crop Rotation Sequencing, Walsh, 2005.

Previous Crop	Corn Seed Yield	Corn Gross Income	2005 Corn Variable Net Income	2004 Corn Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A
Fallow	3.2	6.88	-43.38	59.24	15.86
Grain Sorghum	0.6	1.35	-48.91	48.44	-0.47
Millet	0.5	1.03	-49.23	13.88	-35.35
Corn	0.4	0.95	-49.31	9.56	-39.75
Mung Bean	0.5	1.03	-49.23	5.24	-43.99
Sunflower	0.3	0.73	-49.53	-20.68	-70.21
Average	0.9	2.00	-48.26	19.28	-28.98
LSD 0.20	1.9	4.09	-8.36	13.39	

Planted: Corn (Mycogen 2K541 Bt/RR) on May 17, 2005 at 16,000 Seed/A.
Corn Seed Cost: $24.00/A ($1.50/1000 Seeds).
Harvested: Corn on September 27, 2005.
Corn Market Price $2.15/Bu.
Weed Control: Roundup Ultra Max, 20 oz/A; Choice, 4 oz/A (two applications).
Chemical Cost: $18.26/A; Application Cost $8/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.

Table .-Corn: Three-Year Crop Rotation Sequencing Study, Walsh, 2005.

Previous Crop	2005 Corn Seed Yield	2005 Corn Gross Income	2005 Corn in 2004 Crop Stubble Variable Net Income	2004 Crop in Fallow Variable Net Income	2003 Fallow Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A	$/A
Millet	0.5	1.03	-49.23	154.44	-14.38	90.83
Sunflower	0.3	0.73	-49.53	127.34	-14.38	63.43
Grain Sorghum	0.6	1.35	-48.91	74.85	-14.38	11.56
Corn	0.4	0.95	-49.31	59.24	-14.38	-4.45
Mung Bean	0.5	1.03	-49.23	32.29	-14.38	-31.32
Fallow	3.2	6.88	-43.38	-14.38	-14.38	-72.14
Average	0.9	2.00	-48.26	72.30	-14.38	9.65
LSD 0.20	1.9	4.09	-8.36	13.39		

Planted: Corn (Mycogen 2K541 Bt/RR) on May 17, 2005 at 16,000 Seed/A.
Corn Seed Cost: $24.00/A ($1.50/1000 Seeds).
Harvested: Corn on September 27, 2005.
Corn Market Price $2.15/Bu.
Weed Control: Roundup Ultra Max, 20 oz/A; Choice, 4 oz/A (two applications).
Chemical Cost: $18.26/A; Application Cost $8/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.
The 2005 corn crop was planted in the 2003 fallow location: for millet the rotation was fallow-millet-corn.

Table .-Grain Sorghum: Two-Year Crop Rotation Sequencing, Walsh, 2005.

Previous Crop	Grain Sorghum Seed Yield	Grain Sorghum Gross Income	2005 Grain Sorghum Variable Net Income	2004 Grain Sorghum Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A
Fallow	33	65.01	54.72	74.85	129.57
Grain Sorghum	14	27.58	17.29	90.69	107.98
Millet	11	21.67	11.38	60.99	72.37
Mung Bean	8	15.76	5.47	51.09	56.56
Corn	4	7.88	-2.41	39.21	36.80
Sunflower	1	1.97	-8.32	5.55	-2.77
Average	12	23.31	13.02	53.73	66.75
LSD 0.20	8.0	15.76	8.80	20.65	

Planted: Grain Sorghum (Mycogen 1482) on June 2, 2005 at 35,000 Seed/A.
Grain Sorghum Seed Cost: $2.50/A ($1.00/lb).
Harvested: Grain Sorghum November 9, 2005.
Grain Sorghum Market Price $1.97/Bu.
Weed Control: Banvel, 4 oz; Saber, 11 oz; Penetrant II, 4 oz.
Chemical Cost: $3.79/A; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.

Table .-Grain Sorghum: Three-Year Crop Rotation Sequencing Study, Walsh, 2005.

2004 Crop	2005 Grain Sorghum Seed Yield	2005 Grain Sorghum Gross Income	2005 Grain Sorghum in 2004 Crop Stubble Variable Net Income	2004 Crop in Millet Stubble Variable Net Income	2003 Millet Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A	$/A
Millet	11	21.67	11.38	147.72	126.83	285.93
Sunflower	1	1.97	-8.32	92.06	126.83	210.57
Grain Sorghum	14	27.58	17.29	60.99	126.83	205.11
Fallow	33	65.01	54.72	-14.38	126.83	167.17
Mung Bean	8	15.76	5.47	19.89	126.83	152.19
Corn	4	7.88	-2.41	13.88	126.83	138.30
Average	12	23.31	13.02	53.36	126.83	193.21
LSD 0.20	8.0	15.76	8.80	20.65		

Planted: Grain Sorghum (Mycogen 1482) on June 2, 2005 at 35,000 Seed/A.
Grain Sorghum Seed Cost: $2.50/A ($1.00/lb).
Harvested: Grain Sorghum November 9, 2005.
Grain Sorghum Market Price $1.97/Bu.
Weed Control: Banvel, 4 oz; Saber, 11 oz; Penetrant II, 4 oz.
Chemical Cost: $3.79/A; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.
The 2005 grain sorghum crop was planted in the 2003 millet location:
for millet the rotation was millet-millet-grain sorghum.

Table .-Millet: Two-Year Crop Rotation Sequencing Study, Walsh, 2005.

2004 Crop	2005 Millet Grain Yield	2005 Millet Gross Income	2005 Millet Variable Net Income	2004 Millet Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A
Grain Sorghum	20	67.20	57.00	174.60	231.60
Fallow	21	70.56	60.36	154.44	214.80
Mung Bean	16	53.76	43.56	157.80	201.36
Millet	14	47.04	36.84	147.72	184.56
Corn	11	36.96	26.76	144.36	171.12
Sunflower	8	26.88	16.68	127.56	144.24
Average	15	50.40	40.20	151.08	191.28
LSD 0.20	4.4	14.78	11.79	14.48	

Planted: Millet (Huntsman) on June 18, 2005 at 18 Lb/A.
Millet Seed Cost: $2.41/A ($7.50/Bu).
Harvested: Millet on September 16, 2005.
Millet Market Price $3.36/Bu.
Weed Control: Banvel, 4 oz; Saber, 11 oz; Penetrant II, 4 oz;
Chemical Cost: $3.79/A; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.

Table .-Millet: Three-Year Crop Rotation Sequencing Study, Walsh, 2005.

2004 Crop	2005 Millet Seed Yield	2005 Millet Gross Income	2005 Millet in 2004 Crop Stubble Variable Net Income	2004 Crop in Mung Bean Stubble Variable Net Income	2003 Mung Bean Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A	$/A
Millet	14	47.04	36.84	157.80	19.05	213.69
Sunflower	8	26.88	16.68	108.26	19.05	143.99
Grain Sorghum	20	67.20	57.00	51.09	19.05	127.14
Mung Bean	16	53.76	43.56	12.09	19.05	74.70
Fallow	21	70.56	60.36	-14.38	19.05	65.03
Corn	11	36.96	26.76	5.24	19.05	51.05
Average	15	50.40	40.20	53.35	19.05	112.60
LSD 0.20	4.4	14.78	11.79	14.48		

Planted: Millet (Huntsman) on June 18, 2005 at 18 Lb/A.
Millet Seed Cost: $2.41/A ($7.50/Bu).
Harvested: Millet on September 16, 2005.
Millet Market Price $3.36/Bu.
Weed Control: Banvel, 4 oz; Saber, 11 oz; Penetrant II, 4 oz;
Chemical Cost: $3.79/A; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.
The 2005 millet crop was planted in the 2003 bean location: for corn the rotation was bean-corn-millet.

Table .-Sunflower: Two-Year Crop Rotation Sequencing, Walsh, 2005.

Previous Crop	Sunflower Seed Yield	Sunflower Gross Income	2005 Sunflower Variable Net Income	2004 Sunflower Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A
Fallow	716	65.80	40.14	127.34	167.48
Grain Sorghum	499	45.86	20.20	131.66	151.86
Millet	639	58.72	33.06	92.06	125.12
Mung Bean	243	22.33	-3.33	108.26	104.93
Corn	343	31.52	5.86	96.86	102.72
Sunflower	217	19.94	-5.72	27.02	21.30
Average	443	40.70	15.04	97.20	112.24
LSD 0.20	302.0	27.75	37.77	37.77	

Planted: Sunflower (Mycogen 8377NS) on June 25, 2005 at 17,000 Seeds/A.
Sunflower Seed Cost: $12.75/A ($0.75/1000 Seeds).
Harvested: Sunflower on October 25, 2005.
Sunflower Market Price $0.0919/Lb.
Weed Control: Prowl, 48 oz; Spartan, 2 oz.
Chemical Cost: $12.91/A; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.

Table .-Sunflower: Three-Year Crop Rotation Sequencing Study, Walsh, 2005.

2004 Crop	2005 Sunflower Seed Yield	2005 Sunflower Gross Income	2005 Sunflower in 2004 Crop Stubble Variable Net Income	2004 Crop in Grain Sorghum Stubble Variable Net Income	2003 Grain Sorghum Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A	$/A
Millet	639	58.72	33.06	174.60	105.97	313.63
Sunflower	217	19.94	-5.72	131.66	105.97	231.91
Grain Sorghum	499	45.86	20.20	90.69	105.97	216.86
Corn	343	31.52	5.86	48.44	105.97	160.27
Mung Bean	243	22.33	-3.33	53.09	105.97	155.73
Fallow	716	65.80	40.14	-14.38	105.97	131.73
Average	443	40.70	15.04	80.68	105.97	201.69
LSD 0.20	302.0	27.75	37.77	37.77		

Planted: Sunflower (Mycogen 8377NS) on June 25, 2005 at 17,000 Seeds/A.
Sunflower Seed Cost: $12.75/A ($0.75/1000 Seeds).
Harvested: Sunflower on October 25, 2005.
Sunflower Market Price $0.0919/Lb.
Weed Control: Prowl, 48 oz; Spartan, 2 oz.
Chemical Cost: $12.91/A; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.
The 2005 sunflower was planted in the 2003 grain sorghum location: for millet the rotation was grain sorghum-millet-sunflower.

Dryland Crop Rotation Study

Kevin Larson and Dennis Thompson

We have found from our Crop Rotation Sequencing Study that crops differ in their utilization of water and nutrients. Some crops, such as sunflower, mine nearly all available soil water and nutrients and leave little for subsequent crops. Whereas, other crops, such as millet, use only a portion of the available water and nutrients, leaving residual water and nutrients for subsequent crops. One of the problems with our Crop Rotation Sequencing Study is that only spring crops are included in the rotations. Winter wheat, one of the primary dryland crops in our area, was not included in the sequencing study. We established this dryland crop rotation study in order to study winter wheat in the crop rotations and compare them to a grain sorghum-millet rotation, a sequence that has performed quite well in our studies. The purpose of this study is to determine the crop rotations that produce highest yields and incomes.

Materials and Methods

This is our establishment year in testing the following rotations: Wheat-Sorghum-Fallow, Wheat-Sunflower-Fallow, and Grain Sorghum-Millet. We planted millet, Huntsman, at 18 Lb/A on June 17, 2005; grain sorghum, Mycogen 1482, at 35,000 Seeds/A on June 2, 2005; and sunflower, Mycogen 8377NS, at 17,000 Seeds/A on June 28, 2005. We applied 70 Lb N/A to the study site. Before planting we sprayed two applications of Glystar Plus at 20 Oz/A each. For in-season weed control, we chose short-residual herbicides that should not interfere with crop rotations: millet and grain sorghum, Banvel 4 Oz/A, Saber 11 Oz/A, and Penetrant II 4 Oz/A; sunflower, Prowl 48 Oz/A and Spartan 2 Oz/A; and fallow, Glystar Plus 24 Oz/A and LoVol 0.5 Lb/A two times. We harvested the crops with a self-propelled combine equipped with a digital scale: millet, September 16; grain sorghum, November 11; and sunflower, October 25. We recorded cost of production and yields in order to determine rotation revenues.

Results and Discussion

This is the first year of this dryland crop rotation study; therefore, all the crops followed wheat. Millet produced the highest viable net income, $63.72/A. The high variable net income of millet is due to low seed cost ($2.41/A), low weed control cost ($7.79/A), moderate yield (22 Bu/A), and a good crop price ($3.36/Bu). Therefore the millet-grain sorghum rotation already has an economic advantage. Millet is known for its low water use. The grain sorghum crop following millet should have higher available soil water and nutrients that should increase its yield and income.

One problem we encountered after setting up these rotations was the lack of crop uniformity between crop locations and replications. This was most evident with the grain sorghum crop. The crops were planted south to north and every 20 ft. strip a different crop or crop rotation phase was assigned to that location. The grain sorghum strip on the west side of the study produced 41 Bu/A, the grain sorghum strips about 100 ft. to the east in the middle of the study averaged 24 Bu/A, and the grain sorghum strip about another 100 ft. further east on the east edge of the study averaged 11 Bu/A. Since this is the first year of these rotations, all the crops followed wheat and therefore we expected similar grain sorghum yields. We do not have an explanation for the lack of production uniformity. There is not a soil change in the study site; soil moisture should have been similar since all the crops were planted in wheat stubble; the site was tilled the same and sprayed with the same chemicals and rates; all crop strips were planted with the same seed on the same day using the same equipment; there was no large bindweed areas in the site. The 30 Bu/A yield decrease when harvesting grain sorghum strips 200 ft. apart simply defies explanation.

Table .-Dryland Crop Rotation Study, Walsh, 2005.

Crop	Seeding Density	Seed Cost	Weed Control Cost	Yield	Crop Price	Gross Income	Variable Net Income
	*/A	$/A	$/A	*/A	$/*	$/A	$/A
Millet	18 lb	2.41	7.79	22 bu	3.36/bu	73.92	63.72
Grain Sorghum	35,000 seeds	2.50	7.79	25 bu	1.97/bu	49.25	38.96
Sunflower	17,000 seeds	12.75	16.91	390 lb	0.0919/lb	35.84	6.18
Fallow	---	---	17.30	---	---	-17.30	-17.30
Average			12.45			35.43	22.89

Planted: Grain Sorghum Mycogen 1482 at 35,000 Seeds/A on June 2; Millet, Huntsman at 18 Lb/A on June 17; and Sunflower Mycogen 8377NS at 18,000 Seeds/A on June 28.
Harvested: Millet, September 16; Sunflower, October 25; and Grain Sorghum, November 11.
Weed control cost is herbicide cost and $4/A application cost for each application.

Garbanzo Bean Weed Control Study, Walsh, 2005

Kevin Larson and Dennis Thompson

PURPOSE: To test pre-emergence Pursuit and post emergence Spartan as potential herbicides for garbanzo bean production.

MATERIALS and METHODS: We applied Pursuit at 1.08 oz/A (preemergence) on March 18, 2005 and Spartan at 2.0 oz/A (when garbanzo beans and most broadleaf weeds were 5 in. tall) on May 28, 2005. We inoculated Dwelley, a Kabuli type garbanzo bean, with Rhizobium at 1 lb. to 300 lb. of seeds. We planted the beans on March 17 at 80 Lb Seed/A in 30 in. row spacings. Before garbanzo bean emergence, we sprayed 24 Oz/A of Roundup Ultra to control emerged weeds. No fertilizer was applied. The study site was cultivated once. Using a row crop head, we harvested the 10 ft. by 300 ft. plots on August 9 and weighed the seed with a digital scale.

RESULTS: Pursuit produced significantly higher yields ($P > 0.20$) than Spartan. Pursuit controlled pigweed (mainly prostrate pigweed) better than Spartan; whereas, Spartan controlled Kochia better than Pursuit. Pursuit completely controlled foxtail, the main grass present, while Spartan did not control grasses.

DISCUSSION: Weed control is a serious production problem for garbanzo beans. All too frequently, garbanzo bean fields are unharvestable because of weeds. We could find only three herbicides, Dual, Goal, and Pursuit, which specifically mention garbanzo beans on their labels; however, Treflan is registered for use on dry beans, and in my opinion garbanzo bean is a dry bean. Spartan is not registered for use on garbanzo beans. Spartan is labeled for use on peanuts and sunflower. Pursuit is much better at controlling problem broadleaf weeds than Dual, Goal, or Treflan. Pursuit by itself caused only minor crop injury and controlled most of the broadleaf and grass weeds. Spartan had the same low crop injury level as Pursuit. However, Spartan controlled some of the broadleaf weeds better than Pursuit, and Spartan can be applied post emergence. Pursuit applied preemergence controlled most broadleaf weeds and grasses present in our garbanzo bean study; however, some broadleaf weeds escaped. If Spartan was registered for use in garbanzo beans, our study results suggest that Spartan may be effective when applied post emergence in controlling the broadleaf weeds missed by Pursuit alone. Nonetheless, it is still important to choose a clean, weed free site so that the beans have less competition from weeds and can be cultivated.

Garbanzo bean yields were low. The growing conditions were quite good until the pod-filling period when conditions became hot and dry.

Table .Garbanzo Bean Weed Control Study, Walsh, 2005.

Herbicide	Rate	Application Timing	Pigweed Control	Kochia Control	Foxtail Control	Crop Injury	Test Weight	Seed Yield
	*/A		%	%	%	%	Lb/Bu	Lb/A
Spartan	2.0 oz	Post	80	60	0	10	55.5	241
Pursuit	1.08 oz	Pre	100	40	100	10	55.0	252
Average			90	50	50	10	55.3	247
LSD 0.20								9.3

Planted: Dwelley at 80 Lb/A on March 17; Harvested: August 9 with row crop head.
Applied Pursuit at 1.08 Oz/A on March 18.
Applied Spartan at 2.0 Oz/A on May 28, crop and most broadleaf weeds 5 in. tall.

Dry Bean Trial, Row Crop Head and Hand Harvest Comparison, Walsh, 2005

Kevin Larson and Mark Brick

PURPOSE: To test the suitability of dry bean varieties (7 pinto beans and 2 black beans) for direct row crop head harvesting.

MATERIALS and METHODS: We planted 7 pinto bean varieties and 2 black bean varieties into a dryland site previously in a wheat-sorghum-fallow rotation. For our plot design, we used a RCBD with four replications. We fertilized the site with 70 Lb N/A as 32-0-0. We planted the beans on May 26 at 20,000 Seeds/A, except Fisher and Vision we planted at 22,000 Seeds/A because of low germination lot. To control weeds, we applied Pursuit at 1.08 Oz/A, and cultivated once. We hand harvested a 2 ft. by 5 ft. area in each plot on October 14. We machine harvested the remaining 10 ft. by 44 ft. plot using a row crop head on October 28.

RESULTS: The hand harvesting produced 279 Lb/A more seed than the row crop head harvesting. There was no significant difference between the top yielding hand harvested variety, Cahone, and the two black bean varieties, 27864 and Jaguars ($P > 0.05$). There was no significant difference between the highest yielding row crop harvested variety, 27864, the next two highest producing pinto bean varieties, Cahone and Vision. Cahone and 27864 were the highest yielding bean varieties for both the hand harvesting and row crop harvesting methods.

DISCUSSION: This is the first edible dry bean trial that we have had at Plainsman since 1993. The renewed interest in dry beans occurred because of price drops in our commonly grown commodities and recent better-than-average prices for dry beans. The reason we tested direct head harvest was to minimize soil loss. Dry beans leave little residue to protect against wind erosion, even before undercutting which leaves soils especially venerable. From our results, it is obvious that there was considerable yield loss from direct harvesting with a row crop head. Nonetheless, we were encouraged by the black beans nonshattering, bush type plant architecture, which with more development promises the possibility of direct harvest.

Although the yield of the dry beans was low, depending on the dry bean price, it may be competitive with good to very good yielding grain sorghum crop. Our hand harvest dry bean average yield of 434 Lb/A would provide the same gross income as a 44 Bu/A grain sorghum crop with a bean price of $20/cwt, 55 Bu/A grain sorghum crop with a bean price of $25/cwt, or a 66 Bu/A grain sorghum crop with a bean price of $30/cwt (based on grain sorghum loan rate of $1.97/Bu).

Table .Dryland Dry Bean Trial, Walsh, 2005.

Variety	Bean Type	Hand Harvested Yield	Row Head Harvested Yield
		Lb/A	Lb/A
Cahone	Pinto	666	211
27864	Black	646	248
Jaguars	Black	562	175
Vision	Pinto	487	196
Grand Mesa	Pinto	483	177
GTS 900	Pinto	458	104
96731	Pinto	283	140
Fisher	Pinto	176	71
Buster	Pinto	145	69
Average		434	155
LSD 0.05		171.6	58.2

Planted: May 26 at 20,000 Seeds/A (Buster, Fisher, and Vision at 22,000 Seeds/A)
Weed Control: Pursuit, 1.08 Oz/A.
Hand Harvested: October 14, 2.5 ft X 5 ft.
Row Head Harvested: October 28, 10 ft X 44 ft.

National Winter Canola Variety Performance Trial, Walsh 2005

Kevin Larson, Kraig Rooseboom, and Dennis Thompson

Purpose: To identify the best adapted, highest yielding varieties of winter canola.

Results and Discussion

All of the plants of winter canola varieties survived the winter. The 100% winter survival is indicative of a mild winter. Severe winter can cause large stand losses. Typically, selecting winter canola varieties with high winter survival is a wise choice for our environment.

Canola would be a good candidate as a limited irrigated crop. We furrow irrigated the study with an irrigation in the fall and an irrigation in the spring. This year, we had poor soil moisture at planting. The lack of soil moisture at planting is a common scenario. Because we frequently have dry conditions at planting, and recommend maximum planting depth for canola is only 1.5 in., irrigating after planting is a good way to assure a stand.

Flowering dates are an important consideration because they reflect timeliness of harvest and flower sensitive freeze dates. The earlier flowering varieties are ready for harvest before the later flowering varieties. This could be important because the timing of wheat and canola harvests could clash. Remember, canola is one of the worst crops for shattering; do not delay harvest when it is ready for harvest. Varieties that flower early risk late-season frost damage. The earliness of some canola varieties may help avoid harvesting conflicts with wheat, but costly freeze damage on early flowering varieties may negate the harvest scheduling benefit.

Materials and Methods

We planted 28 winter canola varieties for the National Winter Canola Trial on September 9, 2004. The trial was planted at 5 Lb Seed/A with a 12 in. row-spaced drill to a depth of 1.5 inches in dry soil. We furrow irrigated the site on 5 ft. beds until the moisture soaked across the bed. We fertilized the site with 75 Lb N/A using a sweep plow prior to planting. No other fertilizers were applied. The soil test was: N, 14 ppm; P, 6.2 ppm; and K, 490 ppm. For weed control, we applied Treflan 24 Oz/A prior to planting. We furrow irrigated once in the fall and once in the spring with about 8 to 10 in./A of total water applied for the winter canola trial. We harvested the winter canola variety trial on June 28. We harvested using a small grain head attached to a self-propelled combine (direct harvest) equipped with a digital scale.

National Canola Variety Trial: Walsh, CO, 2005.

Variety	Stand	Winter Survival	Flowering Date	Plant Height	Seed Yield
	(0-10)	(0-10)		In.	lb/acre
NPZ 0326	8.3	10	20-Apr	67	2482
Kronos	5.7	10	19-Apr	61	2462
ARC2189-1	5.2	10	19-Apr	60	2409
Baldur	4.2	10	18-Apr	59	2402
Wichita	4.7	10	17-Apr	57	2366
ARC92007-2	7.0	10	19-Apr	63	2290
Abilene	4.3	10	19-Apr	63	2129
KS9135	5.7	10	20-Apr	64	2125
KS2064	4.2	10	18-Apr	58	2109
KS2169	5.0	10	18-Apr	56	2092
ARC2180-1	8.5	10	19-Apr	68	2033
Rasmus	3.5	10	18-Apr	58	2000
KS9124	4.5	10	20-Apr	58	1941
Titan	3.8	10	18-Apr	60	1881
Jetton	6.2	10	20-Apr	59	1875
Casino	2.5	10	20-Apr	61	1862
VSX-2	5.3	10	19-Apr	60	1808
ARC92004-1	5.5	10	20-Apr	61	1775
Baros	6.3	10	17-Apr	57	1703
KS2098	4.8	10	21-Apr	68	1689
KS7436	4.0	10	19-Apr	58	1676
Plainsman	3.7	10	21-Apr	68	1617
KS2185	3.2	10	17-Apr	54	1610
KS7436-055	2.3	10	19-Apr	52	1599
Virginia	2.3	10	20-Apr	52	1544
Sumner	4.2	10	16-Apr	53	1518
KS3018	4.3	10	18-Apr	63	1300
Ceres	0.5	10	20-Apr	52	436
Mean	4.6	10	18-Apr	60	1883
LSD 0.05	2.92				531.7

Planted: September 9, 2004; Harvested: June 28, 2005.
Limited furrow irrigated with about 10 in. of total water applied.