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Plainsman Research Center 2004 Research Reports

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Plainsman Research Center, 2004 Research Reports

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This Plainsman Research booklet is dedicated to the memory of Bernard Neill. He was one of the founders of the Plainsman Agri-Search Foundation. In fact, his financial support in the form of a matching fund was the impetus for the formation of the Plainsman Agri-Search Foundation. He served as a Foundation Board Member for more than 30 years, since its formation up until his passing.

Bernard was a good farmer. A "good farmer" is a simple phrase, but much is implied. To be considered a good farmer means that he took care of the land and was concerned about young and future farmers. He was a well-known and frequent buyer of many 4-H livestock projects. He kept his eye on improvements in agricultural technology and was always eager to try something new. Instead of listing, he flat planted. He was an early adopter of seedrow-applied starter fertilizer, and he was one of the first to use strip-till for dryland grain sorghum production.

Bernard will be missed for his support of research and his desire to improve agriculture.

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2004 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.	66	-4	47.7	20.2	34.0	0.14	0.14	1.00	1.00	
Feb.	75	-1	48.4	19.2	33.8	0.27	0.17	3.25	2.50	
Mar.	86	23	64.6	32.1	48.4	0.85	0.35	2.25	1.25	
Apr.	85	20	66.7	38.2	52.5	3.61	1.24	0.50	0.50	3.49
May	99	30	83.3	49.3	66.3	0.03	0.02	0.00	0.00	14.04
Jun.	102	40	85.5	55.3	70.4	7.65	2.18	0.00	0.00	6.27
Jul.	100	51	85.6	59.6	72.6	3.49	1.72	0.00	0.00	8.18
Aug.	97	51	84.1	57.1	70.6	3.10	1.95	0.00	0.00	7.48
Sept.	98	39	83.1	54.2	68.7	2.45	1.82	0.00	0.00	9.50
Oct	85	28	69.7	40.6	55.2	0.55	0.27	0.00	0.00	2.19
Nov.	75	3	49.7	30.3	40.0	3.12	1.32	7.75	2.25	
Dec.	75	-12	50.4	21.9	36.2	0.36	0.17	6.50	4.00	
Total Annual			**68.23**	**39.83**	**54.03**	**25.62**		**21.25**		

*** 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 May- 14.04
Late freeze in May damaged wheat.
An extra short frost free growing season of 150 days- 49 days less than prior yearl.

	2004	2003
Highest Temperature:	102 degrees on June 8	106 degrees on Aug. 19th
Lowest Temperature:	-12 degrees on Dec. 24	0 degrees on Mar. 2nd
Last freeze in spring:	30 degrees on May 14	31 degrees on Apr. 28th
First freeze in fall:	32 degrees on Oct. 14	32 degrees on Oct. 13th
2004 frost free season:	150 frost free days	199 frost free days
Avg. for 21 years:	Avg for 21 years 20.50 inches	Avg, for 20 years 19.74 inches

Maximum Wind:

Jan.	37 mph on 18th	July.	37 mph on 23rd
Feb.	44 mph on 20th	Aug.	42 mph on 11th
Mar.	43 mph on 1st	Sept.	36 mph on 20th
Apr.	50 mph on 19th	Oct.	38 mph on 23rd & 29th
May	43 mph on 12th	Nov.	44 mph on 2nd & 11th
Jun.	45 mph on 16th	Dec.	36 mph on 30th

2003-04 Eastern Colorado Winter Wheat Variety Performance Trials

Jerry Johnson and Scott Haley

Colorado State University, with the support and cooperation of the Colorado wheat industry, conducts annual dryland (UVPT) and irrigated (IVPT) variety performance trials to obtain unbiased and reliable information for Colorado wheat producers to make better wheat variety decisions. Good variety decisions can return millions of dollars to Colorado wheat producers.

The 2004 dryland UVPT was comprised of 46 entries grown at 11 locations. Of the 46 entries in this trial, 29 were named varieties and 17 were experimental lines. In addition to CSU varieties and experimental lines, the trial included public varieties from Nebraska, Kansas, and Texas, and private varieties from General Mills, AgriPro, and Trio Research Inc. A randomized complete block design with three replicates was used in all trials. Dryland trials were seeded at 600,000 seeds per acre, planted in 9 inch-spaced rows at Akron, Burlington, and Julesburg, 12 inch-space rows at Walsh, and 10 inch-spaced rows at the other locations.

The irrigated IVPT was conducted at Rocky Ford, Haxtun, and Fort Collins. The irrigated trials are managed for maximum yield and are seeded at 1.2 million seeds per acre with fertilization and water management necessary to obtain or exceed 100 bushels per acre. The Haxtun and Fort Collins trials were grown under sprinkler irrigation and the Rocky Ford trial was furrow-irrigated. The Haxtun and Rocky Ford trials are seeded in eight rows on 7-inch spacing while the Fort Collins trial is seeded in six rows on 9-inch spacing. Both the Haxtun and Rocky Ford trials provided excellent results while the Fort Collins location was compromised due to irrigation management issues on a farm recently acquired by the research station.

Dryland planting conditions in fall of 2003 were generally poor due to dry soil conditions. These conditions led to extremely narrow planting windows at most locations to plant and obtain good stands. Inadequate fall and winter precipitation was followed by a dry spring (with the exception of some timely rains in April) and moderate drought stress conditions at many locations. The spring drought was aggravated by very short sub-soil moisture conditions. Uneven and incomplete fall emergence was observed at Lamar, Cheyenne Wells, Genoa, and Orchard and led to these trials being abandoned (Genoa and Orchard) or yield data that were too variable to be useful for variety comparisons (Lamar and Cheyenne Wells). The trial at Walsh was lost to severe hail damage on the eve of harvest and the trial at Burlington was lost to spring drought and a severe spring freeze at flowering in mid-May. Rains beginning during the third week in June and continuing into early July provided very moderate temperatures during grain filling as well as leading to serious weed pressure in trials and production fields alike. The rain made it difficult to get into fields for harvest and led to reports of sprouting in both hard white and hard red varieties.

Russian wheat aphid pressure was high again this year, especially in east-central and southeastern Colorado. The new Russian wheat aphid biotype, denoted as "biotype B," overcomes the resistance in all RWA-resistant varieties released to date. This new biotype was found throughout eastern Colorado in 2004 in conjunction with the original RWA biotype (denoted as "biotype A"). Recent findings suggesting that additional biotypes may be present in Colorado and other areas of the Great Plains could present formidable challenges to our entomology and wheat breeding programs. Wheat steak mosaic virus and high plains disease were not problematic in 2004 while barley yellow dwarf virus, due to high greenbug infestation levels, was observed at the IVPT at Rocky Ford. Both leaf rust and stripe rust were identified in late-maturing wheat (due to poor stands) at some locations but infestations were generally very light and too late in the grain filling period to cause significant damage.

The following summary tables of results are designed to disseminate the essential information as quickly as possible to as many people as possible through the wheat industry, popular press, and DTN.

Winter wheat Uniform Variety Performance Trial at Sheridan Lake in 2004[1]

Variety	Yield	Grain Moisture	Test Weight	Plant Height	Shatter[2]
	bu/ac	%	lb/bu	in	0-9
Avalanche	50.7	11.9	58.0	22	1
Jagalene	50.4	11.4	57.4	22	0
Harry	49.0	9.0	51.9	23	0
Trego	48.8	13.1	58.9	21	0
Ankor	48.2	11.5	56.5	21	0
Wahoo	47.4	11.0	55.3	23	0
CO00554	47.0	11.2	56.3	22	1
TAM 111	46.9	12.1	57.6	21	1
CO00739	46.7	10.8	56.9	22	0
AP502 CL	46.0	11.2	55.9	20	0
CO00016	45.1	10.3	55.8	19	0
NuHills	44.0	11.7	56.3	21	0
NuHorizon	44.0	11.7	57.6	20	0
T81	43.7	12.0	57.5	21	0
Prairie Red	43.5	12.0	56.1	20	0
Above	43.4	11.5	55.8	21	0
Goodstreak	42.6	11.5	58.1	26	0
W99-194	42.6	12.1	57.7	23	0
CO980607	41.7	11.8	57.6	19	0
Stanton	41.6	11.7	57.6	21	0
Lakin	41.4	11.8	57.8	24	1
CO99W192	41.3	10.2	54.5	21	0
Overley	41.1	10.8	55.6	24	0
Akron	40.5	11.7	56.6	21	0
Yumar	40.0	11.0	56.6	23	0
NuFrontier	39.1	11.5	57.1	23	0
CO00796	38.8	10.9	57.2	22	0
Yuma	38.6	11.0	57.1	22	0
Jagger	38.5	11.1	56.1	21	1
CO991132	38.1	9.9	54.9	23	0
CO00D007	37.6	11.2	54.8	23	0
CO991057	37.5	10.4	55.2	21	0
CO99W254	36.2	11.2	56.3	20	0
Arrowsmith	36.0	11.8	56.2	26	0
Alliance	35.9	11.9	57.1	21	1
CO00347	35.2	10.5	53.7	22	2
CO00698	34.2	10.7	56.1	20	0
Thunderbolt	34.2	12.2	59.5	21	2
CO99W183	33.9	9.4	53.2	20	0
Millenium	32.9	11.0	55.1	25	2
Halt	32.4	11.3	57.3	21	2
Antelope	32.2	10.7	55.6	22	0
CO00345	30.8	11.4	56.2	21	2
CO970547-7	30.8	11.2	57.7	20	0
CO99W329	30.3	11.0	57.8	17	0
Prowers 99	26.8	12.3	57.3	22	0
Average	**40.2**	**11.3**	**56.5**	**22**	
CV %	13.2				
$LSD_{(0.30)}$	4.5				
$LSD_{(0.05)}$	8.6				

[1]Trial conducted on the Burl Scherler farm; seeded 9/10/03 and harvested 7/03/04.
[2]Rating scale 0-9, with 0 = no shatter and 9 = severely shatter.

Winter wheat Irrigated Variety Performance Trial at Rocky Ford in 2004[1]

Variety	Yield	Grain Moisture	Test Weight	Plant Height	(6/24/04) Lodging[2]	(7/03/04) Lodging	50% Heading[3]
	bu/ac	%	lb/bu	in	0-9	0-9	date
Prairie Red	106.0	10.7	55.2	35	2	2	5/3/2004
NuHills	102.1	11.0	55.5	34	2	0	5/5/2004
CO991057	102.1	10.7	55.7	37	3	1	5/3/2004
CO00016	100.9	10.7	54.9	37	6	4	5/3/2004
Ok102	99.9	12.0	57.7	34	1	0	5/7/2004
Ankor	97.3	10.9	53.9	36	4	2	5/5/2004
Yuma	95.8	11.3	55.9	35	3	2	5/4/2004
CO00698	95.1	11.4	56.9	39	6	4	5/6/2004
CO00D007	95.0	10.9	55.1	38	3	2	5/3/2004
CO99W183	94.0	11.1	56.7	35	3	2	5/5/2004
CO970547-7	93.4	11.1	56.2	34	5	3	5/4/2004
CO991132	92.9	10.4	54.3	36	2	1	5/3/2004
NuFrontier	92.2	11.7	57.4	36	3	0	5/7/2004
CO99W254	91.5	11.5	56.9	34	2	2	5/3/2004
CO99W192	90.3	9.6	51.1	37	6	4	5/8/2004
Nuplains	89.1	11.6	57.0	36	2	0	5/10/2004
Dumas	88.2	11.6	58.0	34	2	0	5/5/2004
CO00345	87.9	12.3	57.6	34	5	5	5/4/2004
Overley	85.6	11.6	56.8	40	2	0	5/6/2004
CO00347	85.4	12.2	56.9	35	6	4	5/5/2004
CO980607	84.8	11.5	57.0	35	4	2	5/3/2004
Wesley	83.3	10.4	54.2	34	1	1	5/7/2004
CO99W329	82.8	11.5	56.3	34	3	1	5/2/2004
CO00796	81.8	11.3	57.4	39	3	2	5/9/2004
Jagalene	81.5	12.3	57.0	36	4	2	5/8/2004
CO00739	80.0	11.1	55.4	37	4	3	5/8/2004
Antelope	79.6	10.7	54.8	35	2	1	5/6/2004
CO00554	78.4	12.3	56.3	36	5	2	5/5/2004
NuHorizon	77.4	11.9	56.4	35	1	0	5/8/2004
Platte	77.2	10.6	53.2	34	1	0	5/9/2004
Average	**89.7**	**11.3**	**55.9**	**36**			**5/5/2004**
CV %	8.9						
$LSD_{(0.30)}$	6.8						
$LSD_{(0.05)}$	13.1						

[1]Trial conducted on at the Arkansas Valley Research Center; seeded 10/01/03 and harvested 7/03/04.
[2]Rating scale 0-9, with 0 = no lodging and 9 = completely lodged. Some lodging was first observed on 14 May. Lodging was exacerbated by the hail storm of 20 June.
[3]Date to 50% Heading.

Dryland Wheat Strips for Forage and Grain Yield at Walsh, 2004

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: Thirteen wheat varieties were planted on September 25, 2003 at 45 Lb Seed/A in 20 ft. by 1100 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 31) and at boot (April 22). We measure the forage for fresh weight, oven-dried the samples, and recorded dry weight at 15% moisture content. There was a minor infestation of aphids, including Russian Wheat Aphid. We harvested the plots on July 13 with a self-propelled combine and weighed them in a digital weigh cart. Grain yields were adjusted to 12% seed moisture content.

RESULTS: A hailstorm on June 16 greatly reduced yields. Above produced the highest grain yield with 20 Bu/A. The top four grain producing varieties were TAM 107 and varieties with significant TAM 107 parentage. Jagalene produced the highest dry forage yield at jointing, 3133 Lb/A, and Prowers 99 produce the most forage at boot, 5775 Lb/A. The two-year grain yield average for our study places Above as the highest yielding variety, 106% of TAM 107 yield. However, after three years of testing, no variety produced a higher average grain yield than TAM 107, our check variety.

DISCUSSION: This year the best forage variety was Jagalene; however, the grain yield of Jagalene was very low due to hail damage, and under these conditions would not qualify as dual-purpose wheat. The best overall dual-purpose wheat variety was Above. It had well above average forage yields and the highest grain yield. This past wheat season was dry, and for us it ended with hailstorms. Stressful years, such as this past one, separate hardy varieties that yield under adverse conditions from weaker varieties that yield well only under favorable conditions. The varieties that performed well under these dry, hail-damage conditions should be considered varieties of choice, and for the most part are close genetic derivatives of TAM 107.

Table .Dryland Wheat Strips, Forage and Grain Yield at Walsh, 2004.

Variety	Jointing		Boot		Plant	Test	Grain
	Fresh Wt.	Dry Wt.	Fresh Wt.	Dry Wt.	Height	Weight	Yield
	----------Lb/A----------				In	Lb/Bu	Bu/A
Above	9034	2756	17823	5448	22	54	20
TAM 107	8367	2512	14039	4311	22	56	19
TAM 110	9028	2797	17500	4998	23	55	19
Prairie Red	7905	2499	15609	4632	23	55	18
T-81	8393	2656	14915	4322	22	56	17
Avalanche	8925	2866	15785	4856	23	56	17
Trego	9015	2856	15767	4778	24	57	16
Ankor	9244	2824	17878	5206	22	55	14
Jagger	9282	2876	17677	5209	22	55	14
Jagalene	9902	3133	16435	5032	23	57	11
Halt	6917	2123	16792	4378	19	55	10
2137	8286	2470	15496	4685	22	55	10
Prowers 99	10359	2979	19144	5775	24	56	8
Average	8820	2719	16528	4895	22	56	15
LSD 0.05	2568.0	763.1	3824.7	1033.0			2.3

Planted: September 25, 2003; 45 Lb seed/A; 5 gal/A 10-34-0.
Jointing sample taken March 31, 2004.
Boot sample taken April 22, 2004.
Grain Harvested: July 13, 2004. A June 16 hailstorm greatly reduced grain yields.
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, 2002-2004.

		Grain Yield					Yield as % of TAM 107 Average				
Firm	Variety	2002	2003	2004	2-Year Avg	3-Year Avg	2002	2003	2004	2-Year Avg	3-Year Avg
		----------Bu/A----------					----------%----------				
AgriPro	Thunderbolt	15	12	--	14	--	88	41	--	65	--
Colorado State	Akron	16	25	14	20	18	94	86	74	80	85
Colorado State	Halt	15	22	10	16	16	88	76	53	64	72
Colorado State	Prowers 99	--	23	8	16	--	--	79	42	61	--
Colorado State	Prairie Red	14	29	18	24	20	82	100	95	97	92
Colorado State	Above	12	31	20	26	21	71	107	105	106	94
Colorado State	Avalanche	11	28	17	23	19	65	97	89	93	84
Colorado State	Ankor	--	27	14	21	--	--	93	74	83	--
Kansas State	Jagger	13	17	14	16	15	76	59	74	66	70
Kansas State	Ike	16	26	--	21	--	94	90	--	92	--
Kansas State	2137	13	20	10	15	14	76	69	53	61	66
Kansas State	Trego	15	30	16	23	20	88	103	84	94	92
Kansas State	Stanton	14	28	--	21	--	82	97	--	89	--
Texas A & M	TAM 110	16	28	19	24	21	94	97	100	98	97
Texas A & M	TAM 107	17	29	19	24	22	100	100	100	100	100
Trio	T 81	11	28	17	23	19	65	97	89	93	84
Average		13	25	15	20	18					

Grain Yields were corrected to 12.0 % seed moisture content.

Irrigated Dual Purpose Wheat Planting Dates, Seeding Rates, Varieties at Walsh, 2004

Kevin Larson, Rick Kochenower, and Gene Krenzer

Purpose: To determine the effects of seeding rates, planting dates, and varieties on irrigated winter wheat forage and grain production.

Materials and Methods: We planted four wheat varieties, Custer, Intrada, Jagger, and TAM 107, at three seeding rates, 60, 120, and 180 Lb/A, on two planting dates, September 9, 2003 (one treatment set for both forage and grain) 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 at 84 Lb N/A to the September 9 planting date treatments and 19 Lb N/A to the September 29 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 A-in./A of total applied water, once in early spring. We harvested the plots for grain on July 12, 2004 with a self-propelled combine and weighed them in a digital scale. Grain yields were adjusted to 12% moisture content.

Results: A hailstorm on June 16 greatly reduced grain yields. Grain yields of TAM 107 were significantly higher than Jagger, Custer, and Intrada for all planting date and seeding rate treatments ($P > 0.05$). The higher grain yields for TAM 107 were due to hail damage causing much more seed shattering for Jagger, Custer, and Intrada. There was no significant grain yield difference between planting dates, therefore the grain yield for the planting dates were pooled for grain yield analysis. The average grain yield for the September 9 planting date was 2 Bu/A higher than the grain only September 29 planting date; whereas, the September 29 planting date was 4 Bu/A less than the grain only September 29 planting date.

Forage yields were not significantly different between varieties and their means were pooled for forage yield analysis. Forage yields for the 120 Lb/A and 180 Lb/A seeding rates were significantly higher than the 60 Lb/A rate for both planting dates, ($P> 0.05$). There was no significant forage yield difference between 120 Lb/A and 180 Lb/A seeding rates for both planting dates. The extra income gained from grazing the forage of the September 9 planting date provided $30.06/A to $59.14/A more than the September 29 grain only planting date. Variable net income derived from forage was negative for all three seeding rates with the October planting date, ranging from -$16.40/A to -$6.93/A.

Discussion: 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 forage production years.

The method we use to assign value for the forage was wheat forage leasing based on livestock weight gain. After consulting with David Schutz, Manager of the Eastern Plains Research Center, we followed his suggestions of 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 $0.35/lb. We made these assumptions for our lease grazing: we started with 500 lb calves and they grazed for two months. On average, the calves weighed 560 lb and ingested 3% of their body weight (16.8 lb/day) and they gain 2 lb/day. The forage income using the lease grazing weight gain method had positive incomes for all the September 9 planting date treatments and negative incomes for all the September 29 planting date treatments, regardless of the forage value ($/lb gain) rate used. For the September 9 planting date, the 120 Lb/A seeding rate produced more income at all three gain rates used than the 60 Lb/A and 180 Lb/A seeding rates. The120 Lb/A seeding rate produced the highest income, $59/A, at the $0.35/Lb gain rate, although it was less than $7/A more than the 60 Lb/A and 180 Lb/A rates.

There was a 2 Bu/A grain yield increase ($6.40/A using a grain price of $3.20/Bu) for the September 9 planting date and a 4 Bu/A decrease (-$12.80/A) for the September 29 planting date compared to the grain only September 29 planting date. The September 9 planting date averaged 1,383 Lb/A more forage than the September 29 planting date. The average cost of forage on a dry weight basis for the September planting date was $19.40/A for 1,777 Lb/A or $21.83/Ton [$20.80/A to replace the N removed with forage (84 Lb N/A at $0.20/Lb and $4/A application cost), $5/A seed cost (over 60 Lb/A at $0.083/Lb), and $6.40/A grain yield gain].

Of the four wheat varieties tested, TAM 107 produced significantly higher grain yield than Jagger, Custer, and Intrada. TAM 107 had the lowest seed losses from hail damage than the other three varieties. The grain yield of TAM 107 was 10 Bu/A higher in the September 9 planting date than the September 29 planting date with forage removed.

The September 29 planting date did not produce sufficient forage to make grazing economically feasible. In fact, the highest forage yield (477 Lb/A) of the September 29 planting date at the highest forage value ($0.35/Lb gain) lost money compared to harvesting grain only. The September 9 planting date consistently produced high forage incomes for all seeding rates. All the forage treatments of the September 9 planting date produced $30/A to $59/A more than grain harvest alone. The 120 Lb/A seeding rate planted September 9 provided the highest forage and grain income.

Table .Irrigated Dual Purpose Wheat Grain Yields at Walsh, 2004.

Variety	Seeding Rate			Varietal Average
	60 Lb/A	120 Lb/A	180 Lb/A	
	----------Bu/A----------			
TAM 107	25	27	28	27
Jagger	16	19	18	17
Custer	15	18	17	17
Intrada	14	15	15	15
Average	17	19	19	19
LSD 0.05	4.6	5.5	3.9	2.2

Grain yields are pooled means of planting dates.
Grain yields are adjusted to 12% seed moisture content.

Table .Irrigated Dual Purpose Wheat Forage Yields at Walsh, 2004.

Seeding Rate	Planting Date		Seeding Rate Average
	Sept. 9	Sept. 29	
	----------Lb/A----------		
60 lb/acre	1616	256	936
120 lb/acre	1885	448	1167
180 lb/acre	1830	477	1154
Average	1777	394	1085
LSD 0.05	182.8	112.9	92.7

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

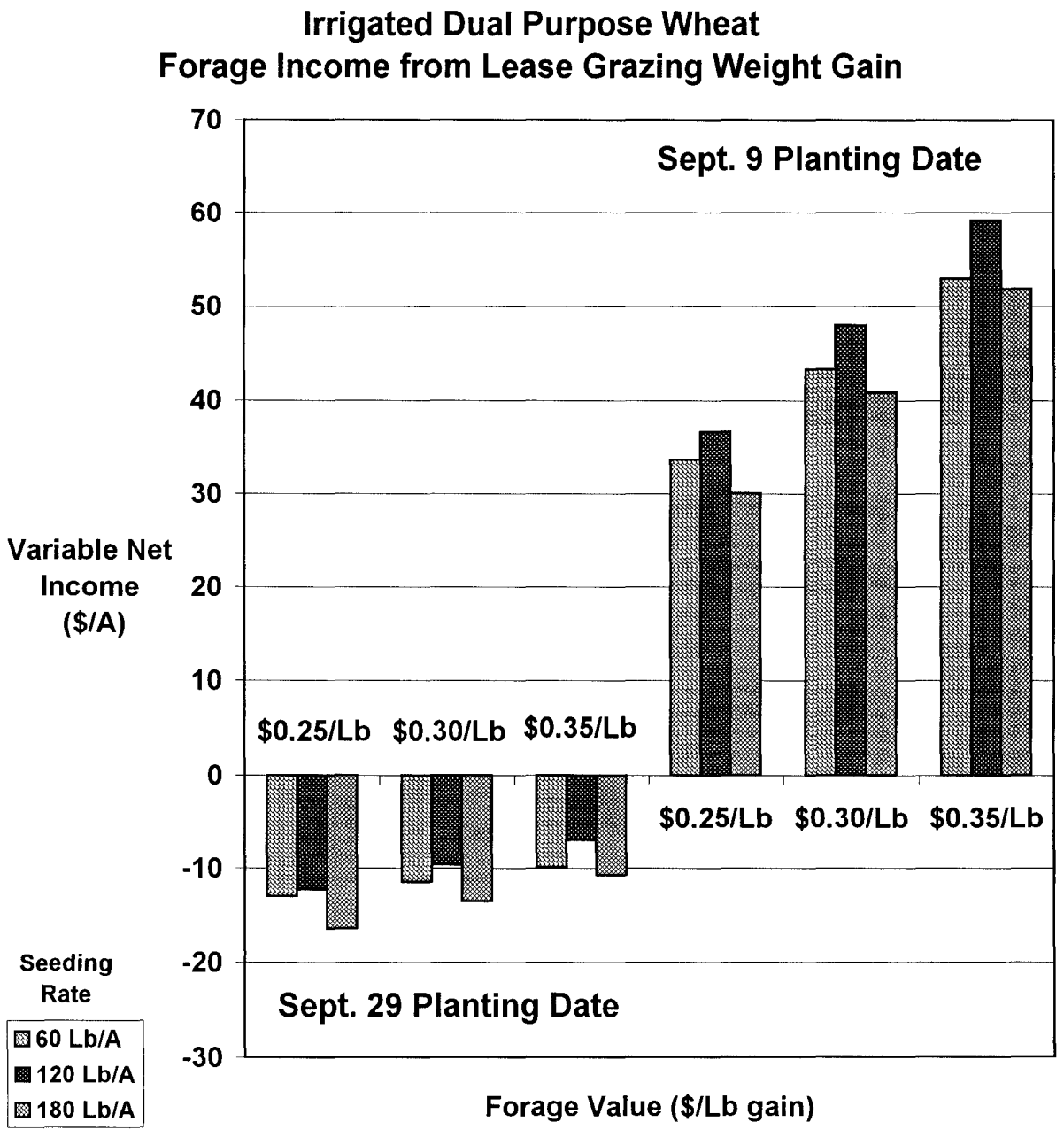


Fig. . Forage income from irrigated dual purpose wheat at Walsh, 2004. The planting dates were September 9 and September 29, 2003. The seeding rates were 60, 120, and 180 Lb/A. The forage values are on based on 2 Lb/day gain from 500 Lb calves grazing for two months with a price per Lb gain of $0.25/Lb, $0.30/Lb, and $0.35/Lb. Cost of forage was grain yield loss or gain at $3.20/Bu compared to September 29 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).

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 15; PD2, September 29; PD3, October 15; PD4, November 3; and PD5, November 17. 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 and PD2, April 2; PD3, April 16; PD4 and PD5, April 26. 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 50 ft. plots on July 12 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, 3000 Lb/A; PD2, 2000 Lb/A; PD3, 1750 Lb/A; PD4, 1100 Lb/A; and PD5, 850 Lb/A. The earliest planting date, September 15, produced the highest forage yield. PD1 at the lowest seeding rate produced as much forage as PD3 at the highest planting date, about 2200 Lb/A each. Planting date grain yield averages decrease with each subsequent planting date. PD1 and PD2 had yield maximums at 90 Lb seed/A. The last three planting dates had linear yield responses to increasing seeding rates: they had their highest yields at 120 Lb seed/A. The highest yields of PD1 and PD2 were 14 to 23 Bu/A higher than the highest yields of PD3, PD4, and PD5. RWA infestation increased with later planting dates, lower seeding rates, and later sampling

dates. The worst RWA infestation, 52% infested tillers, occurred with the combination of the latest planting date, November 17, and the lowest seeding rate, 30 Lb/A.

Discussion

The first two planting dates, September 15 and September 29, produced substantially higher grain yields than the last three planting dates, October 15, November 3, and November 17. The large grain yield disparity between September 29 planting date and October 15 planting date suggests that the current wheat planting date deadline of October 15 is correct. To achieve high grain yields, growers should consider seeding at higher rates. The study this year produced highest grain yield at a seeding rate of 90 Lb/A.

High seeding rates produced the highest grain yields in part because they lowered RWA infestation. Apparently, low plant stands attract RWA. RWA adversely impacted the latest planting dates more than the earlier planting dates. RWA infestation was more than four times higher in the two latest planting dates than in the first planting date. This suggests that less developed wheat is more susceptible to RWA or that RWA is more attracted to less developed wheat. When planting late, we recommend increasing seeding rates to lower RWA infestation and achieve high grain yields

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 three times more than late planting. The large forage production drop with late planting date is to great to compensate for the three weeks extension in grazing. Forage production from each planting date increase with higher seeding rates. We recommend that for high forage production use high (90 to 120 Lb/A) seeding rates.

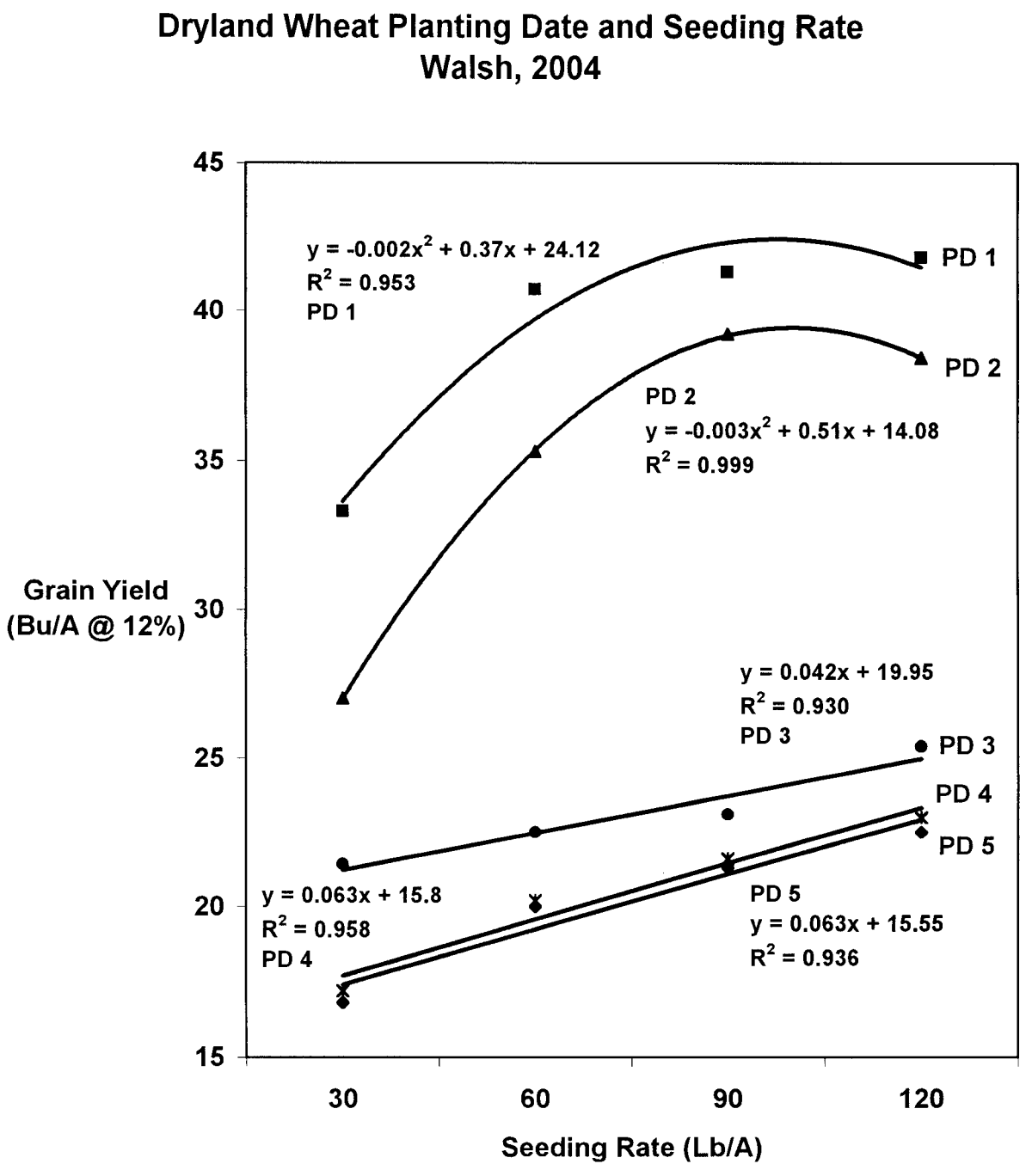


Fig. Grain yields at jointing from planting dates and seeding rates for dryland wheat at Walsh. Planting dates were PD 1, September 15; PD 2, September 29; PD 3, October 15; PD 4, November 3; and PD 5, November 17, 2003. Seeding rates were 30, 60, 90, and 120 Lb/A, corresponding to 462,000, 924,000, 1,386,000, and 1,848,000 seeds/A.

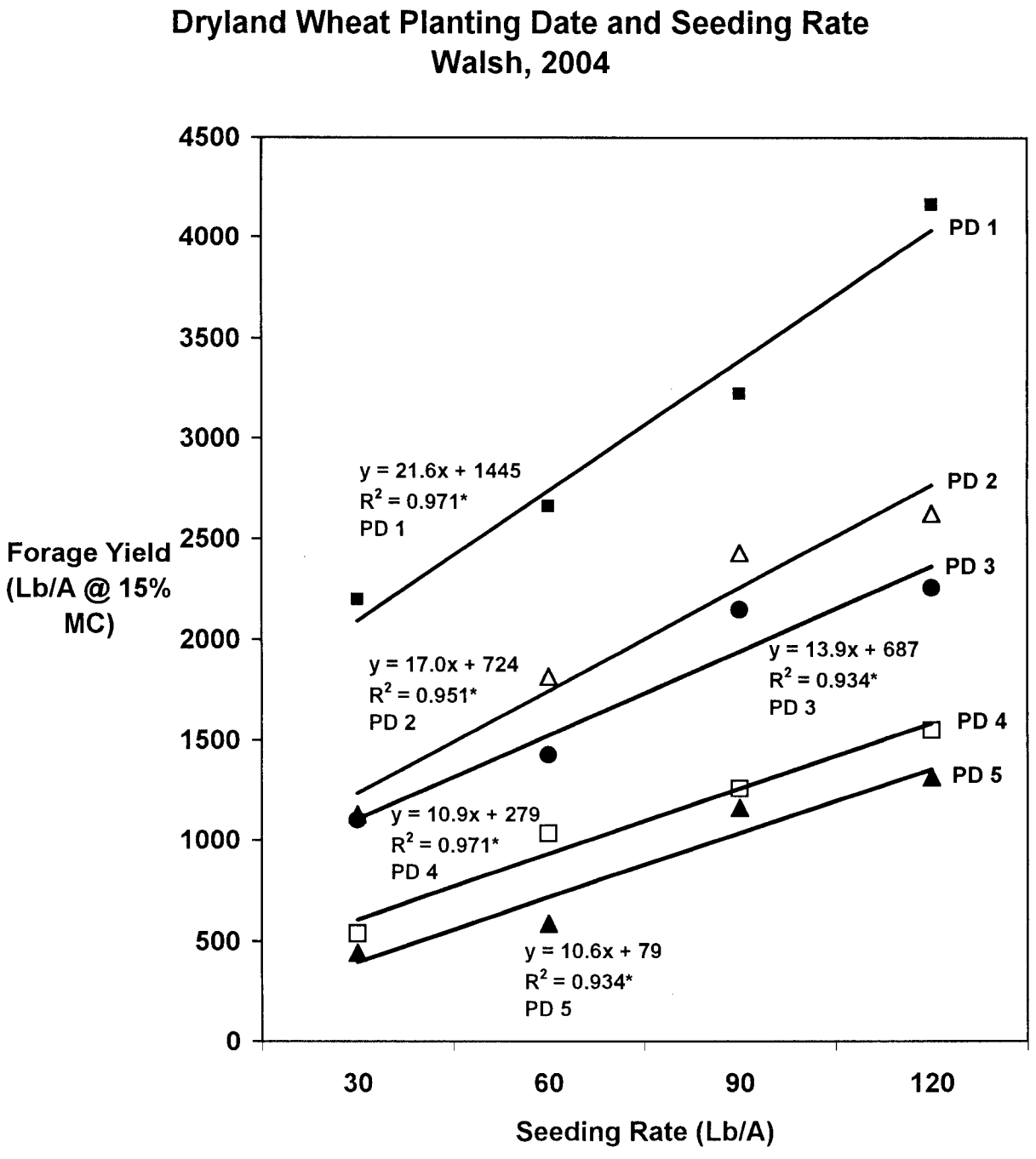


Fig. Forage yields at jointing from planting dates and seeding rates for dryland wheat at Walsh. Planting dates were PD 1, September 15; PD 2, September 29; PD 3, October 15; PD 4, November 3; and PD 5, November 17, 2003. Seeding rates were 30, 60, 90, and 120 Lb/A, corresponding to 462,000, 924,000, 1,386,000, and 1,848,000 seeds/A. Forage harvested: PD 1 and PD 2, April 2; PD 3, April 16; PD 4 and PD 5, April 26.

Table .Dryland Wheat Planting Date and Seeding Rate, Russian Wheat Aphid Infestation.

	Planting Date					Seeding Rate			
Sample Date	PD 1 Sept. 15	PD 2 Sept. 29	PD 3 Oct. 15	PD 4 Nov. 3	PD 5 Nov. 17	SR 30 30 Lb/A	SR 60 60 Lb/A	SR 90 90 Lb/A	SR 120 120 Lb/A
	----------% Tillers Infested with RWA----------								
March 26	0	0	0	0	1	0	0	0	0
April 15	1	0	3	6	3	2	4	2	2
May 3	4	6	5	12	11	13	8	8	3
June 1	10	14	25	45	46	52	32	38	24
Average	4	5	8	16	15	17	11	12	7

RWA infestation recorded from 25 tillers sampled per treatment.

Managing New Russian Wheat Aphid Biotypes

Frank Peairs, Terri Randolph, Scott Haley, Jerry Johnson,
Jeff Rudolph, Thia Walker, Mike Koch, Bob Hammon
Colorado State University

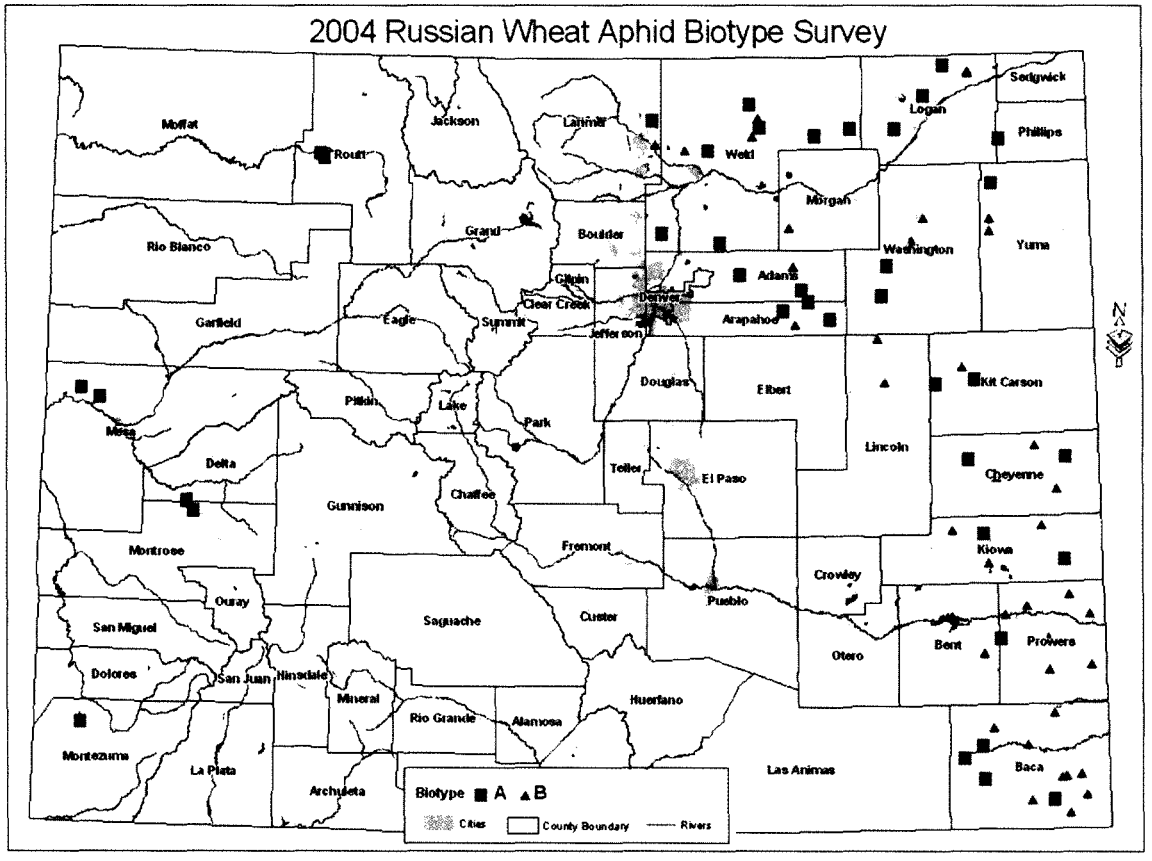
Background

Wheat varieties resistant to Russian wheat aphid have been available in Colorado for about 10 years, starting with Halt. Since then, resistant versions of several popular Colorado HRW wheats have been released (the variety name in parentheses is the original, susceptible variety from which the resistant variety was developed through the backcross process), including Ankor (Akron), Prairie Red (TAM 107), Prowers 99 (Lamar) and Yumar (Yuma). The resistance in all of these varieties is conferred by the gene Dn4. The sixth resistant variety, Stanton, is a wheat variety from Kansas with a different source of resistance. Together, Russian wheat aphid resistant varieties accounted for approximately 25% of Colorado's wheat acres in the 2002 and 2003 crop years, with higher percentages in counties with more consistent infestations.

In the spring of 2003 we received a number of reports of unusual Russian wheat aphid damage in resistant varieties. We were soon able to confirm that this damage was caused by a new Russian wheat aphid biotype that is unaffected by the sources of resistance currently in use. We use the term "Biotype A" to refer to the original aphid for which the resistant varieties were developed and "Biotype B" to refer the new aphid population that is able to overcome the resistance in available resistant varieties.

Biotype Survey

As of July 15, 2004 we have collected 100 Russian wheat samples from Colorado and the southern Nebraska Panhandle. The majority are from wheat producing areas of eastern Colorado. Infested tillers were collected from each site. Twenty young aphids were placed in a pot containing one plant each of TAM 107 and Prairie Red, which was then held in a cage in the greenhouse until the TAM 107 plant was heavily damaged. Aphids that damaged only TAM 107 were considered to be Biotype A, while those that damaged both varieties were categorized as Biotype B (or a mixture of both biotypes). The results of the 91 usable samples are summarized in the map and table below.



County	Total Samples	Biotype		County	Total Samples	Biotype	
		A	B			A	B
Adams	3	2	1	Morgan	1	0	1
Arapahoe	4	3	1	Otero	2	1	1
Baca	13	5	8	Park	1	1	0
Bent	2	0	2	Phillips	1	1	0
Cheyenne	5	2	3	Prowers	10	1	9
Delta	4	4	0	Pueblo	1	0	1
Kiowa	5	2	3	Routt	2	2	0
Kit Carson	2	1	1	Washington	6	3	3
Lincoln	2	0	2	Weld	10	7	3
Larimer	2	1	1	Yuma	2	1	1
Logan	5	3	2	Nebraska (all)	6	2	4
Montezuma	2	2	0	**TOTALS**	**91**	**43**	**48**

Roughly half (47%) of the samples we were able to classify were Biotype A, the original Russian wheat aphid. Biotype B was found throughout eastern Colorado. It was not found in the West Slope samples.

The range of Biotype B clearly has expanded since it was first observed in southeast Colorado last spring. However, it does not seem to have displaced Biotype A, and it is unknown whether this pattern will change over the next few years. Varieties resistant to Biotype A therefore remain an important Russian wheat aphid management tool.

How Many Biotypes?

When we started our survey, only two biotypes were known. However, on June 4, 2004 a USDA researcher informed us that he had identified at least three additional biotypes – two from Texas and one from Wyoming. At that point we modified our survey methods to allow us to detect one or more of these new biotypes. To avoid confusion, we have presented our results to show the number and location of Biotype A and B samples. Realistically, Biotype B samples should be considered as "non-A". However, our opinion is that the Biotype B designation is accurate in most cases. Nonetheless, it does appear that we encountered at least two additional biotypes after we changed our methods – one from Baca County similar to the USDA Texas isolate and a previously unknown type from Montezuma County.

Developing New Resistant Varieties

A common question is how soon will varieties resistant to both Biotype A and the new biotype(s) be available? This depends on where we find new sources of resistance. If resistance is found in advanced breeding material with good quality and agronomic traits, then the development period would be relatively short. This is highly unlikely and, in fact, screening of over 350 elite breeding programs from Great Plains programs failed to identify and useful resistance. The more likely scenario will be that resistance will be found in an unadapted, undesirable wheat, as was the case with Dn4. If this is the case, the development period will be substantially longer, perhaps as long as 10 years. Effective resistance to Biotype B has been identified in a few breeding lines from CSU and theUSDA-ARS in Stillwater, Oklahoma, and a collection of germplasm from the National Small Grains Collection (Aberdeen, Idaho). Agronomic and quality
evaluation of these materials is underway. However, no screening has been conducted with any of the newly discovered types so it is uncertain which, if any, of these accessions found to be resistant to biotype B will be resistant to the new biotypes.

We also have begun to screen for new sources of resistance. Most of the sources known to be resistant to Biotype A have proven to be susceptible to Biotype B. A promising exception is Dn7, which confers high resistance to both biotypes, but was transferred to wheat from rye and is generally associated with poor baking quality. Also some of the newly discovered biotypes are virulent to Dn7. In addition, we have evaluated more than 700 Biotype A resistant lines and have identified several promising new sources. We also have started to screen an additional 12,000 lines from the National Small Grains Collection, which should be completed in the fall of 2005. Lines resistant to Biotype B will be rescreened with Biotype A and with a Dn7-virulent type to identify promising lines for use in the development of varieties with broad resistance to as many Russian wheat aphid biotypes as possible.

Management of the New Biotypes

The resistant varieties mentioned above are still the most economical and effective management option for Biotype A. However, currently available resistance is not effective against Biotype B or the other newly discovered types, so they must be managed with the methods developed before resistant varieties were available. These include biological control, cultural controls, and judicious insecticide treatments based on appropriate scouting and economic threshold information.

Biological controls consist of (1) native natural enemies, such as lady beetles, lacewings, and spiders, which feed on a variety of insects including aphids; (2) exotic natural enemies collected from the Russian wheat aphid's native range and imported specifically for its control; and (3) commercially available natural enemies, which can be purchased and released in large numbers to control Russian wheat aphid. Each of these approaches may provide some control benefit in certain situations, but overall, biological control has not been sufficiently effective against Russian wheat aphid.

Cultural controls are changes in crop production practices that result in a crop environment that is less favorable for the pest or more favorable for natural enemies. Several cultural controls are known to provide some control benefit for Russian wheat aphid. Delayed planting of winter wheat and early planting of spring grains can help reduce initial aphid infestations. Crop diversification by producing winter wheat in rotation with summer crops is thought to enhance biological control activity, as well as providing a number of other economic and pest management benefits. Finally, any practice that results in a healthier and more vigorous crop should help minimize Russian wheat aphid problems, which often are worse in stressed portions of the field.

The important considerations in chemical control of Russian wheat aphid are what product to use and when to use it. We have tested a number of insecticide treatments since Russian wheat aphid first appeared in Colorado. It is convenient to compare treatments based on their consistency in achieving very good control (better than 90% control at three weeks after treatment). These results, summarized in Table 1, indicate that one pint of Lorsban 4E has been our most consistent treatment. Other available treatments, which we have not tested as extensively, include Cruiser and Gaucho seed treatments, Di-Syston and Furadan soil treatments, and Mustang Max foliar treatment.

Table 1. Control of Russian wheat aphid with hand-applied insecticides in winter wheat, 1986-2003[1].

PRODUCT	LB (AI)/ACRE	TESTS WITH > 90% CONTROL	TOTAL TESTS	% TESTS
LORSBAN 4E	0.50	23	39	59
DI-SYSTON 8E	0.75	16	41	39
LORSBAN 4E	0.25	7	21	33
DIMETHOATE 4E	0.375	7	33	21
DI-SYSTON 8E	0.50	2	10	20
PENNCAP M	0.75	3	19	17
WARRIOR 1E	0.03	2	12	17

[1]Includes data from several states.

The presence of other pests may have a bearing on the most appropriate treatment choice. For example, if cutworms are present in addition to Russian wheat aphid, a pyrethroid insecticide such as Mustang Max or Warrior would be a better choice than Lorsban 4E. The pyrethroids are highly effective against cutworms and moderately effective against Russian wheat aphid, while Lorsban is highly effective against the aphid but not effective against cutworms at the label rate.

See Table 2 for simple treatment guidelines for deciding whether a Russian wheat aphid treatment should be made. If one tiller shows damage, then the plant should be considered damaged. Aphids can be very difficult to find during cold weather, so base treatment decisions on damage alone under such conditions.

Table 2. Treatment guidelines for Russian wheat aphid by crop stage.

Crop Stage	**Level at which aphids should be treated**[1]
FALL	
Any growth stage	10-20% damaged plants
SPRING	
Regrowth to early boot	5-10% damaged and infested tillers
Early boot to flowering	10-20% damaged and infested tillers
After flowering	More than 20% damaged and infested tillers

[1]Based on a 100 plant or tiller sample.

An alternative threshold for the period from spring regrowth to heading, which takes into consideration control costs and expected crop value, is as follows:

$$\% \text{ Infested Tillers} = \frac{\text{Control Costs (\$/acre)} \times 200}{\text{Expected yield (bu/acre)} \times \text{Expected price (\$/bu)}}$$

For example, the % infested tillers above which treatment should be considered for $15 control costs, 34 bu/acre expected yield and $3.50 would be calculated as follows:

$$25\% \text{ Infested Tillers} = \frac{\$15.00 \times 200}{34 \times \$3.50}$$

Increases in crop value or reduced control costs result in less infestation required to justify treatment, while the reverse is true for decreased crop value or increased control costs. For example, if the price of wheat were lower it would take more aphid damage to justify an insecticide expenditure.

$$32\% \text{ Infested Tillers} = \frac{\$15.00 \times 200}{34 \times \$2.75}$$

If the percentage of infested tillers calculated in this manner is less than the percentage of infestation observed in a 100-tiller sample from the field being evaluated, then a treatment should be considered. After heading, use a factor of 500 rather than 200 in the numerator.

Further Information

The ***High Plains Integrated Pest Management Guide for Colorado, western Nebraska, Wyoming, and Montana*** provides on-line management information for Russian wheat aphid and the other pests and diseases of small grains, as well as most other crops grown in the region.

http://www.highplainsipm.org/

The Colorado State University fact sheet ***Aphids in Small Grains*** summarizes management information for Russian wheat aphid as well as other aphids that attack wheat and similar crops in Colorado.

http://www.ext.colostate.edu/pubs/insect/05568.pdf

Areawide Pest Management for Wheat: Management of Greenbug and Russian Wheat Aphid is a cooperative project between USDA-ARS and several states, including Colorado. This project is designed to improve the management of these key wheat pests through diversified cropping, resistant varieties, remote sensing, and other pest management tools. New pest management information is being developed through economic surveys, field research, and grower focus groups. Colorado research sites are located at Walsh, Lamar, and Briggsdale.

http://www.pswcrl.ars.usda.gov/AWPM2/index.htm

CONTROL OF BROWN WHEAT MITE *[Petrobia latens* (Muller)*]* IN WINTER WHEAT WITH SPRAYER APPLIED DIMETHOATE 4EC. LAMAR, CO 2004

Cynthia Walker, Deborah Harn, Frank Peairs, Shawn Walter, Department of Bioagricultural Sciences and Pest Management

Dimethoate 4EC was applied to winter wheat on 30 March 2004 using a Delco Sprayer at a rate of 0.5 pint/A calibrated to apply 12.4 gallons of water using TeeJet AI 11002 VS nozzles at 60 psi with a 20 inch nozzle spacing and a speed of 6 mph. Wind speed ranged from 3-5 mph and temperatures ranged from 61°F to 70°F during the application. Plots were approximately 50 feet by 320 feet and consisted of four replicates arranged in a split plot design. Two varieties were included in the trial, Prairie Red and TAM 107 grown under two cropping systems, Wheat-Fallow and Wheat-Sorghum-Fallow. Crop stage was jointing (Zadoks 32).

Pretreatment counts of brown wheat mite *(Petrobia latens* Muller*)* were determined by using a Vortis insect suction sampler which collects the insects in an attached jar.. The Vortis suctions an area $0.2m^2$ and was placed over 5 randomly selected rows within each plot. Mites were then counted in the lab from the composite sample of suctioned rows. The results are shown in Table 1. There were no differences in the number of BWM in the two cultivars but there were more BWM collected from wheat grown under a WF system compared to the WSF system. No further sampling of BWM occurred as the Vortis sampler broke and was not repaired in time for additional samples.

Table 1. Number of brown wheat mites (BWM) in two cultivars grown under WF or WSF cropping systems prior to treating with Dimethoate 4EC.

ave # of BWM			
	Prairie Red	**TAM 107**	**Average by System**
WF	98.5	100.5	**99.5**
WSF	73.0	69.8	**71.4**
Average by Cultivar	**85.75**	**85.15**	

Six weeks after treatment, samples were collected to determine the level of Russian Wheat aphid *(Diuraphis noxia* Mordvilko*)* in the plots. Evaluations were made by collecting 25 tillers randomly from the plots. The number of RWA was determined by examining the tillers in the lab. During the evaluation, it was noted that a high number of the tillers had colonies of Banks grass mites *(Oligonychus pratensis* Banks*)*. Due to the high number of tillers infested with BGM, a subsample of the samples were evaluated to determine the number of BGM present. The results of RWA and BGM evaluations are presented in Table 2. The number of RWA, BGM, and the yield for the cultivars, system, and treatment were compared by analysis of variance and the Student-Neuman-Keul test ($\propto = 0.05$).

More RWA were observed in the WF system compared to the WSF system. While there were more RWA in the plots that had been treated with Dimethoate 4EC than the untreated plots, there were no significant differences. There were also more BGM in the sprayed plots than the unsprayed plots. Although the differences were not significant, it is interesting to note that more BGM were found in the treated plots.

Table 2. Number of Russian wheat aphid (RWA) and Bank's grass mites (BGM) in two cultivars grown under WF or WSF cropping systems 42 days after treating with Dimethoate 4EC.

		ave # of RWA (42 DAT)		Average by System	
		Sprayed	**Unsprayed**	**Sprayed**	**Unsprayed**
WF	**Prairie Red**	14.5	0.5	**38.0**	**31.0**
	TAM 107	61.5	61.5		
WSF	**Prairie Red**	49.5	8.5	**26.0**	**19.0**
	TAM 107	2.5	29.5		
Average by Treatment		**32.0a**	**25.0a**		
		ave # of BGM (42 DAT)			
WF	**Prairie Red**	130.0	57.0	**143.0**	**57.0**
	TAM 107	156.0	57.0		
WSF	**Prairie Red**	165.0	165.5	**143.0**	**186.3**
	TAM 107	121.0	207.0		
Average by Treatment		**143.0a**	**121.6a**		

Yields were determined by collecting 5 meter rows from each plot and threshing the samples with a Brehon Simple Sampler portable combine. These results are shown in Table 3. The yields in the plots treated with Dimethoate 4EC were significantly higher than the plots left untreated. While yields were slightly higher in the WSF system, there were no significant differences between systems or by cultivar.

Table 3. Yield (bu/A) from two cultivars grown under WF or WSF cropping systems treated with Dimethoate 4EC.

		Bu/A			
		Treated	**Untreated**	**Ave by Cultivar**	**Ave by System**
WF	**Prairie Red**	12.4	7.0	**9.7**	**10.1**
	TAM 107	12.6	8.4	**10.5**	
WSF	**Prairie Red**	13.3	7.3	**10.3**	**10.3**
	TAM 107	13.8	6.7	**10.3**	
Average by Treatment		**13.0a**	**7.4b**		

Field History

Pest:	Brown wheat mite *(Petrobia latens* Muller*)*, Russian Wheat aphid *(Diuraphis noxia* Mordvilko*)*, Banks grass mites *(Oligonychus pratensis* Banks*)*
Cultivars:	Prairie Red, TAM 107
Planting Date:	7 September 2003
Irrigation:	Dryland
Planting Rate:	45 lbs/A
Crop History:	Wheat-Fallow or Wheat-Sorghum-Fallow
Herbicide:	8 oz/A Clarity on 24 October 2003; 0.1 oz/A Ally + 8 oz/A 2,4-D on 25 March 2004
Insecticide:	None prior to Dimethoate 4EC
Fertilization:	NH_3 30 lbs/A on 4 July 2003; 4.4 lbs/A at planting
Soil Type:	Wiley silt loam
Location:	Southwest of Lamar on Chris Rundell Farm. Approximately 0.5 miles south of Prowers County Road AA on County Road 2. Prowers County, SW¼ Sec.8, T24S, R47W.

CONTROL OF BROWN WHEAT MITE *[Petrobia latens* (Muller)*]* IN WINTER WHEAT WITH HAND-APPLIED DIMETHOATE 2.67 EC AT THREE GROWTH STAGES. LAMAR, CO 2004

Cynthia Walker, Deborah Harn, Frank Peairs, Shawn Walter, Department of Bioagricultural Sciences and Pest Management

Dimethoate 2.67 EC was applied to winter wheat on three dates using a 'rickshaw-type' CO_2 sprayer at a rate of 1 pint/A calibrated to apply 18.5 gallons of water using TeeJet AI 11002 VS nozzles at 30 psi with a and a speed of 2.4 mph. Plots measured 12 feet by 50 feet and consisted of six replicates arranged in a complete randomized block design. The application date, crop growth stage, and conditions during application are shown in Table 1.

Table 1. Application dates, crop growth stage, and conditions during application of Dimethoate 2.67 EC for brown wheat mite.

		Weather conditions during application	
Application date	**Crop Growth Stage**	**Temperature**	**Wind Speed**
17 February 2004	Zadoks 27-28	54°-57°F	2-3 mph
2 March 2004	Zadoks 30	40°-43°F	7-8 mph
30 March 2004	Zadoks 33	58°-66°F	3-6 mph

Pretreatment counts of brown wheat mite *(Petrobia latens* Muller*)* were determined by using a Vortis insect suction sampler which collects the insects in an attached jar. The Vortis suctions an area $0.2m^2$ and was placed over 5 randomly selected rows within each plot. Mites were then counted in the lab from the composite sample of suctioned rows. The results are shown in Table 2. No pretreatment levels of BWM could be made prior to the third spray, nor was any further sampling was conducted as the Vortis sampler broke and was not repaired in time for additional samples.

Table 2. Effect of treatment timing of 1Pt/Ac of dimethoate 2.67EC on brown wheat mite, Stulp's Farm, Lamar, CO, 2004

	Total BWM ± SEM[1]				
Treatment	**1 week post spray 1**	**2 weeks post spray 1**	**3 weeks post spray 1 / 1 week post spray 2**	**Yield[2]**	**Test Weight**
Spray 2, 2 March 2004	---	---	14.3 ± 2.1 B	6.3 ± 0.5	50.4
Spray 1, 17 February 2004	8.8 ± 2.8	2.8 ± 1.9	19.5 ± 7.5 B	6.4 ± 1.3	46.6
Untreated	18.5 ± 5.9	13.1 ± 4.7	88.8 ± 16.4 A	7.7 ± 0.8	48.1
F value	2.19	4.09	15.81	0.61	
p > F	0.1694	0.0708	0.0002	0.5558	

[1]SEM, standard error of the mean. Means in the same column followed by the same letter(s) are not statistically different, SNK (α=0.05).
[2]Yield presented in bushels per acre

Plots were harvested on 3 July 2004 using a small plot combine which harvested an area 9.6' × 50'. These results are presented in Table 2. Plots which were treated with

Dimethoate 2.67 EC had slightly lower yields and test weights than the untreated plots. The reasons for this phenomenon are unclear and the study should be repeated to see if the same impact on yield is observed.

Table 3. Yield of winter wheat treated with Dimethoate 2.67 EC in three single applications at different growth stages.

	Bu/A	Test Wt.
Untreated	7.7	50.4
Spray 1	6.4	46.6
Spray 2	6.3	48.1
Spray 3	6.6	47.8

Field History

Pest:	Brown wheat mite *(Petrobia latens* Muller*)*
Cultivars:	Trego (hard white winter)
Planting Date:	9 Sept & 10 Sept 2003
Irrigation:	Dryland
Planting Rate:	42-45 lbs/A
Crop History:	Wheat-Fallow (for over 15 years)
Herbicide:	Spot spray for bindweed using 2,4-D + Banvel
Insecticide:	None prior to Dimethoate 2.67 EC
Fertilization:	NH_3 40 lbs/A on 4 July 2003
Soil Type:	Colby silt loam
Location:	Southwest of Lamar on Stulp/Ragsdale Farm. Approximately 4.5 miles south of Lamar on US Hwy 287, just south of County Road DD. Prowers County, NE¼ of Sec.31, T23S, R46W.

RUSSIAN WHEAT APHID *(Diuraphis noxia* Mordvilko*)* **INFESTATIONS IN SPRING FEED BARLEY. Walsh, CO. 2004*.**

Kevin Larson,[1] Dennis Thompson [1], Deb Harn [1], Do Mornhinweg [2], Thia Walker [3], Frank Peairs[3].
[1]Plainsman Research Center, Walsh, CO. [2]USDA-ARS, Stillwater, OK. [3]Department of Bioagricultural Science & Pest Management, Fort Collins, CO.

Nine varieties of spring feed barley were planted at the Plainsman Research Center farm on 18 February 2004 at a seeding rate of 58 lb/A. Seven of the nine lines are believed to have some level of resistance to RWA. Two lines, Otis and Baroness, are susceptible to RWA and were included in the experiment for comparison purposes. Otis was also seed-treated with an insecticide, Gaucho®, making ten treatments in all. The experimental design was a randomized complete block with plots measuring 5' × 50' in four replicates. Plots were sprayed on 18 March 2004 with a combination of Ally (0.1 oz/A), 2,4-D (0.38 lb/A), and Activator 90 (1 qt/100 gal water). Plots were allowed to become naturally infested with RWA and were evaluated on 24 May 2004 to determine infestation levels and numbers of RWA. Evaluations were made by collecting 25 tillers per plot and determining the total number of RWA, the percent of symptomatic tillers without RWA(S/NoRWA), the percent of symptomatic tillers with RWA (S/RWA), and the percent of asymptomatic tillers with RWA (As/RWA). The results of the RWA evaluation are shown in Table 1. The highest infestations were found in the Baronesse (33%) followed by the untreated Otis (29%). Both these varieties had the highest levels of RWA as well. The Otis treated with Gaucho® had dramatically less RWA and less infested tillers (3%).

Depsite the plots being hailed on prior to harvest, Do Mornhinweg harvested them and provided the results for Table 1. She estimated that the Otis lines had a 50% loss while Baronesse and ID-251 had a 25% yield loss. While the yields may not be reliable due to the hail losses, 28-95 had the highest yield despite having an RWA infestation of 12%. Several of the experimental lines appear to have good resistance to RWA and the ability to yield well under southeast Colorado growing conditions. These include 28-44B, 28-58B, and 28-77. The Otis treated with Gaucho® had a higher yield than the untreated Otis. This fact, coupled with the reduced infestation level, indicates that the insecticide treatment was beneficial.

Due to the research results in this trial over the last two years, at least two RWA-resistant feed barleys are scheduled to be released to foundation for seed increase. The variety 27-132 will definitely be released along with one, possibly two, others. These varieties will then be available to seed growers in 1 to 2 years as Foundation Seed. Based on the results, the released varieties are believed to be adapted for Colorado, Nebraska, and Idaho.

* This study was also located at Fort Collins, Akron, Stoneham, and Stratton.

Table 1. Evaluation for RWA in spring feed barley at Plainsman Research Center.

Variety	Growth Stage	Percent of Tillers			Total # RWA	Ave. lbs/ plot
		S/NoRWA	S/RWA	As/RWA		
Otis	Heading	7	22	7	59.75	4.67
Otis + Gaucho	Heading	0	1	2	2.5	5.81
Baronesse	Boot	13	28	5	56.25	3.87
ID-251	Late Boot	4	0	9	4.75	3.32
27-132	Heading	1	0	3	1.5	5.71
28-30	Heading	1	0	6	9.5	5.54
28-44B	Heading	2	2	3	3	7.11
28-58B	Heading	2	0	4	6	6.68
28-77	Late Boot-Heading	0	0	3	1.5	7.00
28-95	Heading	8	7	5	20.75	7.27

Residual P on Dryland Wheat, Long Term Study at Manter, 2004

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 income.

RESULTS: The highest producing P treatment was 69 Lb P_2O_5/A with 47 Bu/A. The 92 Lb P_2O_5/A treatment produced significantly less than the other P treatments, and therefore is treated as an outlier and was not used in the yield analysis. Regression analysis shows the optimum P rate at about 60 Lb P_2O_5/A. There was no test weight response to residual P rates. Test weights were 56 to 57 Lb/Bu regardless of P treatment. After two wheat crops, two P rates produced positive total net returns, 23 Lb P_2O_5/A with $7.66 and 46 Lb P_2O_5/A with $11.93, using wheat prices of $3.50/Bu for 2002 and $3.20/Bu for 2004 and 10-34-0 cost of $210/Ton.

DISCUSSION: This is the second wheat crop after we applied the one-time P fertilizer rates. For the first wheat crop following P rates, the yield response from the 46 Lb P_2O_5/A rate had already paid for itself ($0.15/A return from $14.35/A yield increase minus $14.20/A P cost). By the second wheat crop, the two lowest P rates, 23 and 46 Lb P_2O_5/A, produced positive net returns. Although net returns from P rates above 46 P_2O_5/A are increasing, the high cost of P fertilizer continues to keep these P rates from producing positive net returns. Contrary to popular belief, the residual P from the 23 P_2O_5/A rate continues to increase yield compared to 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: For the one time P rate application, Lyndell Herron chiseled on 50 Lb N/A (as NH_3) with six phosphate fertilizer treatments: 0, 5.7, 11.4, 17.2, 22.9, and 28.6 Gal/A of 10-34-0 (0, 23, 46, 69, 92, and 115 Lb P_2O_5/A), using a 30 ft. dual placement N and P chisel applicator with 18 in. spaced shanks on July 13, 2001. Each treatment was replicated twice. Herron planted Akron in the 60 ft. by 680 ft. plots around September 25, 2001 and 2003 at 35 Lb Seed/A. We harvested the plots on June 18 for 2002 and June 25 for 2004 with a self-propelled combine and weighed them in a digital grain cart. Seed yields were adjusted to 12% seed moisture.

In 2001, we randomly sampled the soil at 6 to 8 sites at 0 to 8 in. and 8 to 24 in. depths and sent them to the Colorado State University Laboratory for analysis. The soil was Silty Clay for both depths. The soil test recommendation for our 35 Bu/A yield goal was 0 Lb N/A and 40 Lb P_2O_5/A; no other nutrients were required. The soil test analysis is as follows:

Table .-Soil Analysis.

Depth	pH	Salts mmhos/cm	OM %	N	P	K	Zn	Fe	Mn	Cu
				----------ppm----------						
0-8"	7.8	0.8	1.3	11	2.1	390	0.6	5.1	15	2.5
8-24"				17						

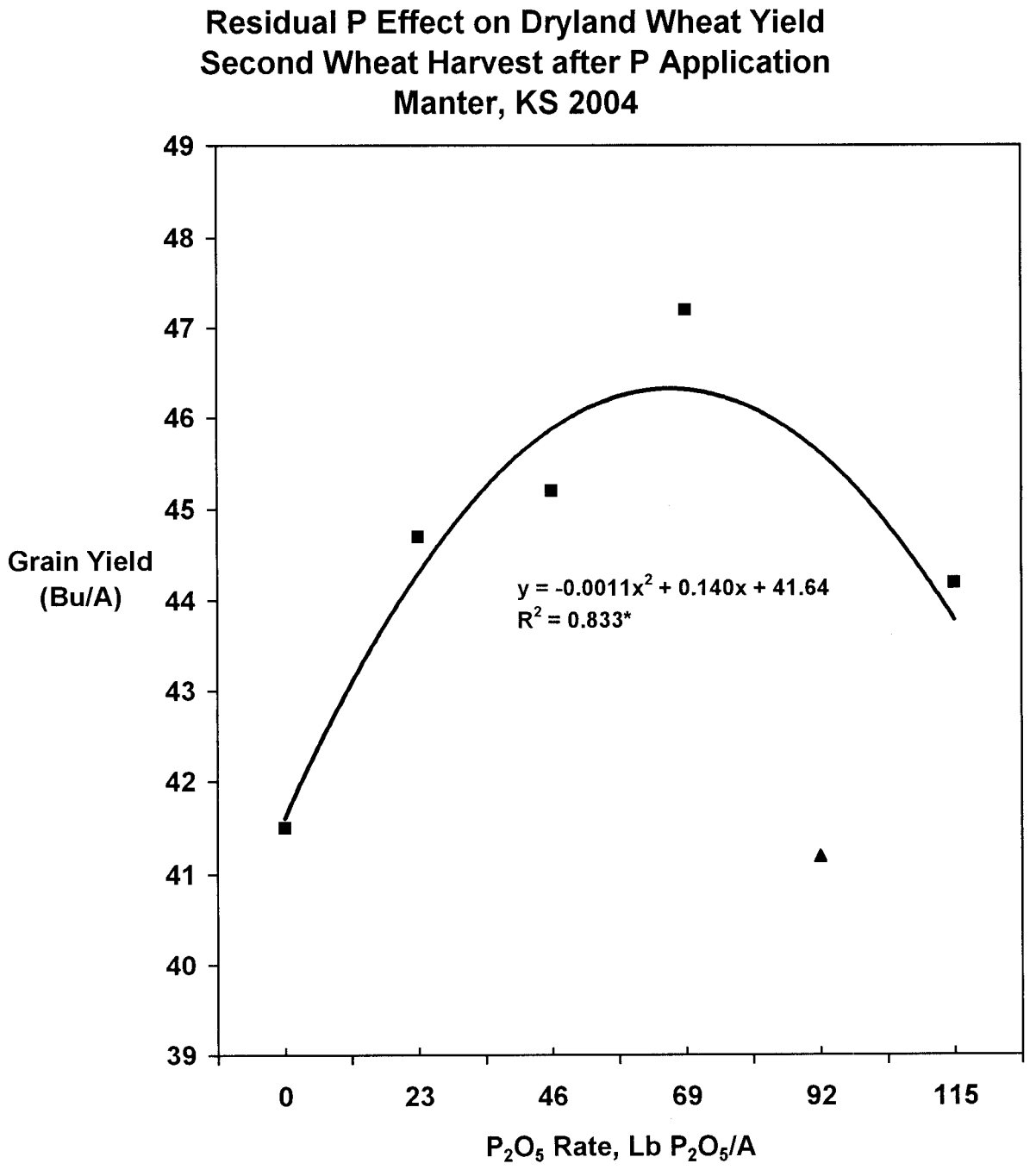


Fig. . Yield and test weight of long term P on dryland wheat, second wheat crop after P application, at Manter. P treatment are 0,23, 46, 69, 92, and 115 Lb P_2O_5/A applied with a chisel with shanks 18 in. apart to a 6 in. depth on July 31, 2000. Grain yields were adjusted to 12% seed moisture content.

Residual P on Dryland Wheat, Manter KS
Net Return from One Time P Application, 2002 and 2004

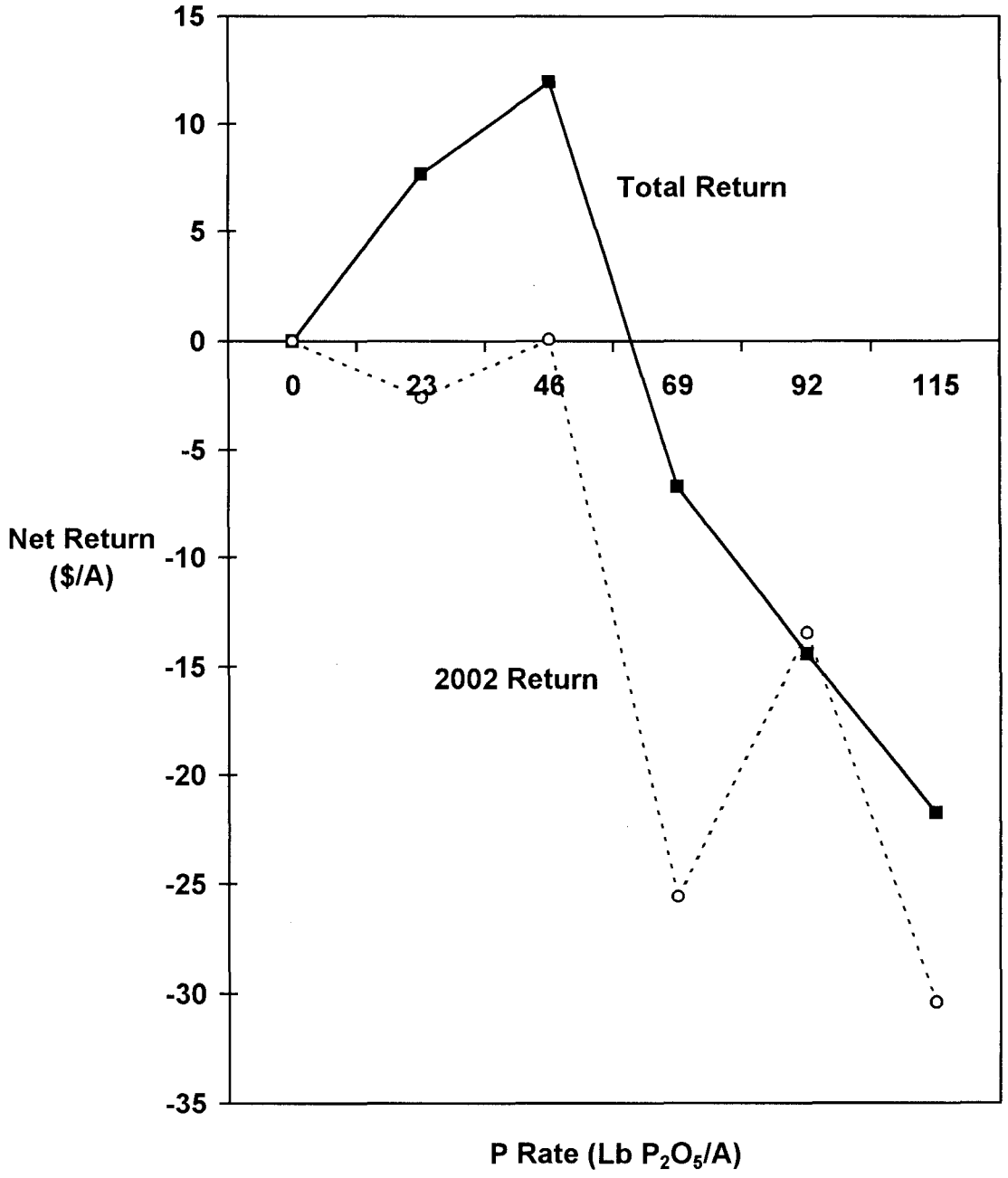


Fig. . Net return of long term P on dryland wheat, second wheat crop after P application, at Manter. P treatment are 0,23, 46, 69, 92, and 115 Lb P_2O_5/A applied with a chisel with shanks 18 in. apart to a 6 in. depth on July 13, 2001. Total return is sum from 2002 and 2004 wheat crops.

Comparison of Large Plot Farm-Scale Strips and Small Plot Performance Trials for Variety Ranking

Kevin Larson[1], Jerry Johnson, Scott Haley, James Quick, James Echols, John Shanahan, Dennis Thompson, and Deborah Harn

Growers' acceptance of research results from replicated small plots has been less than desirable. A common belief among growers is that small replicated plots are inferior to large farm-scale plots because large plots more closely resemble field conditions. Growers' distrust of research results from small plots and greater acceptance from large farm-scale plots was one of the reasons for establishing the Plainsman Agri-Search Foundation. The Plainsman Agri-Search Foundation is a growers association that helps advise and financially supports the Plainsman Research Center, one of the branch stations of Colorado State University Agricultural Experiment Station. The Plainsman Agri-Search Foundation purchased a large farm so that the staff at Plainsman Research Center could perform farm-scale research and not rely on information from small research plots. Dryland winter wheat variety trials have been conducted with small replicated plots and large farm-scale strip plots adjacent to one another at the Plainsman Research Center for 10 years. We compared ranking order of dryland winter wheat varieties of large strip plots with two replications to small plots with three or four replications to determine if ranking order was equivalent.

Materials and Methods

We compared grain yields from the past 10 years, 1994 to 2003, (1996 is omitted because winterkill prevented grain harvest) of dryland winter wheat variety performance trials (Johnson, Haley, Quick, Echols, and Shanahan were the principal investigators) and dryland winter wheat variety strips (Larson, Thompson, and Harn were the principal investigators). Small harvest plots (4 ft. by 44 ft.) were used to determine grain yield of varieties for the variety performance trials and large harvest plots (20 ft. by at least 1000 ft.) for wheat variety strips. Both small and large plots were harvested with self-propelled combines. The harvested grain from each plot was weighed with a portable digital scale for the small plots, whereas, a digital scale wagon was used to measure the grain from the large plots. Both small and large variety plots were conducted in the same field at the Plainsman Research Center near Walsh, Colorado. Herbicides and fertilizers were applied field-wide, therefore, all plots received the same weed control and fertilization and are comparative for any particular year. There were more varieties tested in each study; however, we only ranked those varieties that were common to both studies. We compared variety rankings for grain yield between the large wheat variety strip plots and the small wheat variety performance plots with CoStat version 3.03 software using Friedman's method for randomized blocks (CoHort, 1986). The large and small plots were designated as blocks.

Results and Discussion

For the 10 years of comparison, the average yield from the strip plots was 3 Bu/A higher than the small plots. One reason that the large strip plots had higher average yield was that the yields from the wheat strips were adjusted for moistures and correct plot dimensions were used; whereas, moisture was not measured and plot lengths were

incorrectly assigned for the small plots variety performance trials (from conversation with Scott Haley). The discrepancies between yield measurements did not allow us to directly analyze varieties for average grain yields between large and small plots, therefore, we used a nonparametric rankings test, Friedman's method for randomized blocks, to evaluate equivalency of variety ranking order between small and large plots.

In six of nine harvest years, wheat varieties were ranked similarly for small and large plots ($P > 0.11$) (Fig. 1). Three of nine harvest years had non-significant variety ranking probabilities, the lowest variety ranking probability occurred in 2002. The coefficient of variation for 2002 was 39.9%, and because of the high variance the principal investigators wisely excluded the Walsh site from the dryland wheat variety performance summary. For all other harvest years, the coefficient of variation ranged from 7.3% to 14.0%. Average grain yields of varieties for large and small plots were similarly ranked three-fours of the time (6 out of 8 years) with a ranking probability greater than 0.11 and excluding the highly variable year (2002). In three-fourths of the harvest years (if the high variance year is excluded), large and small plots provided similar variety yield rankings, indicating that accurate variety evaluations can be performed with either small or large plots. This is similar to a report from researchers in Ontario, Canada who found that non-replicated on-farm strip tests and replicated small-plot trails for dryland winter wheat varieties were both effective methods for variety evaluation (Yan et al., 2002).

Table 1.-Dryland Wheat Variety Ranking Probability Comparison of 10 Years of Large and Small Plots Average Yields.

Year	Ranking Probability	Common Varieties Ranked	Large Plot LSD 0.05	Small Plot LSD 0.30	Large Plot Average Yield	Small Plot Average Yield	Large Plot Varieties Tested	Small Plot Varieties Tested
2003	0.02	14	2.1	2.4	25	19	18	27
2002	0.48	11	2.9	3.0	13	7	16	29
2001	0.11	9	3.0	4.3	43	38	15	26
2000	0.34	10	4.1	3.1	34	35	15	26
1999	0.11	11	4.2	3.9	60	62	16	22
1998	0.05	10	3.7	2.8	54	48	16	22
1997	0.37	8	5.5	5.0	57	47	13	24
1995	0.10	6	1.8	1.4	12	12	12	19
1994	0.09	6	1.2	2.1	29	27	10	18
Average	0.19	9	3.2	3.1	36	33	15	24

There was no grain harvested in 1996 for both large and small plots due to winterkill.
Large plot variety strips (20 ft.by 1000 ft.) were RCBD with two replications for all years tested.
Small plot variety performance trials (4 ft. x 44 ft.) were RCBD with three replication for 1998 to 2003 and RCBD with four replication for 1994 to 1997.

The 10-year average of least significant differences (LSD) for multiple variety grain yield comparisons for the large plots is only 0.1 bu/acre higher than the LSD for the small plots. The critical LSD values between large and small plots are similar, but

the level of significance is higher for the large plots, alpha = 5%, than for the small plots, alpha = 30%. The use of a similar critical LSD value for the small plots is warranted if 1 in 3.33, type I errors are acceptable (the chance of making a type I error for the large plots is 1 in 20). From conversions with growers, most dryland wheat producers are willing to accept critical LSD values with 20% to 30% levels of significance. One grower pointed out that he would not bet on harvesting a wheat crop 3 out of 4 years, let alone have one variety yield more than another varieties 3 out of 4 times.

There are advantages and disadvantages of small and large plots for variety evaluations. Small plots allow many varieties to be evaluated simultaneously; whereas, typically only a few select varieties are compared in large plots. Small plots require specialized small plot equipment for planting and harvesting; therefore, the number of locations for small variety plot trials is limited. Large plot variety strip tests can be planted and harvested with typical farm-scale equipment. Numerous on-farm variety strip plots can be tested on growers' fields using their own equipment, and thus provide greater environmental conditions for variety evaluation.

Conclusion

In 6 of 9 years (6 of 8 years, if the high variance year is excluded), small plot variety performance trials with three or four replications provided similar dryland winter wheat variety yield rankings compared to large plot variety strips with two replications. Growers should not be leery of variety evaluations from replicated small plots, if greater type I errors are acceptable. Likewise, researchers should be more accepting of on-farm variety strips, if there are sufficient numbers of on-farm tests to use as replications.

Literature Cited

W. Yan, L.A. Hunt, P. Johnson, G. Stewart, and X. Lu. 2002. On-farm strip trials vs. replicated trials for cultivar evaluation. Crop Science 42:385-392.

CoHort Software, CoStat Users Manual. 1986. Nonparametric tests. CoStat Version 3.03. Berkeley, California. p. 199-211.

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Oats: Seeding Rate Effect on Forage and Grain Yields at Walsh, 2004

Kevin Larson

Oats are occasionally grown in Southeastern Colorado mainly for forage and less often for grain. The typical seeding rate for oats in our area is one to two bushels per acre (36 to 72 Lb/A). We conducted this study to ascertain if the seeding rate optimum is different between oats harvested for forage and oats harvested for grain.

Materials and Methods

We tested four seeding rates: 20, 40, 60, and 80 lb/A. We planted the dryland site on March 10, 2004. The experimental design for our study was a completely randomized block design with four replications. We applied N fertilizer at 50 Lb/A to the site with a sweep plow with an anhydrous attachment. Forage samples (2.0 ft by 2.5 ft) were harvested at boot on May 28, 2004. 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 5 ft. by 50 ft. plots on July 30 with a self-propelled combine equipped with a digital scale. Grain yields were adjusted to 12% seed moisture content.

Results and Discussion

Forage yields had significant linear response to increasing seeding rates (R^2 = 0.947*). We did not achieve a seeding rate optimum for forage yield. Forage yields continued to increase linearly to our highest seeding rate of 80 Lb/A. High seeding rates of at least 80 Lb/A are needed for high forage yields in dryland oats.

There was a nonsignificant linear decline in grain yield from the lowest seeding rate to the highest seeding rate (R^2 = 0.263). The lowest seeding rate tested, 20 Lb/A, had the highest grain yield of 25 Bu/A. However, there was only a 3 Bu/A grain yield difference between the seeding rates. A low seeding rate of 20 Lb/A is all that is required for high grain yield for dryland oats. Even though a low seeding rate is sufficient for high grain yield, a high seeding rate produces significantly more forage and nearly as much grain yield. We recommend a dryland oat seeding rate of at least 80 Lb/A because the forage increase and near neutral grain yield obtain with higher seeding rates.

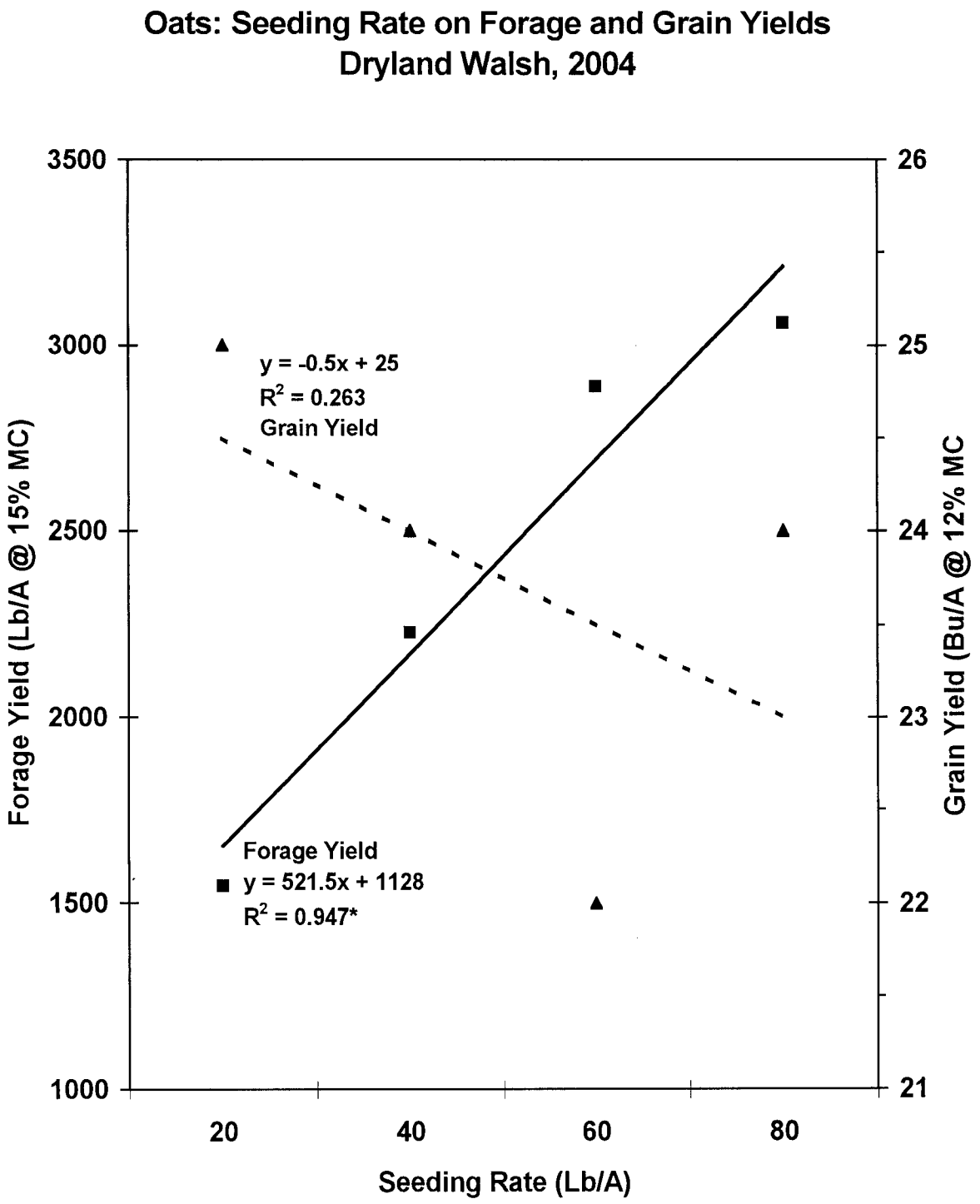

Fig. Forage yield and grain yield from seeding rates for dryland oats at Walsh. Seeding rates were 20, 40, 60, and 80 Lb/A. Oat variety planted was Magnum 2000. Forage samples were taken at boot.

Early Maturing Irrigated Grain Sorghum Hybrid Performance Trial at Walsh, 2004

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 30), under drip-irrigated conditions with 2300 sorghum heat units in Silty Loam soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 87,100 Seed/A. PLANTED: June 30. HARVESTED: November 26.

EMERGENCE DATE: 6 days after planting. SOIL TEMP: 72 F.

IRRIGATION: Drip irrigated for 15 weeks with 11.7 A-in./A.

PEST CONTROL: Preemergence Herbicides: Roundup 16 Oz/A, Atrazine 1.0 Lb/A. Post Emergence Herbicides Banvel 4 Oz/A, Saber 10 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	0.05	21	0	0	1
July	3.49	780	13	1	32
August	3.10	639	6	0	63
September	2.45	573	9	0	93
October	0.55	249	0	0	118
Total	9.64	2262	28	1	118

\1 Growing season from June 30 (planting) to October 25 (first freeze, 29 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

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

COMMENTS: Planted in good soil moisture. Weed control was very good. Above normal precipitation for the growing season with very cool temperatures throughout the season. No greenbug infestation. Only a few hybrids lodged. Late freeze date. Yields and test weights were good considering the late date of planting and the cool 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"	7.8	0.5	1.7	14	2.5	455	0.8	4.6
8"-24"				14				
Comment	Alka	VLo	Hi	Hi	VLo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	----------Lb/A----------			
Recommended	40	40	0	0
Applied	120	20	0.3	0

Yield Goal: 120 Bu/A.
Actual Yield: 86 Bu/A.

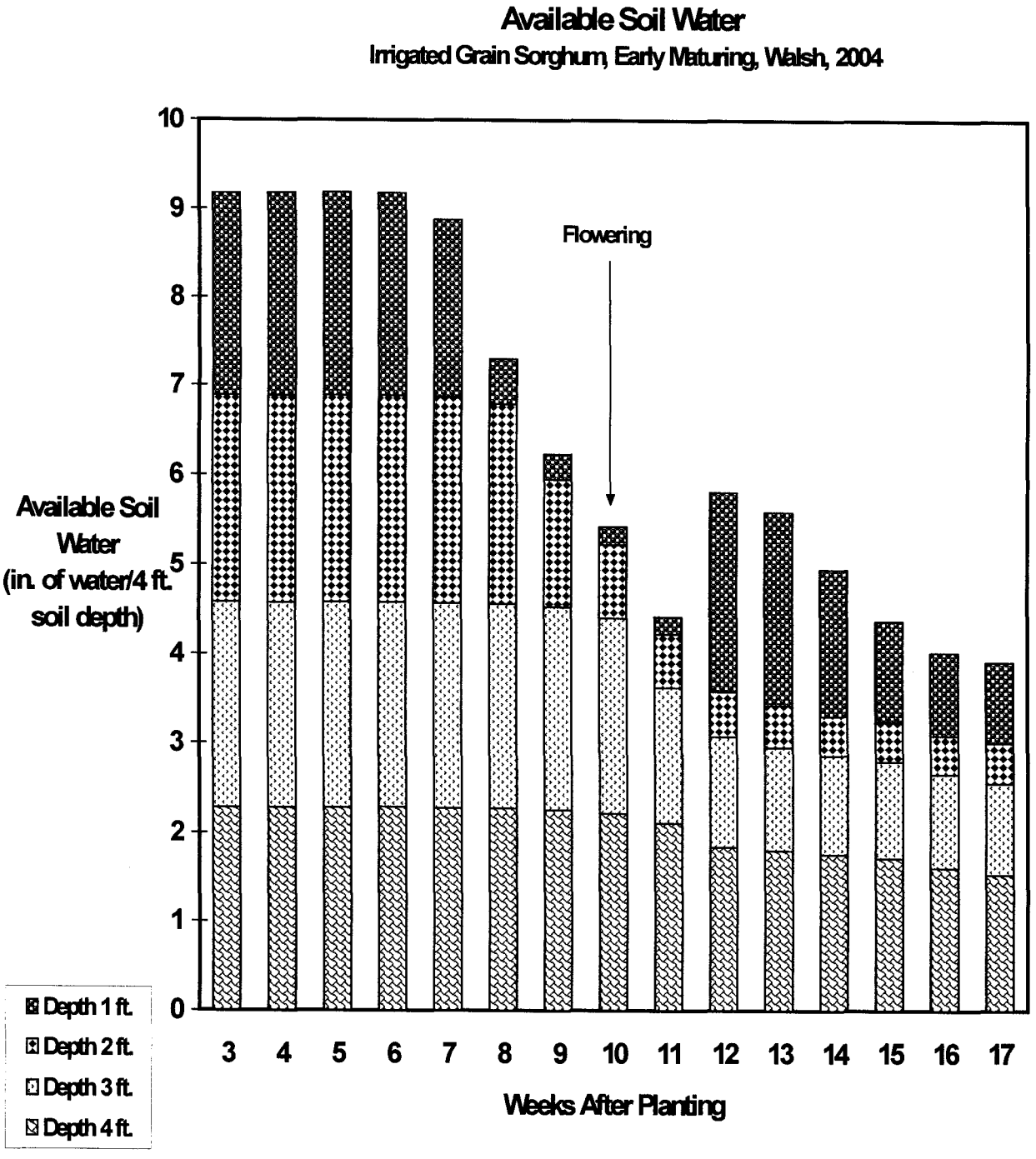

Fig. 1. Available soil water in drip irrigated grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 9.64 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table 2.--Irrigated Grain Sorghum Early Maturing Hybrid Performance Test at Walsh, 2004. \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	Reward	6	63	1460	106	E	42	42.2	2	56	100	116
SORGHUM PARTNERS	251	6	61	1398	103	E	43	34.5	0	57	97	113
DEKALB	DKS 29-28	6	66	1531	112	E	42	48.8	0	56	97	113
DEKALB	DK-28E	7	62	1421	106	E	44	48.0	0	55	93	108
PIONEER	86G08	6	67	1555	113	E/ME	50	43.4	18	55	93	108
SORGHUM PARTNERS	KS 310	6	67	1555	111	E	46	51.9	0	55	93	108
TRIUMPH	TR 418	6	63	1460	105	E	43	45.3	1	57	91	106
FRONTIER HYBRIDS	F-222E	7	71	1624	HD	ME/E	51	37.6	5	54	80	93
SORGHUM PARTNERS	K35-Y5	7	69	1587	116	ME	42	50.0	0	55	77	89
(Check)	399 X 2737	5	76	1751	ED	ML	44	48.4	0	47	37	43
Average		6	67	1534	114	E	45	45	3	55	86	
LSD 0.20											5.3	

\1 Planted: June 30; Harvested: November 26.

Yields are corrected to 14.0% seed moisture content.

DAP: Days After Planting or maturation of seed at first freeze (29 F, October 25).

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, 2002-2004.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2002	2003	2004	2-Year Avg	3-Year Avg	2002	2003	2004	2-Year Avg	3-Year Avg
		----------Bu/A----------					----------%----------				
ASGROW	Reward	76	123	100	112	100	119	105	116	111	113
DEKALB	DK-28E	88	122	93	108	101	138	104	108	106	117
DEKALB	DKS 29-28	74	134	97	116	102	115	114	113	114	114
SORGHUM PARTNERS	KS 310	69	128	93	111	97	108	109	108	109	108
SORGHUM PARTNERS	K35-Y5	60	123	77	100	87	94	105	89	97	96
SORGHUM PARTNERS	251	77	102	97	100	92	120	87	113	100	107
(Check)	399 X 2737	21	88	37	63	49	33	75	43	59	50
Average		64	117	86	102	89					

Grain Yields were corrected to 14.0 % seed moisture content.

Irrigated at Walsh for 2002, 2003 and 2004.

Dryland Grain Sorghum Hybrid Performance Trial at Vilas, 2004

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

PURPOSE: To identify high yielding hybrids under dryland conditions with 2900 sorghum heat units in a Sandy Clay soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 34,800 Seed/A. PLANTED: June 11. HARVESTED: November 16.

EMERGENCE DATE: 10 days after planting. SOIL TEMP: 71 F.

PEST CONTROL: Preemergence Herbicides: Roundup 16 Oz/A, Atrazine 0.63 Lb AI/A. Post Emergence Herbicides: Banvel 5 Oz/A, 2,4-D 0.28 Lb AI/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	6.82	624	6	0	19
July	3.49	780	13	1	50
August	3.10	639	6	0	81
September	2.45	573	9	0	111
October	0.55	249	0	0	136
Total	16.41	2865	34	1	136

\1 Growing season from June 11 (planting) to October 25 (first freeze, 29 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in good soil moisture. Weed control was good. Above normal precipitation for the growing season but very dry around flowering (reflected in available soil water graph). Temperatures were quite cool throughout the season. Late freeze date. No greenbug infestation. Four hybrids lodged 18% or more. Grain yields were fair.

SOIL: Sandy Clay 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"	7.3	0.3	1.0	6	1.8	203	0.6	6.0
8"-24"				6				
Comment	Alka	Vlo	Lo	Mod	V Lo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	----------Lb/A----------			
Recommended	0	40	0	0
Applied	60	20	0	0

Yield Goal: 45 Bu/A.
Actual Yield: 28 Bu/A.

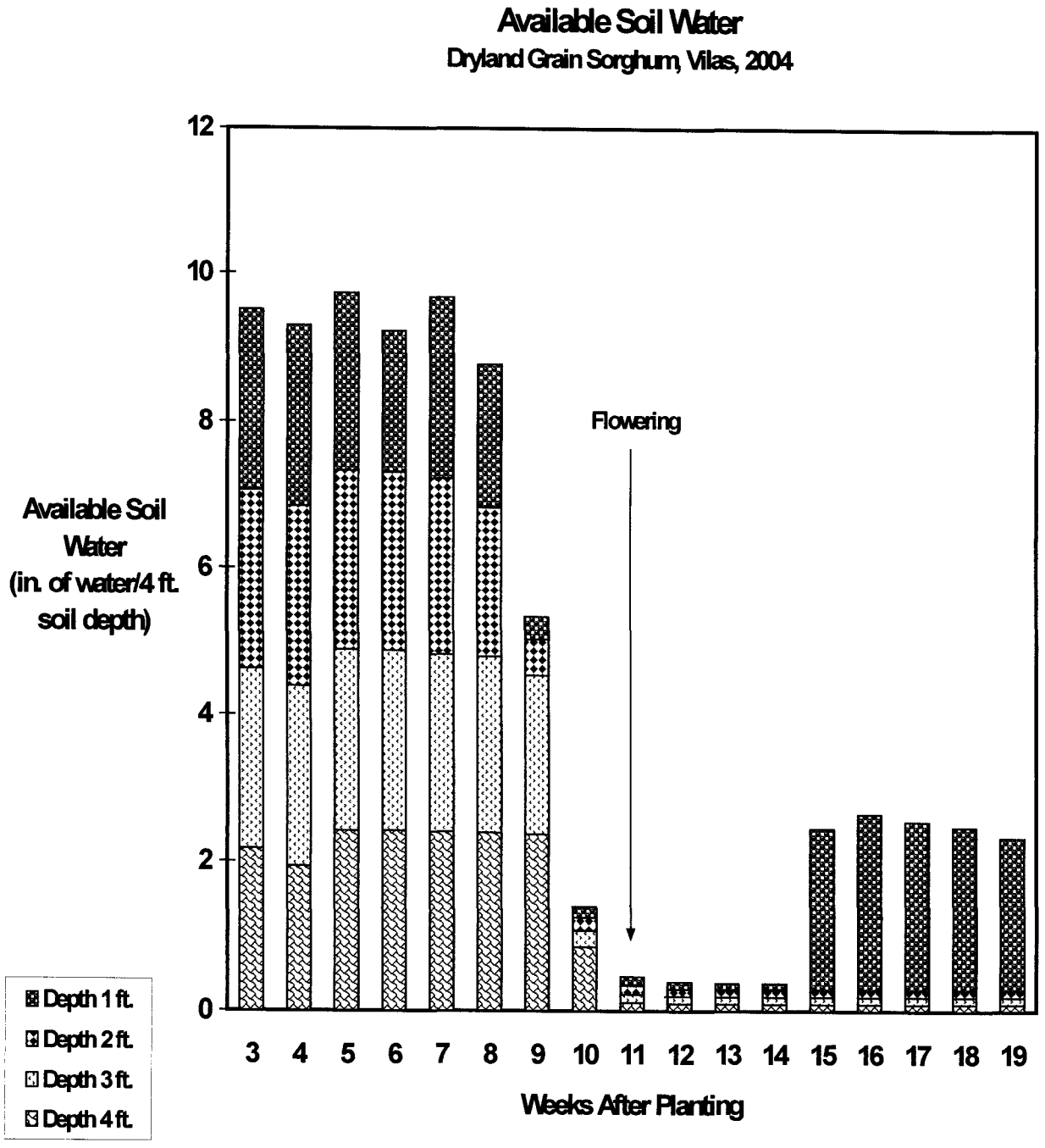

Fig. 2. Available soil water in dryland grain sorghum at Vilas. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 16.41 in. Any increase in available soil water between weeks is from rain.

Table 4.--Dryland Grain Sorghum Hybrid Performance Test at Vilas, 2004. \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	%
SORGHUM PARTNERS	NK 5418	10	75	1657	119	ME/M	34	19.4	14	56	39	140
PIONEER	85G01	9	75	1657	121	ME/M	38	19.8	30	58	35	126
ASGROW	Seneca	10	80	1756	124	ME	35	15.1	3	60	33	116
DEKALB	DKS 37-07	10	72	1592	117	ME	35	15.8	18	56	28	99
ASGROW	Pulsar	10	71	1569	116	ME	35	15.6	18	58	24	85
SORGHUM PARTNERS	NK 6673	9	77	1701	122	ME/M	36	19.1	3	55	20	73
SORGHUM PARTNERS	NK 6641	9	72	1592	118	ME/M	35	18.6	36	58	19	68
SORGHUM PARTNERS	NK 7633	9	82	1795	128	M/ML	34	16.0	1	57	35	123
DEKALB	DK-44	11	80	1756	126	M	37	13.9	4	58	31	110
SORGHUM PARTNERS	NK 7655	10	84	1840	131	ML	38	18.5	2	54	22	80
(Check)	399 X 2737	9	83	1817	130	ML	36	16.7	2	55	20	73
Average		10	77	1703	123	ME	36	17.1	12	57	28	
LSD 0.20									8.0		7.1	

\1 Planted: June 11; Harvested: November 16.

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.

Table 5.--Summary: Dryland Grain Sorghum Hybrid Performance Tests at Vilas, 2002-2004.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2002	2003	2004	2-Year Avg	3-Year Avg	2002	2003	2004	2-Year Avg	3-Year Avg
		----------Bu/A----------					----------%----------				
ASGROW	Seneca	7	17	33	25	19	93	107	116	112	105
ASGROW	Pulsar	6	21	24	23	17	74	129	85	107	96
DEKALB	DKS 36-00	5	9	--	7	--	64	58	--	61	--
DEKALB	DK-44	7	20	31	26	19	88	124	110	117	107
PIONEER	85G01	--	26	35	31	--	--	159	126	143	--
SORGHUM PARTNERS	KS 585	10	11	--	11	--	134	66	--	100	--
SORGHUM PARTNERS	K59-Y2	11	19	--	15	--	153	116	--	135	--
SORGHUM PARTNERS	NK 7633	10	20	35	28	22	128	122	123	123	124
SORGHUM PARTNERS	K73-J6	10	11	--	11	--	132	66	--	99	--
SORGHUM PARTNERS	NK 8828	7	11	--	9	--	95	70	--	83	--
(Check)	399 X 2737	9	15	15	20	13	119	94	73	84	95
Average		7	16	28	22	17					

Grain Yields were corrected to 14.0 % seed moisture content.

Dryland Grain Sorghum Hybrid Performance Trial at Walsh, 2004

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

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

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 34,800 Seed/A. PLANTED: June 3; Replanted June 24. HARVESTED: November 6.

EMERGENCE DATE: 12 days after planting. SOIL TEMP: 72 F.

PEST CONTROL: Preemergence Herbicides: Roundup, 16 Oz/A; 2,4-D, 0.5 Lb/A. Post Emergence Herbicides: Banvel 4.0 Oz/A, Atrazine 1.0 Lb/A, COC 1 Qt/A. CULTIVATION: Once. INSECTICIDES: None.

FIELD HISTORY: Last Crop: Wheat. 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--------		
June	7.62	571	12	1	27
July	3.49	780	13	1	58
August	3.10	639	6	0	89
September	2.45	573	9	0	119
October	0.55	249	0	0	144
Total	17.21	2812	29	2	144

\1 Growing season from June 3 (planting) to October 25 (first freeze, 29 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in poor soil moisture; replanted in good soil moisture. Weed control was good. The growing season was very wet and very cool. Late freeze date. No greenbug infestation. None of the hybrids lodged. Grain yields were very good considering the late replanting date and the cool 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"	7.6	0.8	1.2	36	1.8	341	0.5	5.3
8"-24"				14				
Comment	Alka	Vlo	Mod	VHi	VLo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

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

Yield Goal: 45 Bu/A.
Actual Yield: 61 Bu/A.

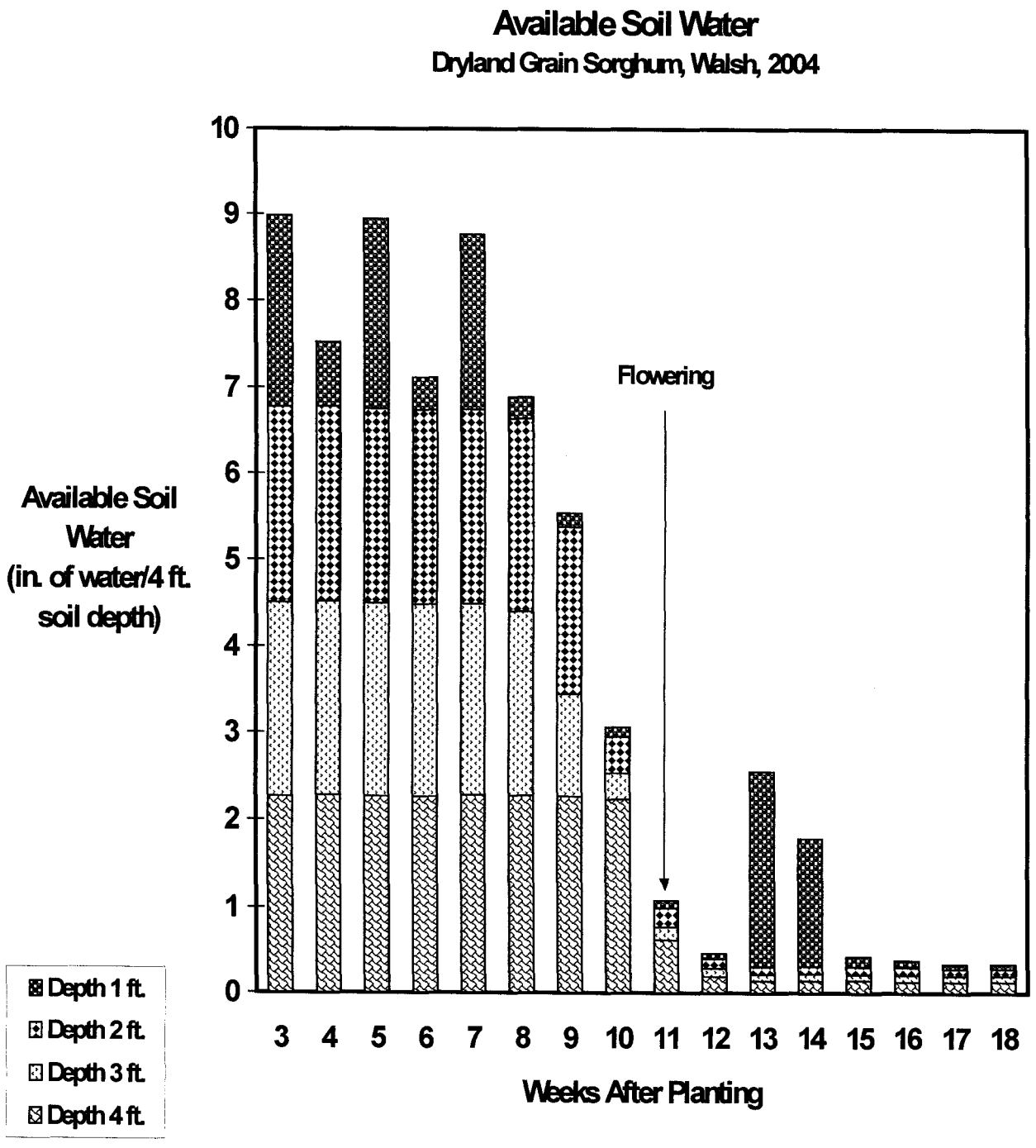

Fig. 3. Available soil water in dryland grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 17.21 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table 6.--Dryland Grain Sorghum Hybrid Performance Test at Walsh, 2004. \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	%
PIONEER	85G01	12	76	1691	HD	ME/M	42	30.0	0	55	81	131
TRIUMPH	TR 438	13	72	1616	115	ME	44	31.8	0	56	79	129
SORGHUM PARTNERS	NK 5418	12	72	1616	115	ME/M	38	26.3	0	55	75	122
DEKALB	DKS 37-07	11	74	1655	HD	ME	38	32.1	0	55	70	114
ASGROW	Seneca	12	77	1708	HD	ME	38	23.0	0	56	66	107
ASGROW	Pulsar	12	75	1671	HD	ME	38	25.7	0	54	64	105
FRONTIER HYBRIDS	F-222E	12	74	1655	121	ME/E	37	26.5	0	56	63	102
SORGHUM PARTNERS	NK 6641	13	75	1671	HD	ME/M	38	24.0	0	55	60	98
FRONTIER HYBRIDS	F-303C	13	75	1671	HD	ME	37	23.8	0	54	57	93
SORGHUM PARTNERS	NK 6673	12	76	1691	HD	ME/M	38	25.4	0	53	56	91
FRONTIER HYBRIDS	F-270E	13	77	1708	HD	ME	35	24.8	0	54	53	86
SORGHUM PARTNERS	NK 7633	13	79	1756	SD	M/ML	39	25.9	0	52	55	90
DEKALB	DK-44	13	79	1756	SD	M	39	25.9	0	52	52	85
(Check)	399 X 2737	12	81	1808	ED	ML	37	21.5	0	50	43	70
SORGHUM PARTNERS	NK 7655	12	82	1835	ED	ML	39	22.8	0	49	40	65
Average		12	76	1701	HD	ME	38	26.0	0	54	61	
LSD 0.20											5.1	

\1 Planted: June 3; Replanted June 24; Harvested: November 6.

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.

Table 7.--Summary: Dryland Grain Sorghum Hybrid Performance Tests at Walsh, 2002-2004.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2002	2003	2004	2-Year Avg	3-Year Avg	2002	2003	2004	2-Year Avg	3-Year Avg
		----------Bu/A----------					----------%----------				
ASGROW	Seneca	52	36	66	51	51	102	144	107	126	118
ASGROW	Pulsar	54	34	64	49	51	105	135	105	120	115
DEKALB	DK-44	56	23	52	38	44	109	94	85	90	96
DEKALB	DKS 36-00	57	29	--	43	--	112	116	--	114	--
NC+	NC+ 5B89	67	34	--	51	--	131	134	--	133	--
PIONEER	85G01	--	31	81	56	--	--	125	131	128	--
SORGHUM PARTNERS	KS 585	60	12	--	36	--	117	48	--	83	--
SORGHUM PARTNERS	K59-Y2	55	17	--	36	--	107	66	--	87	--
SORGHUM PARTNERS	NK 7633	48	36	55	46	46	93	146	90	118	110
SORGHUM PARTNERS	K73-J6	34	18	--	26	--	66	72	--	69	--
SORGHUM PARTNERS	NK 8828	47	25	--	36	--	90	100	--	95	--
TRIUMPH	TR 438	59	25	79	52	54	115	98	129	114	114
(Check)	399 X 2737	41	15	43	29	33	79	58	70	64	69
Average		51	26	61	44	46					

Grain Yields were corrected to 14.0 % seed moisture content.

Irrigated Grain Sorghum Hybrid Performance Trial at Walsh, 2004

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

PURPOSE: To identify high yielding hybrids under irrigated conditions with 3000 sorghum heat units in a Silty Loam soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 87,100 Seed/A. PLANTED: May 26. HARVESTED: November 27.

EMERGENCE DATE: 10 days after planting. SOIL TEMP: 71 F.

IRRIGATION: Drip irrigated for 15 weeks with 11.7 A-in./A.

PEST CONTROL: Preemergence Herbicides: Roundup 16 Oz/A, Atrazine 1.0 Lb/A. Post Emergence Herbicides: Banvel 4 0z/A, Saber 10 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	0.01	102	3	0	5
June	7.65	624	12	1	35
July	3.49	780	13	1	66
August	3.10	639	6	0	97
September	2.45	573	9	0	127
October	0.55	249	0	0	152
Total	17.25	2967	43	2	152

\1 Growing season from May 26 (planting) to October 25 (first freeze, 29 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

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

COMMENTS: Planted in marginal soil moisture. Weed control was good. The growing season was very wet and very cool. Late freeze date. No greenbug infestation. Three hybrids had 14% or more lodging. 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"	7.8	0.5	1.7	14	2.5	455	0.8	4.6
8"-24"				14				
Comment	Alka	VLo	Hi	Hi	VLo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	----------Lb/A----------			
Recommended	49	20	0	0
Applied	120	20	0.3	0

Yield Goal: 140 Bu/A.
Actual Yield: 111 Bu/A.

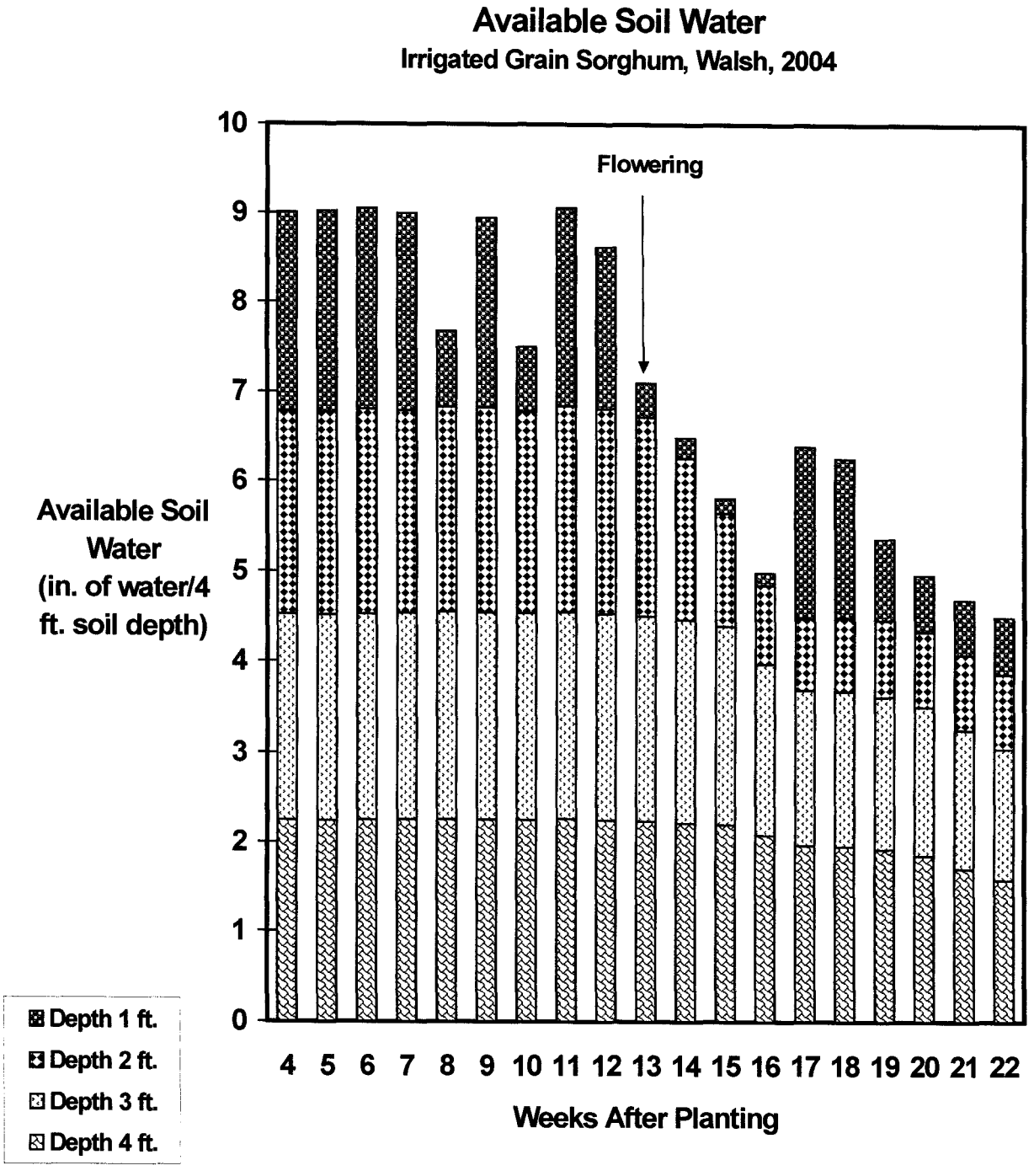

Fig. 4. Available soil water in irrigated grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 17.25 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table 8.--Irrigated Grain Sorghum Hybrid Performance Test at Walsh, 2004. \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	%
PIONEER	85G01	10	89	1995	140	ME/M	53	32.9	19	58	121	109
SORGHUM PARTNERS	NK 5418	9	85	1929	134	ME/M	48	26.9	1	58	115	103
SORGHUM PARTNERS	NK 6641	10	90	2020	139	ME/M	48	27.7	4	57	110	99
SORGHUM PARTNERS	NK 6673	10	89	1995	140	ME/M	48	28.9	1	57	107	96
ASGROW	A 567	10	90	2020	142	M/ML	55	27.3	8	58	117	105
FRONTIER HYBRIDS	F-303C	11	95	2115	148	M/ME	49	28.5	0	58	110	99
PIONEER	84G62	9	98	2178	152	ML	53	36.4	2	57	131	118
DEKALB	DKS 53-11	11	98	2178	153	ML	54	25.3	6	58	119	107
SORGHUM PARTNERS	NK 7655	11	101	2249	HD	ML	53	29.3	4	54	117	105
(Check)	399 X 2737	9	98	2178	154	ML	48	31.3	0	56	109	98
ASGROW	A 571	10	104	2304	HD	ML	53	23.0	5	55	107	96
DEKALB	DKS 54-00	10	97	2138	156	ML	53	25.7	6	55	107	96
FRONTIER HYBRIDS	F-457E	9	97	2157	151	ML/M	49	33.3	15	55	104	94
TRIUMPH	TR 465	10	99	2200	156	ML/M	51	26.5	14	56	99	89
SORGHUM PARTNERS	NK 7633	9	97	2157	156	ML	51	26.5	1	55	99	89
FRONTIER HYBRIDS	F-700E	9	102	2272	HD	ML	52	29.3	8	54	98	88
Average		10	96	2130	149	M	51	28.7	6	56	111	
LSD 0.20											5.8	

\1 Planted May 26; Harvested: November 27.

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, 2002-2004.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2002	2003	2004	2-Year Avg	3-Year Avg	2002	2003	2004	2-Year Avg	3-Year Avg
		----------Bu/A----------					----------%----------				
ASGROW	A 571	--	132	107	120	--	--	106	96	101	--
DEKALB	DKS 54-00	76	135	107	121	106	100	108	96	102	101
DEKALB	DKS 53-11	--	119	119	119	--	--	96	107	102	--
NC+	NC+ 7R83	78	128	--	103	--	103	103	--	103	--
PIONEER	84G62	99	139	131	135	123	130	111	118	115	120
SORGHUM PARTNERS	NK 5418	--	122	115	119	--	--	98	103	101	--
SORGHUM PARTNERS	KS 585	90	123	--	107	--	118	98	--	108	--
SORGHUM PARTNERS	K59-Y2	78	127	--	103	--	102	102	--	102	--
SORGHUM PARTNERS	KS 73-J6	74	136	--	105	--	98	109	--	104	--
SORGHUM PARTNERS	NK 7633	87	127	99	113	104	115	102	89	96	102
SORGHUM PARTNERS	NK 7655	--	120	117	119	--	--	96	105	101	--
SORGHUM PARTNERS	NK 8828	57	115	--	86	--	75	92	--	84	--
TRIUMPH	TR 465	66	--	99	83	--	86	--	89	88	--
(Check)	399 X 2737	76	125	109	117	103	100	100	98	99	99
Average		76	125	111	118	104					

Grain Yields were corrected to 14.0 % seed moisture content.

Dryland Forage Sorghum Hybrid Performance Trial at Walsh, 2004

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

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

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 69,700 Seed/A. PLANTED: June 3. HARVESTED: October 19.

EMERGENCE DATE: 12 days after planting. SOIL TEMP: 72 F.

PEST CONTROL: Preemergence Herbicides: Roundup 16 Oz/A, 2,4-D 0.5 Lb/A. Post Emergence Herbicides: Atrazine 1.0 Lb/A, Banvel 4 Oz/A, COC 1Qt/A. CULTIVATION: Once. INSECTICIDES: None.

FIELD HISTORY: Last Crop: Wheat. 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--------		
June	7.62	571	12	1	27
July	3.49	780	13	1	58
August	3.10	639	6	0	89
September	2.45	573	9	0	119
October	0.55	185	0	0	138
Total	17.21	2748	40	2	138

\1 Growing season from June 3 (planting) to October 19 (harvest).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in marginal soil moisture. Weed control was good. The growing season was very wet and very cool. No greenbug infestation. Three hybrids had more than 10% 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"	7.6	0.8	1.2	36	1.8	341	0.5	5.3
8"-24"				14				
Comment	Alka	VLo	Mod	VHi	VLo	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	0

Yield Goal: 10 Ton/A.
Actual Yield: 9.7 Ton/A @ 70% MC.

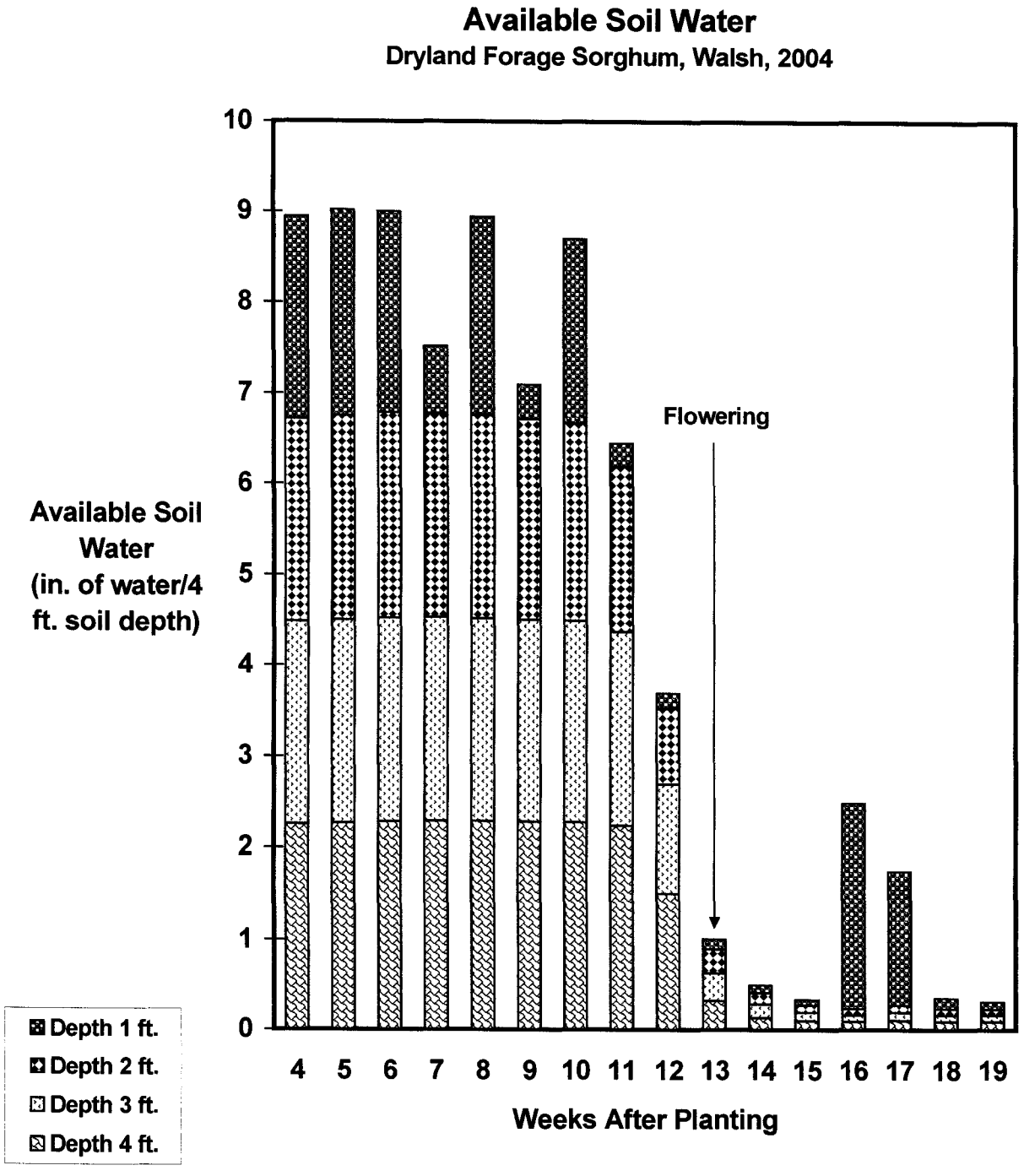

Fig. 5. Available soil water in dryland forage sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 17.21 in. Any increase in available soil water between weeks is from rain.

Table 10.--Dryland Forage Sorghum Hybrid Performance Test at Walsh, 2004. \1

Brand	Hybrid	Forage Type \2	Days to Emerge	Days to 50% Bloom	Harvest Density	Plant Ht.	Stage \3 at Harvest	Stem Sugar	Plants Lodged	Forage Yield	Yield % of Test Average
					Plants/A (1000 X)	In.		%	%	Tons/A	%
SORGHUM PARTNERS	1990	FS	11	Veg	26.5	75	Veg	12	0	12.4	128
SORGHUM PARTNERS	NK 300	FS	11	96	27.3	53	SD	9	0	12.1	125
FONTIER HYBRIDS	Sil Maker 6000	FS	13	92	18.8	51	SD	9	0	11.6	120
(Check)	NB 305F	FS	13	101	19.9	65	LM	16	0	9.5	98
BUFFALO BRAND	Canex BMR 248	FS	12	97	17.4	70	ED	17	0	9.2	95
SORGHUM PARTNERS	SS 405	FS	11	103	25.6	81	MM	13	30	8.9	92
BUFFALO BRAND	Canex BMR 208	FS	12	96	18.0	66	SD	9	0	8.7	90
BUFFALO BRAND	Canex	FS	12	94	24.6	76	SD	16	18	8.5	88
BUFFALO BRAND	Canex BMR 328	FS	12	93	23.0	62	SD	5	0	7.5	77
BUFFALO BRAND	Canex BMR 310	FS	12	96	17.4	64	SD	5	0	6.3	65
AERC	AERC SSH 35	FS	14	95	10.7	72	SD	3	3	3.1	32
SORGHUM PARTNERS	Sordan Headless	SS	11	113	26.9	69	PM	15	0	13.4	138
SORGHUM PARTNERS	Trudan Headless	SS	12	109	26.3	80	PM	17	0	12.3	127
SORGHUM PARTNERS	Trudan 8	SS	12	90	21.7	86	HD	6	12	11.7	120
BUFFALO BRAND	Grazex BMR 727	SS	11	92	26.5	84	HD	5	0	10.1	104
BUFFALO BRAND	Grazex BMR 771	SS	12	88	27.7	80	MT	11	1	10.0	104
SORGHUM PARTNERS	Sordan 79	SS	12	91	27.3	89	HD	14	5	9.6	99
BUFFALO BRAND	Grazex BMR 782	SS	11	90	26.7	80	HD	13	0	9.4	97
GARST	8292 YG1	Corn	10	81	17.8	86	SD	12	0	8.5	87
Sorghum Average		FS	12	91	22.9	72	HD	11	4	9.7	
LSD 0.20										1.40	

\1 Planted: June 3; Harvested: October 19.

\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 11.--Summary: Dryland Forage Sorghum Hybrid Performance Tests at Walsh, 2002-2004.

		Forage Yield					Yield as % of Test Average				
Brand	Hybrid	2002	2003	2004	2-Year Avg	3-Year Avg	2002	2003	2004	2-Year Avg	3-Year Avg
		----------Tons/A----------					----------%----------				
AERC	AERC SSH 35	--	4.9	3.1	4.0	--	--	102	32	67	--
BUFFALO BRAND	Canex	13.5	5.5	8.5	7.0	9.2	124	115	88	102	109
BUFFALO BRAND	Canex II	11.7	4.3	--	8.0	--	107	89	--	98	--
BUFFALO BRAND	Canex BMR 208	9.5	4.8	8.7	6.8	7.7	87	99	90	95	92
BUFFALO BRAND	Canex BMR 310	8.8	5.5	6.3	5.9	6.9	81	115	65	90	87
BUFFALO BRAND	Canex BMR 248	--	5.1	9.2	7.2	--	--	107	95	101	--
BUFFALO BRAND	Buffalo Brand	12.0	5.6	--	8.8	--	110	116	--	113	--
BUFFALO BRAND	Grazex II	10.5	4.1	--	7.3	--	96	86	--	91	--
BUFFALO BRAND	Grazex II W	9.7	4.6	--	7.2	--	89	95	--	92	--
BUFFALO BRAND	Grazex BMR 727	8.5	3.9	10.1	7.0	7.5	78	80	104	92	87
SORGHUM PARTNERS	NK 300	11.9	4.2	12.1	8.2	9.4	109	87	125	106	107
SORGHUM PARTNERS	SS 405	16.0	6.0	8.9	7.5	10.3	147	124	92	108	121
SORGHUM PARTNERS	1990	12.9	3.3	12.4	7.9	9.5	118	48	128	88	98
SORGHUM PARTNERS	Sordan 79	12.2	3.9	9.6	6.8	8.6	112	81	99	90	97
SORGHUM PARTNERS	Sordan Headless	12.5	4.3	13.4	8.9	10.1	115	89	138	114	114
SORGHUM PARTNERS	Trudan 8	11.8	4.2	11.7	8.0	9.2	108	87	120	104	105
SORGHUM PARTNERS	Trudan Headless	9.6	--	12.3	11.0	--	88	--	127	108	--
(Check)	NB 305F	12.8	5.0	9.5	7.3	9.1	117	104	98	101	106
(Check)	Corn	5.7	3.1	8.5	5.8	5.8	52	64	87	76	68
Average		10.9	4.8	9.7	7.3	8.5					

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

Table 12.--Dryland Forage Sorghum Hybrid Dry Matter Analysis at Walsh, 2004.

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-----		
SORGHUM PARTNERS	1990	FS	Veg	45	8.3	29.5	48.0	84.9	68.2	175	0.73	0.45	0.70
SORGHUM PARTNERS	NK 300	FS	Veg	40	7.6	30.5	46.8	84.6	67.3	174	0.71	0.44	0.69
FONTIER HYBRIDS	Sil Maker 6000	FS	86	47	10.8	29.8	51.8	83.9	69.0	167	0.72	0.45	0.71
(Check)	NB 305F	FS	79	40	14.5	27.2	50.2	83.4	66.9	163	0.76	0.49	0.69
BUFFALO BRAND	Canex BMR 248	FS	80	40	12.8	28.8	52.9	82.2	66.5	155	0.74	0.46	0.69
SORGHUM PARTNERS	SS 405	FS	Veg	48	9.7	30.1	52.1	81.7	66.3	154	0.72	0.44	0.68
BUFFALO BRAND	Canex BMR 208	FS	82	42	13.4	28.7	53.0	82.3	65.9	153	0.74	0.46	0.68
BUFFALO BRAND	Canex	FS	79	45	14.0	28.0	52.3	81.6	65.6	152	0.75	0.48	0.68
BUFFALO BRAND	Canex BMR 328	FS	81	47	10.3	31.1	53.4	81.5	66.1	151	0.70	0.43	0.68
BUFFALO BRAND	Canex BMR 310	FS	101	37	11.6	28.4	52.0	80.7	65.5	149	0.75	0.47	0.67
AERC	AERC SSH 35	FS	82	37	12.0	30.2	53.9	79.0	64.4	140	0.72	0.44	0.66
SORGHUM PARTNERS	Sordan Headless	SS	69	36	13.1	30.3	51.5	82.6	67.5	160	0.71	0.44	0.70
SORGHUM PARTNERS	Trudan Headless	SS	Veg	40	9.5	29.5	50.2	82.5	66.4	159	0.73	0.45	0.69
SORGHUM PARTNERS	Trudan 8	SS	Veg	47	10.4	31.0	51.9	81.2	65.9	152	0.70	0.43	0.68
BUFFALO BRAND	Grazex BMR 727	SS	71	51	13.9	29.6	52.2	81.1	65.7	150	0.73	0.45	0.68
BUFFALO BRAND	Grazex BMR 771	SS	77	45	11.8	30.8	53.6	80.0	66.0	147	0.71	0.43	0.68
SORGHUM PARTNERS	Sordan 79	SS	71	46	11.7	32.2	54.6	80.8	65.7	147	0.68	0.41	0.68
BUFFALO BRAND	Grazex BMR 782	SS	77	41	13.1	29.2	51.9	80.4	64.8	147	0.73	0.46	0.67
GARST	8292 YG1	Corn	66	57	13.3	33.7	55.3	81.8	65.5	148	0.66	0.39	0.67
Sorghum Average		FS	69	39	10.4	26.7	46.6	73.7	59.7	140	0.65	0.40	0.62

\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.

Irrigated Forage Sorghum Hybrid Performance Trial at Walsh, 2004

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, 50' long. SEEDING DENSITY: 113,250 Seed/A. PLANTED: June 3. HARVESTED: October 15 and 16.

EMERGENCE DATE: 11 days after planting. SOIL TEMP: 72 F.

IRRIGATION: Three furrow irrigations: June 22, August 25, and September 8, total applied 14 A-in./A.

PEST CONTROL: Preemergence Herbicides: Roundup 16 Oz/A, 2,4-D 0.5 Lb/A. Post Emergence Herbicides: Banvel 4 Oz/A, Atrazine 1.0 Lb/A, COC 1 Qt/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	7.62	571	12	1	27
July	3.49	780	13	1	58
August	3.10	639	6	0	89
September	2.45	573	9	0	119
October	0.55	147	0	0	135
Total	17.21	2710	40	2	135

\1 Growing season from June 3 (planting) to October 16 (harvest).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

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

COMMENTS: Planted in marginal soil moisture. Weed control was good. The growing season was very wet and very cool. No greenbug infestation. Four hybrids had 25% 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"	7.6	0.8	1.2	36	1.8	341	0.5	5.3
8"-24"				14				
Comment	Alka	VLo	Mod	VHi	VLo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

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

Yield Goal: 18 Ton/A.
Actual Yield: 15.3 Ton/A @ 70% MC.

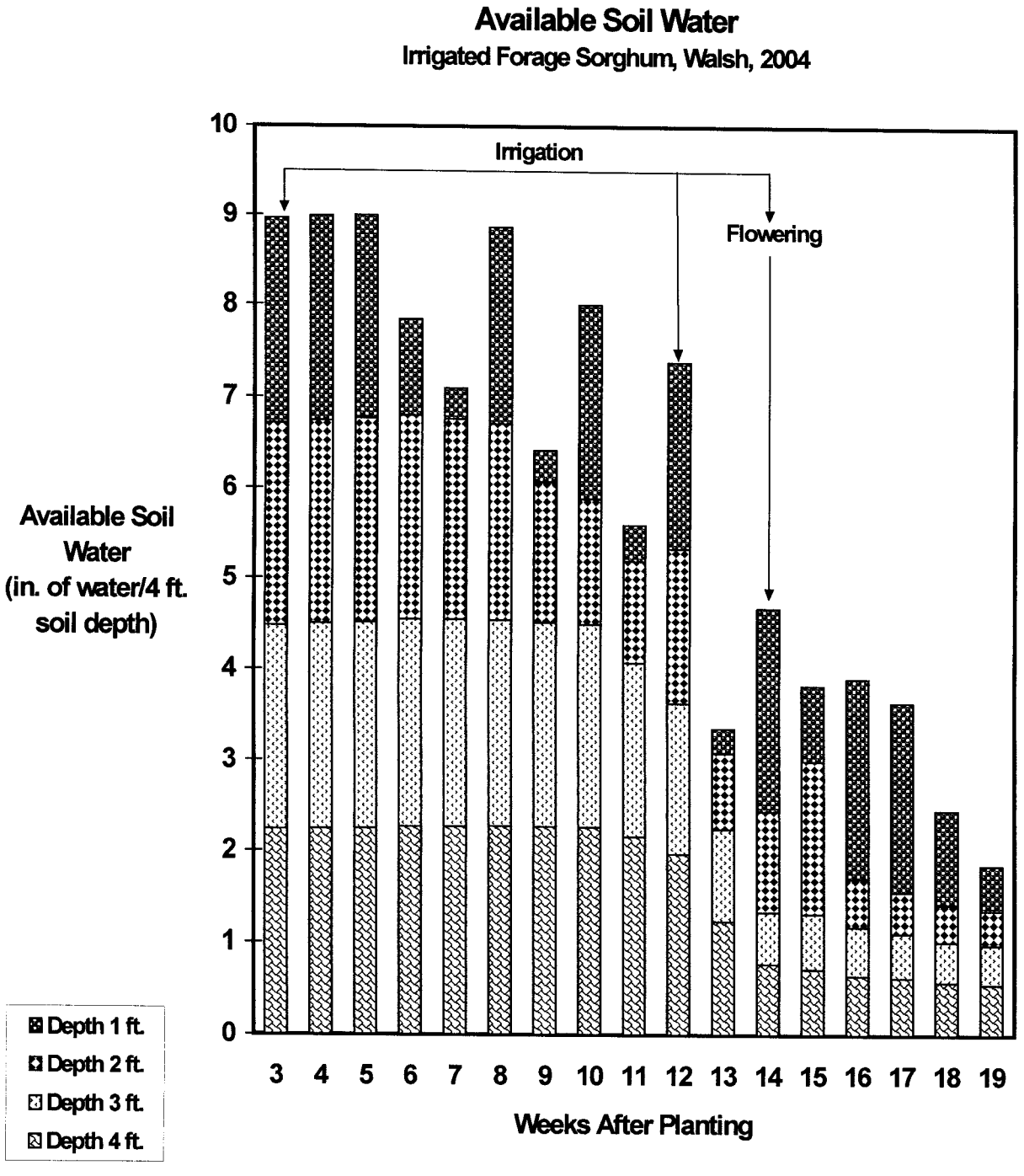

Fig. 6. Available soil water in irrigated forage sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 17.21 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table 13.--Irrigated Forage Sorghum Hybrid Performance Test at Walsh, 2004. \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 Average
					Plants/A (1000 X)	In.		%	%	Tons/A	%
DEKALB	FS-5	FS	10	96	44.1	95	ED	4	0	21.0	137
DEKALB	DKS 59-09	FS	11	95	40.3	70	ED	4	0	20.7	136
FRONTIER HYBRIDS	Sil Maker 5700	FS	10	93	46.1	48	SD	3	0	18.5	121
FRONTIER HYBRIDS	Sil Maker 6500	FS	10	92	43.4	58	SD	4	0	17.9	117
DRUSSEL SEED	DSS Dividend BMR	FS	10	89	38.7	92	SD	4	35	17.8	116
BUFFALO BRAND	Canex BMR 328	FS	11	90	46.9	92	SD	8	0	17.6	115
FRONTIER HYBRIDS	Sil Maker 5500	FS	10	83	39.5	65	HD	6	0	17.4	113
(Check)	NB 305F	FS	13	97	42.6	90	ED	13	2	17.2	112
PIONEER	84B52	FS	10	89	39.1	87	SD	3	40	17.1	112
BUFFALO BRAND	Canex	FS	11	91	39.5	97	SD	13	0	16.4	107
SORGHUM PARTNERS	NK 300	FS	10	86	44.5	68	HD	7	0	16.2	106
MMR	MMR 327/70	FS	11	Veg	33.3	102	Veg	8	4	15.3	100
BUFFALO BRAND	Canex BMR 208	FS	11	91	36.4	90	SD	9	2	15.3	100
BUFFALO BRAND	Canex BMR 248	FS	11	90	30.2	93	SD	12	2	14.4	94
BUFFALO BRAND	Canex BMR 310	FS	12	91	32.9	91	SD	10	0	14.2	93
DEKALB	FS-25E	FS	11	102	42.6	89	MM	9	2	13.3	87
SORGHUM PARTNERS	SS 405	FS	10	101	46.5	107	MM	5	25	13.1	86
MMR	MMR 327/23	FS	11	96	31.4	97	ED	9	45	11.9	77
BUFFALO BRAND	Silex BMR 501	FS	12	101	28.7	87	LM	15	1	9.4	62
AERC	AERC SSH 35	FS	13	93	22.8	84	SD	8	18	7.3	48
SORGHUM PARTNERS	Sordan Headless	SS	11	110	38.3	111	PM	13	0	19.7	129
BUFFALO BRAND	Grazex BMR 782	SS	12	88	36.4	96	HD	9	0	17.4	114
MMR	MMR 352/40	SS	12	102	32.9	106	LM	14	0	17.2	112
MMR	MMR 327/52	SS	11	90	34.5	98	SD	11	2	17.1	112
BUFFALO BRAND	Grazex BMR 771	SS	11	89	37.6	101	HD	11	0	16.4	107
MMR	MMR 327/40	SS	11	101	32.5	103	MM	13	0	16.2	106
SORGHUM PARTNERS	Trudan Headless	SS	11	108	40.7	108	PM	12	0	15.2	99
CAL/WEST SEEDS	CW 1-61-14	SS	13	88	24.4	104	HD	6	1	14.3	93
BUFFALO BRAND	Grazex BMR 727	SS	12	89	31.8	93	HD	9	0	13.4	88
CAL/WEST SEEDS	CW 1-63-14	SS	12	87	27.1	96	HD	7	3	12.8	84
MMR	MMR 327/38	SS	13	97	27.5	91	ED	8	0	12.6	82
CAL/WEST SEEDS	CW 3-65-10	SS	13	97	27.9	93	ED	8	0	11.2	73
CAL/WEST SEEDS	CW 3-65-11	SS	13	97	24.4	98	ED	10	0	9.6	63
GARST	8292 YG1	Corn	9	78	21.7	93	SD	11	0	18.7	122
Sorghum Average		FS	11	94	35.9	91	SD	9	6	15.3	
LSD 0.20										2.05	

\1 Planted: June 3; Harvested: October 15 and 16.

\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 14.--Summary: Irrigated Forage Sorghum Hybrid Performance Tests at Walsh, 2002-2004.

		Forage Yield					Yield as % of Test Average				
Brand	Hybrid	2002	2003	2004	2-Year Avg	3-Year Avg	2002	2003	2004	2-Year Avg	3-Year Avg
		----------Tons/A----------									
AERC	AERC SSH 35	--	19.8	7.3	13.6	--	--	102	48	75	--
BUFFALO BRAND	Canex	19.9	19.8	16.4	18.1	18.7	112	102	107	105	107
BUFFALO BRAND	Canex II	19.0	18.1	--	18.6	--	107	93	--	100	--
BUFFALO BRAND	Canex BMR 208	19.8	16.6	15.3	16.0	17.2	111	86	100	93	99
BUFFALO BRAND	Canex BMR 310	17.9	18.0	14.2	16.1	16.7	101	93	93	93	96
BUFFALO BRAND	Canex BMR 248	--	19.6	14.4	17.0	--	--	101	94	98	--
BUFFALO BRAND	Buffalo Brand	17.8	18.2	--	18.0	12.0	100	94	--	97	65
BUFFALO BRAND	Grazex II	15.7	17.5	--	16.6	11.1	88	90	--	89	59
BUFFALO BRAND	Grazex II W	13.5	17.8	--	15.7	10.4	76	92	--	84	56
BUFFALO BRAND	Grazex BMR 727	17.9	20.8	13.4	17.1	17.4	101	107	88	98	99
CAL/WEST SEEDS	CW 1-61-1	20.1	16.9	--	18.5	--	113	87	--	100	--
CAL/WEST SEEDS	CW 1-61-9	16.9	18.3	--	17.6	--	95	94	--	95	--
CAL/WEST SEEDS	CW 1-61-10	17.1	16.6	--	16.9	--	96	86	--	91	--
CAL/WEST SEEDS	CW 1-63-1	18.0	16.1	--	17.1	--	101	83	--	92	--
DEKALB	FS-5	--	24.0	21.0	22.5	--	--	124	137	131	--
DEKALB	FS-25E	--	23.6	13.3	18.5	--	--	122	87	105	--
DEKALB	DKS 59-09	--	17.4	20.7	19.1	--	--	90	136	113	--
DRUSSEL SEED	DSS Dividend BMR	--	24.1	17.8	21.0	--	--	124	116	120	--
NC+	NC+ Nutri-Cane II	20.7	22.8	--	21.8	--	118	118	--	118	--
NC+	NC+ Nutri-Ton II	19.3	25.6	--	22.5	--	108	132	--	120	--
SORGHUM PARTNERS	NK 300	20.5	21.9	16.2	19.1	19.5	115	113	106	110	111
SORGHUM PARTNERS	SS 405	20.2	20.6	13.1	16.9	18.0	113	106	86	96	102
SORGHUM PARTNERS	1990	18.6	20.2	--	19.4	--	104	104	--	104	--
SORGHUM PARTNERS	Sordan 79	16.6	16.7	--	16.7	--	93	86	--	90	--
SORGHUM PARTNERS	Sordan Headless	20.6	19.9	19.7	19.8	20.1	116	103	129	116	116
SORGHUM PARTNERS	Trudan 8	14.5	19.0	--	16.8	--	81	98	--	90	--
SORGHUM PARTNERS	Trudan Headless	15.9	--	15.2	15.6	--	89	--	99	94	--
(Check)	NB 305F	20.0	20.0	17.2	21.8	19.1	112	113	112	113	112
(Check)	Corn	13.9	19.3	18.7	19.0	17.3	78	99	122	111	100
Average		17.8	19.4	15.3	17.4	17.5					

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

Table 15.--Irrigated Forage Sorghum Hybrid Dry Matter Analysis at Walsh, 2004.

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	FS-5	FS	87	79	11.7	39.3	61.8	77.2	60.5	120	0.56	0.30	0.62
DEKALB	DKS 59-09	FS	85	56	12.5	37.4	56.9	79.0	60.5	129	0.59	0.33	0.62
FRONTIER HYBRIDS	Sil Maker 5700	FS	84	33	14.4	38.5	58.1	80.3	63.3	136	0.57	0.32	0.65
FRONTIER HYBRIDS	Sil Maker 6500	FS	82	46	14.6	32.7	52.1	82.6	65.1	154	0.67	0.41	0.67
DRUSSEL SEED	DSS Dividend BMR	FS	77	64	13.5	37.7	56.8	81.5	63.2	140	0.59	0.33	0.65
BUFFALO BRAND	Canex BMR 328	FS	78	60	13.6	33.6	55.2	83.8	66.4	156	0.66	0.39	0.68
FRONTIER HYBRIDS	Sil Maker 5500	FS	75	39	10.2	39.3	62.0	77.1	61.0	121	0.56	0.30	0.62
(Check)	NB 305F	FS	83	68	13.7	36.7	57.1	82.6	64.6	146	0.61	0.35	0.67
PIONEER	84B52	FS	77	66	13.3	37.8	57.2	82.8	64.7	147	0.59	0.33	0.67
BUFFALO BRAND	Canex	FS	77	72	12.3	35.8	56.0	82.6	66.3	151	0.62	0.36	0.68
SORGHUM PARTNERS	NK 300	FS	78	45	12.2	37.8	58.8	78.1	60.4	124	0.59	0.33	0.62
MMR	MMR 327/70	FS	127	94	10.1	35.5	56.7	80.2	65.2	142	0.63	0.36	0.67
BUFFALO BRAND	Canex BMR 208	FS	80	61	11.9	39.1	59.7	81.9	59.8	131	0.56	0.31	0.61
BUFFALO BRAND	Canex BMR 248	FS	78	61	13.2	35.8	59.3	81.2	64.4	140	0.62	0.36	0.66
BUFFALO BRAND	Canex BMR 310	FS	79	62	14.4	36.3	57.3	82.0	63.4	142	0.61	0.35	0.65
DEKALB	FS-25E	FS	92	74	9.5	38.6	62.6	76.6	62.6	123	0.57	0.32	0.64
SORGHUM PARTNERS	SS 405	FS	88	92	14.8	37.1	57.7	78.0	60.0	124	0.60	0.34	0.61
MMR	MMR 327/23	FS	86	69	13.3	35.5	58.1	80.6	62.3	135	0.63	0.36	0.64
BUFFALO BRAND	Silex BMR 501	FS	87	68	14.4	32.8	49.3	88.8	64.7	175	0.67	0.41	0.67
AERC	AERC SSH 35	FS	83	67	14.3	36.5	55.8	80.0	61.5	134	0.61	0.35	0.63
SORGHUM PARTNERS	Sordan Headless	SS	98	86	10.3	42.2	62.6	75.4	59.3	113	0.51	0.26	0.61
BUFFALO BRAND	Grazex BMR 782	SS	76	69	14.8	35.1	56.7	82.7	65.2	148	0.63	0.37	0.67
MMR	MMR 352/40	SS	92	78	11.3	38.1	59.3	78.5	63.3	131	0.58	0.32	0.65
MMR	MMR 327/52	SS	77	69	14.2	37.8	57.5	81.2	63.1	139	0.59	0.33	0.65
BUFFALO BRAND	Grazex BMR 771	SS	76	65	14.5	36.0	59.7	77.7	60.5	123	0.62	0.36	0.62
MMR	MMR 327/40	SS	90	78	15.4	35.7	54.9	82.2	65.3	149	0.62	0.36	0.67
SORGHUM PARTNERS	Trudan Headless	SS	96	89	10.1	41.5	61.2	78.2	63.1	128	0.52	0.27	0.65
CAL/WEST SEEDS	CW 1-61-14	SS	76	69	11.9	40.1	60.3	80.1	64.2	136	0.55	0.29	0.66
BUFFALO BRAND	Grazex BMR 727	SS	76	64	13.2	38.8	60.9	78.6	61.6	126	0.57	0.31	0.63
CAL/WEST SEEDS	CW 1-63-14	SS	76	72	13.0	39.2	58.9	80.8	63.6	138	0.56	0.31	0.65
MMR	MMR 327/38	SS	84	61	13.3	36.5	55.1	83.1	64.6	150	0.61	0.35	0.66
CAL/WEST SEEDS	CW 3-65-10	SS	83	66	16.6	31.2	48.7	86.2	68.2	178	0.70	0.43	0.70
CAL/WEST SEEDS	CW 3-65-11	SS	86	71	14.9	35.4	51.8	82.9	65.0	155	0.63	0.37	0.67
GARST	8292 YG1	Corn	72	77	17.3	34.3	53.2	83.4	65.3	155	0.65	0.38	0.67
Sorghum Average		FS	84	67	13.1	37.0	57.5	80.7	63.2	139	0.60	0.34	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..

Grain Sorghum Maturity Comparison Study at Brandon, 2004

COOPERATORS: Tim Macklin, Cropping Systems Specialist, Southeastern Colorado, Cooperative Extension; Bruce Fickenscher, Cooperative Extension Leader, Kiowa County; Ron Meyer, Cooperative Extension Specialist, Northeastern Colorado; and Burle Scherler, Farmer, Brandon Colorado.

PURPOSE: To identify which maturity class of grain sorghum hybrids that produce highest yields under dryland conditions.

RESULTS: The three early maturing hybrids: Sorghum Partners NK 310, NC+ 5B89, and Pioneer 87G57, produced higher yield, 11.1 bu/A, and higher test weight, 5.9 lb/bu, than the three medium-early hybrids: Dekalb DK-44, Pioneer 85Y34, and Mycogen 627. There was a significant linear decrease in yield ($R^2 = 0.727$*) and a very highly significant linear decrease in test weight ($R^2 = 0.965$***) between the early maturing hybrids and the medium-early hybrids. The test weight average of 51 lb/bu for the early maturing varieties indicates that even these early maturing varieties did not fully mature before the first freeze. In an adjacent study, a very early maturing grain sorghum hybrid, Mycogen 3556, did mature before the first freeze and produced 58 bu/A with a test weight of 55 lb/bu. With a June 4 planting date, we expected all the early maturing hybrids to fully mature before the first freeze, and in our study none of them fully matured. To a great extent, this maturation delay can be attributed to the abnormally cool growing season: the 2004 growing season was one of the coolest seasons on record. In the Bradon area in order to mature and achieve high yields, only the earliest maturing grain sorghum hybrids should be grown.

PLOT: Twelve rows with 30 in. row spacing, 2500 ft. long. SEEDING DENSITY: 45,000 seeds/acre. PLANTED June 4. HARVESTED: November 8.

PEST CONTROL: Pre-emergence herbicide: Atrazine, 1.0 lb./A. Post emergence herbicide: Roundup, 24 oz/A (shielded sprayer).

Field History: Last Crop: wheat in a wheat-grain sorghum-fallow rotation. FIELD PREPARATION: No Till

FERTILIZATION: Applied 50 lb N/A as 32-0-0 and 5 gal 10-34-0.

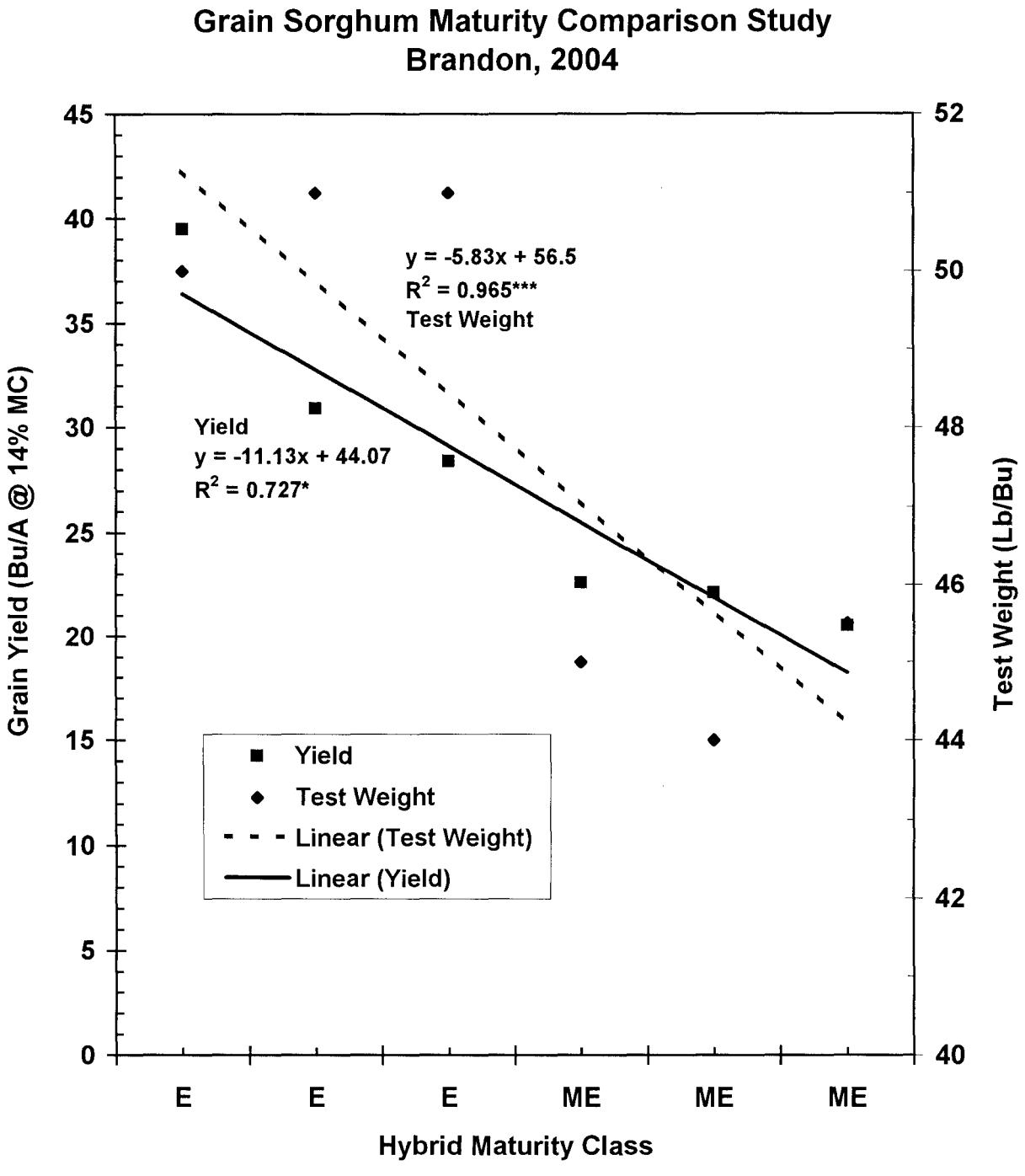

Fig. . Dryland grain sorghum maturity group yield comparison at Bandon. Maturity groups and hybrids used were: E, early (SORGHUM PARTNERS NK310, NC+ 5B89, and PIONEER 87G57); ME, medium early (DEKALB DK-44, PIONEER 85Y34, and MYCOGEN 627). All hybrids were planted at 45,000 Seeds/A.

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. This is the third 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 two replications. We mixed the Zn with 5 Gal 10-34-0/A prior to application. The site was subsurface drip irrigated with 11.7 A-in./A. We planted NC+ 5B89 on July 2 at 87,100 Seeds/A. We applied 120 Lb N/A and 20 Lb P_2O_5/A to the site. For weed control, we sprayed Roundup 16 Oz/A and Atrazine 1.0 Lb/A pre-emergence, and Banvel 4 Oz/A and Saber 10 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 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 (Fig. 9). We expected a yield response to Zn because of the late planting date (July 2) and the suggested Zn role of maturity acceleration observed last year. Last year, 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). Last year 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. This 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 third year of our multi-year irrigated grain sorghum Zn study. The Zn response we obtained this year suggests the Zn fertilizer may be required for high grain sorghum production when planting late. If the growing season is not long enough for full maturation, seedrow Zn may increase both grain yield and test weight. This year's response to Zn shifts our original recommendation of applying seedrow Zn to high

production grain sorghum from 0.5 Lb/A of Zn with a typical planting date to 0.6 to 0.8 Lb/A of Zn with a late planting date.

Literature Cited

Larson, K.J., F.C. Schweissing, D.L. Thompson. 2001. Sorghum hybrid performance tests in Colorado, 2000. Technical Report TR01-2. AES, Dept. of Soil and Crop Sciences, CSU, 53p.

Larson, K.J., F.C. Schweissing, D.L. Thompson. 2003. Sorghum hybrid performance tests in Colorado, 2002. Technical Report TR03-1. AES, Dept. of Soil and Crop Sciences, CSU, 40p.

Larson, K.J., F.C. Schweissing, D.L. Thompson. 2004. Sorghum hybrid performance trials in Colorado, 2003. Technical Report TR04-02. AES, Dept. of Soil and Crop Sciences, CSU, 51p.

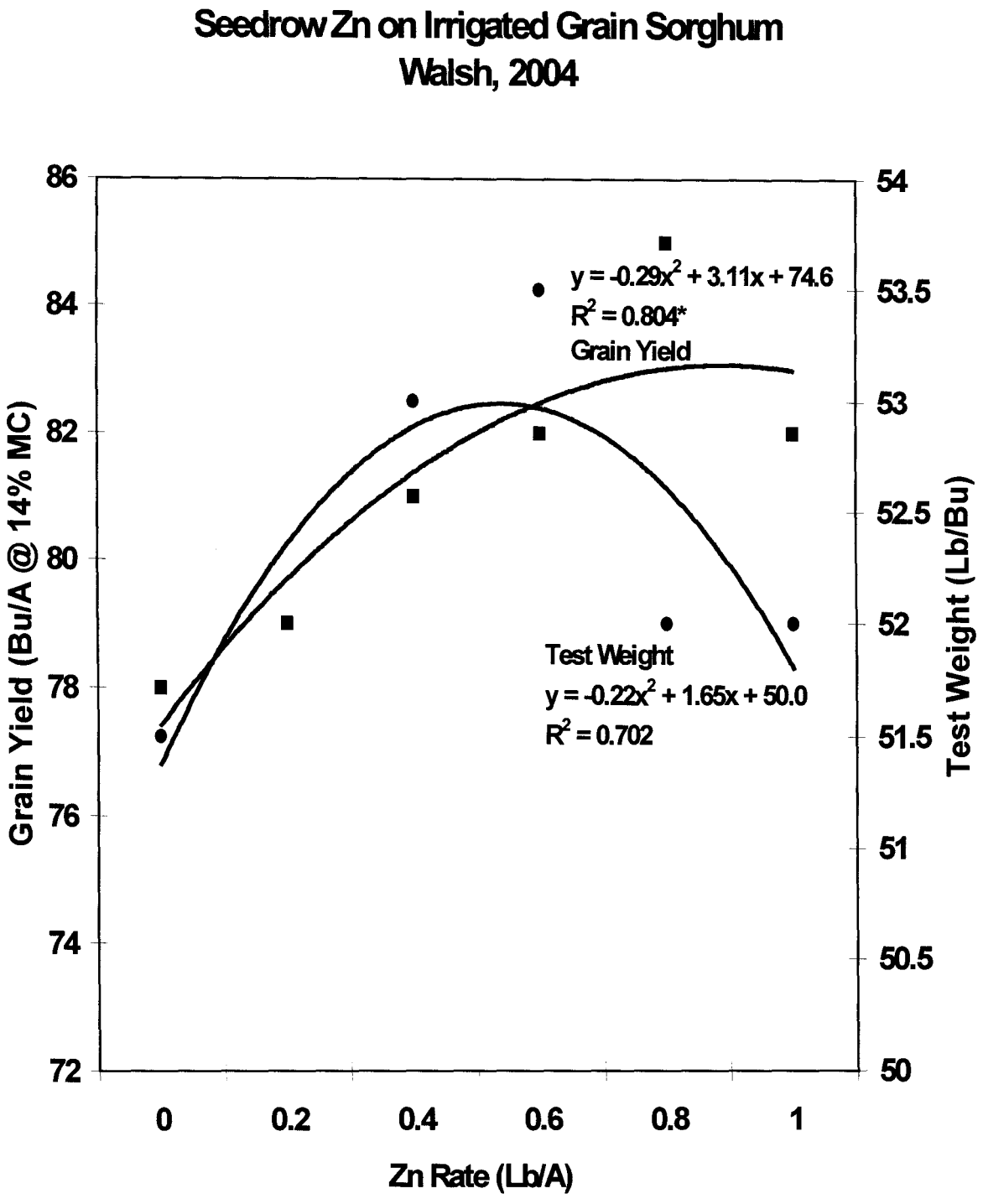

Fig. 7. Seedrow Zn rate on subsurface drip irrigated grain sorghum at Walsh. The Zn rates were 0, 0.2, 0.4, 0.6, 0.8 and 1.0 Lb Zn/A as Zn chelate. The grain sorghum hybrid was NC+ 5B89 planted at 87,100 Seeds/A on July 1.

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

Kevin Larson, Dennis Thompson, and Robert Wood

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 the fertilizer was placed. In this study we compared strip-till placement of anhydrous N to surface applied liquid N for both sprinkler irrigated grain sorghum and corn production.

Materials and Methods

Into a wheat stubble site, we applied N at 135 Lb/A to grain sorghum or 175 Lb/A to corn as anhydrous for the strip-till treatment or liquid 32-0-0 for the surface applied treatment. We used a farmer-constructed implement for the strip-till treatment. Robert Wood, farmer-cooperator, converted a DMI ripper into a strip-till implement by attaching a cold flow anhydrous system, barring off discs, and Lillistan incorporators. We strip-tilled the site on April 8 to a depth of 10 in. and placed anhydrous N at 8 in. On April 20, we surface applied N in 18 in. spaced streams onto the untilled strips. We planned to irrigate after each N application treatment to prevent N volatilization losses, but fortunately it rained (0.38 to 0.53 in.) within two days after each treatment. We planted two corn hybrids, Garst 8377 YG1/RR and Pioneer 34N45, at 26,000 Seeds/A on April 28, and we planted two grain sorghum hybrids, Mycogen 627 and Pioneer 85G01 at 53,000 Seeds/A on May 25. For weed control, we sprayed preplant Balance 3.0 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 Saber 10 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 December 9 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 grain sorghum, strip-till and surface applied N produced the same yield, 118 Bu/A (Table 32). For corn, surface applied N produced significantly more than strip-till N ($P > 0.05$) (Table 34). There was a significant yield difference between the grain sorghum hybrids (Table 33), but not the corn hybrids (Table 35). There was no interaction between the hybrids and the N placement treatments: both the hybrids for the corn and grain sorghum responded similarly to strip-till N and surface applied N. There were significant plant density differences between the hybrids for both corn and grain sorghum. However, there was no significant plant density differences between strip-till N and surface applied N for corn and grain sorghum.

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, 2004). 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 where planting occurs.

We believe 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. However, this moisture loss was not reflected in plant stand: there was no plant density difference in corn between strip-till N and surface applied N. 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).

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).

There appears to be no benefit from strip-till placement of N compared to surface applied N. In fact, strip-till N placement may be a detriment if it is performed too close to planting. The advantage of strip-till may be placement of immobile nutrients such as P. More research in strip-till P placement needs to be conducted.

Literature Cited

Jasa, P.J. Date?. Conservation tillage systems. CE, University of Nebraska, Lincoln, Nebraska. 10p. Accessed: December 2004. http://agecon.okstate.edu/isct/labranza/jasa/tillagesys.doc.

Olsen, B. 2004. Results from 2004 fall field day. CE, AES, Dept. of Agonomy, Kansas State University, Manhattan, Kansas. 4p. Accessed: December 2004. http://www.oznet.ksu.edu/agronomy-block2/fallfieldday2004.pdf.

Table. 32-Sprinkler Irrigated Grain Sorghum, Strip-Till and Surface N Comparison, 2004.

N Placement	50% Silking Date	Plant Density	Test Weight	Grain Yield
		Plants/A X 1000	Lb/Bu	Bu/A
Surface Applied (streamed, liquid 32-0-0)	16-Aug	31.7	59	118
Strip-Till (ripped, NH3 gas)	16-Aug	30.8	59	118
Average	16-Aug	31.3	59	118
LSD 0.05		2.22		5.2

N at 135 Lb/A for Strip-Till N applied April 8; Surface N applied April 20.
Planted: May 25 at 53,000 Plants/A; Harvested: November 8.
Total applied sprinkler irrigation: 7.5 in./A.

Table. 33-Sprinkler Irrigated Grain Sorghum, Hybrid Response to N Placement, 2004.

Hybrid	50% Silking Date	Plant Density	Test Weight	Grain Yield
		Plants/A X 1000	Lb/Bu	Bu/A
PIONEER 85G01	16-Aug	32.8	59	125
MYCOGEN 627	15-Aug	29.8	59	111
Average	15-Aug	31.3	59	118
LSD 0.05		2.00		1.3

N at 135 Lb/A applied strip-till and surface streamed.
Planted: May 25 at 53,000 Plants/A with seedrow applied 10-34-0 at 5 gal/A.
Harvested: November 8.
Total applied sprinkler irrigation: 7.5 in./A.

Table. 34-Sprinkler Irrigated Corn, Strip-Till and Surface Applied N Comparison, 2004.

N Placement	50% Silking Date	Plant Density	Test Weight	Grain Yield
		Plants/A X 1000	Lb/Bu	Bu/A
Surface Applied (streamed liquid 32-0-0)	22-Jul	23.0	61	157
Strip-Till (ripped NH3 gas)	22-Jul	22.2	61	142
Average	22-Jul	22.6	61	150
LSD 0.05		1.55		6.6

N at 175 Lb/A for Strip-Till N applied April 8; Surface N applied April 20.
Planted: April 28 at 26,000 Plants/A; Harvested: December 9.
Total applied sprinkler irrigation: 18.0 in./A.

Table. 35-Sprinkler Irrigated Corn, Hybrid Response to N Placement, 2004.

Hybrid	50% Silking Date	Plant Density	Test Weight	Grain Yield
		Plants/A X 1000	Lb/Bu	Bu/A
GARST 8377 YG1/RR	24-Jul	22.0	60	156
PIONEER 34N45 (Bt)	19-Jul	23.3	61	143
Average	21-Jul	22.7	61	150
LSD 0.05		0.91		20.3

N at 175 Lb/A applied strip-till and surface streamed.
Planted: April 28 at 26,000 Plants/A with seedrow applied 10-34-0 at 5 gal/A.
Harvested: December 9.
Total applied sprinkler irrigation: 18.0 in./A.

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 subsurface drip irrigated study, we tested high and low inputs on two hybrids of corn.

Materials and Methods

We planted two corn Bt/RR hybrids, Dekalb DKC 63-52 and Mycogen 2E762, on May 4 at 26,000 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 0.11 in. per day when equally distributed to all zones. We fully irrigated the high input treatment with 16 in./A and apply one-third less irrigation to the low input treatment (11 in./A). The soil test recommendation for 200 Bu/A crop was 152 Lb N/A and 40 Lb P_2O_5/A. We seedrow applied 20 Lb P_2O_5/A and 0.25 Lb Zn/A at planting and injected 160 Lb N/A for the high input treatment and 135 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 600 ft. plots on December 9 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 191 Bu/A and the low input yield average was 173 Bu/A. Nonetheless, the low input treatment produced significantly higher income than the high input treatment, $6.70/A more ($P > 0.20$). Both hybrids responded similarly to the high and low input regimes. For both the high and low input treatments, Dekalb DKC 63-52 produced significantly higher yield than Mycogen 2E762.

Even though the low input treatment yielded significantly less than the high input treatment, the cost savings from lowering inputs of seed, N, and irrigation gave the low input treatment the income advantage. 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, 2004.

Firm	Hybrid	Plant Density	Silking Date	Grain Moisture	Test Weight	Grain Yield	Variable Net Income
		Plants/A (X1000)		%	Lb/Bu	Bu/A	$/A
DEKALB	DKC 63-52	33.1	7-Aug	14.5	58	195	241.77
MYCOGEN	2E762	32.3	4-Aug	14.5	59	186	223.41
High Input LSD 0.20						4.6	5.62
DEKALB	DKC 63-52	24.7	7-Aug	14.5	59	179	251.28
MYCOGEN	2E762	23.8	4-Aug	14.5	59	168	227.30
Low Input LSD 0.20						1.5	2.07
High Input		32.7	5-Aug	14.5	59	191	232.59
Low Input		24.3	5-Aug	14.5	59	173	239.29
Average		28.5	5-Aug	14.5	59	182	235.94
LSD 0.20						2.6	3.37

Planted: May 4; Harvested: December 9.
Low Input received 26,000 Seeds/A, 11 in./A of water and 135 lb N/A.
High Input received 34,000 Seeds/A, 16 in./A of water and 160 lb N/A.
Seed cost $1.50/1000 seeds; water cost $5/in.; N cost $0.30/lb.
Variable Net Income: grain yield x corn price ($2.16/bu) - seed cost - water cost - N cost.

Limited Sprinkler Irrigation on Corn and Grain Sorghum, Walsh 2004

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

PURPOSE: To identify corn and grain sorghum hybrids that produce highest yields given limited sprinkler irrigation.

MATERIALS AND METHODS: We tested 16 corn hybrids and 20 grain sorghum hybrids under limited sprinkler irrigation. We planted the corn study on April 28 at 28,000 Seeds/A, and the grain sorghum study on May 25 at 53,000 Seeds/A. We fertilized both studies using a strip-till implement with 175 Lb N/A to the corn and 135 Lb N/A to the grain sorghum, and seedrow applied 20 Lb P_2O_5/A, and 0.25 Lb Zn/A. We applied 18.0 acre-in./A of water to the corn and to the grain sorghum we applied 7.5 acre-in./A of water using a sprinkler with long drop nozzles. The plot size was at least four 30 in. rows, 600 ft. long that we harvested with a self-propelled combine and weighed them in a digital weigh cart. Seed moisture was adjusted to 15.5% for corn and 14% for grain sorghum.

RESULTS: Yields and test weights for both corn and grain sorghum were good. Only one grain sorghum hybrid, MYCOGEN 697, had a low test weight. One corn hybrid, FONTANELLE 7700 YGCB, produced less than the nonresistant corn borer hybrids. More than 25 Bu/A separated the highest and lowest yielding hybrids for both corn and grain sorghum studies.

DISCUSSION: We consider limited irrigation as receiving 9 in./A of water during the growing season. This year we applied twice that much irrigation to the corn and we are still considering the corn limited irrigated. We consider the corn limited irrigated because the corn began with very little available soil water; there was some soil moisture to a depth of 12 to 18 in. Half of the irrigation was used to fill the soil water profile. To comply with our limited irrigation definition of 9 in./A of applied water, we assume that the soil water profile is full. If winter moisture is lacking, then irrigation is required to fill it. It turn out that May to mid June was very dry when we were trying to fill our soil water profile, then it turned cool and wet for the rest of the season (we actually received 17.34 in. of rain from planting to the first freeze). Once the soil water profile was filled, rain and irrigation kept it full well past silking. This year it was not critical to completely fill the soil water profile, therefore much less irrigation could have been applied. A full soil water profile is insurance: you may not need it, but you are mighty glad you have it when you do need it.

There was a low incidence of corn borer damage, only 3 to 5% lodging in the nonresistant hybrids. Therefore, it is surprising that the yield of the nonresistant hybrids was significantly less than the test average. With such minor corn borer damage, we expected the nonresistant hybrids to yield with the majority of the Bt corn hybrids.

The only grain sorghum hybrid with a low test weight was MYCOGEN 697, it was the latest maturing grain sorghum hybrid tested. The low test weight indicates that it did not fully mature before the first freeze, even though the first freeze was two weeks

later than average. Typically the period from 50% flowering to 50% mature seed takes about 6 weeks for most grain sorghum hybrids. MYCOGEN 697 appeared to have ample time from flowering to first freeze, 8 weeks. This suggests that the cool, wet season slowed its maturation more so than other grain sorghum hybrids. The next two latest maturing hybrids were FONTANELLE 4532 and WALTER MOSS M-1929 MB, which had 50% flowering dates 3 days earlier than MYCOGEN 697. The test weights of these two hybrids were 5 to 8 Lb/Bu higher than MYCOGEN 697. Again, this indicates that the maturation of MYCOGEN 697 was greatly slowed by the cool, wet weather.

Limited Sprinkler Irrigation Corn Study at Walsh, 2004

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

PURPOSE: To identify corn hybrids that produce highest yields given sprinkler limited irrigation.

RESULTS: Of the 16 hybrids tested, Fontanelle had the highest and lowest yielding hybrids. The highest yielding hybrid, Fontanelle 7951 YGCB, produced 171 Bu/A. The lowest yielding hybrid, Fontanelle 7700 YGCB, produced 137 Bu/A. Corn borer lodging in the nonresistant hybrids was only 3 to 5%; however, the yield of the nonresistant corn borer hybrids was significantly lower than the test average.

PLOT: Four rows with 30" row spacing, at least 600' long. SEEDING DENSITY: 28,000 Seeds/A. PLANTED: April 28. HARVESTED: December 12.

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

PEST CONTROL: Pre Herbicides: Balance 3.0 Oz/A, Atrazine 1.0 Lb AI/A; Post Herbicides: None. CULTIVATION: None. INSECTICIDE: None.

FIELD HISTORY: Last Crop: Wheat. 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--------		
April	0.07	37	0	0	3
May	0.03	564	12	0	34
June	7.65	624	12	1	64
July	3.49	780	13	1	95
August	3.10	639	6	0	126
September	2.45	573	9	0	156
October	0.55	249	0	0	181
Total	17.34	3466	52	2	181

\1 Growing season from April 28 (planting) to October 25 (first freeze).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in fair soil moisture. Weed control was good. The growing season was wet and cool from mid-June to the end of the season. There was only minor corn borer damage for the nonresistant hybrids. Grain yields were very good.

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"	7.8	0.6	1.6	38	2.1	413	0.8	4.3
8"-24"				9				
Comment	Alka	VLo	Hi	VHi	VLo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization for Sprinkler Site.

Fertilizer	N	P_2O_5	Zn	Fe
	----------Lb/A----------			
Recommended	23	40	0	0
Applied	175	20	0.3	0

Yield Goal: 140 Bu/A.
Actual Yield: 154 Bu/A.

Table .Limited Sprinkler Irrigation Corn, Plainsman Research Center, 2004.

Firm	Hybrid	50% Silking Date	Plant Density	Seed Moisture	Test Weight	Grain Yield
			Plants/A (X 1000)	%	Lb/Bu	Bu/A
FONTANELLE	7951 YGCB	22-Jul	23.6	14.7	59	171
GOLDEN HARVEST	H-9250 Bt/RR	24-Jul	27.2	14.4	62	170
MYCOGEN	2T801 (Bt/RR)	26-Jul	27.0	14.8	59	162
GARST	8377 YG1/RR	24-Jul	24.4	14.7	59	162
ASGROW	RX 752 YG	21-Jul	27.4	14.5	59	162
GOLDEN HARVEST	H-9360 Bt	24-Jul	24.2	14.6	59	160
PIONEER	34N45 (Bt)	19-Jul	24.4	14.6	60	159
DEKALB	DKC 63-52 (Bt/RR)	21-Jul	26.6	14.2	59	158
MYCOGEN	2E762 (Bt/RR)	24-Jul	24.6	14.5	58	155
TRIUMPH	1416 Bt	25-Jul	24.8	14.5	58	154
PIONEER	33B51 (Bt)	25-Jul	25.6	14.0	62	152
DEKALB	DKC 60-17	22-Jul	24.0	14.4	59	143
TRIUMPH	1120 Bt/RR	21-Jul	22.0	14.4	58	143
GARST	8292 YG1	25-Jul	22.6	14.8	61	142
ATLAS	2H718	23-Jul	25.2	14.6	58	139
FONTANELLE	7700 YGCB	19-Jul	23.8	14.5	60	137
Average		22-Jul	24.8	14.5	59	154
LSD 0.20						8.32

Planted: April 28; Harvested: December 12.
Grain Yield corrected to 15.5% moisture content.
Twelve sprinkler rotations applied a total of 18.0 acre-in./A of water.

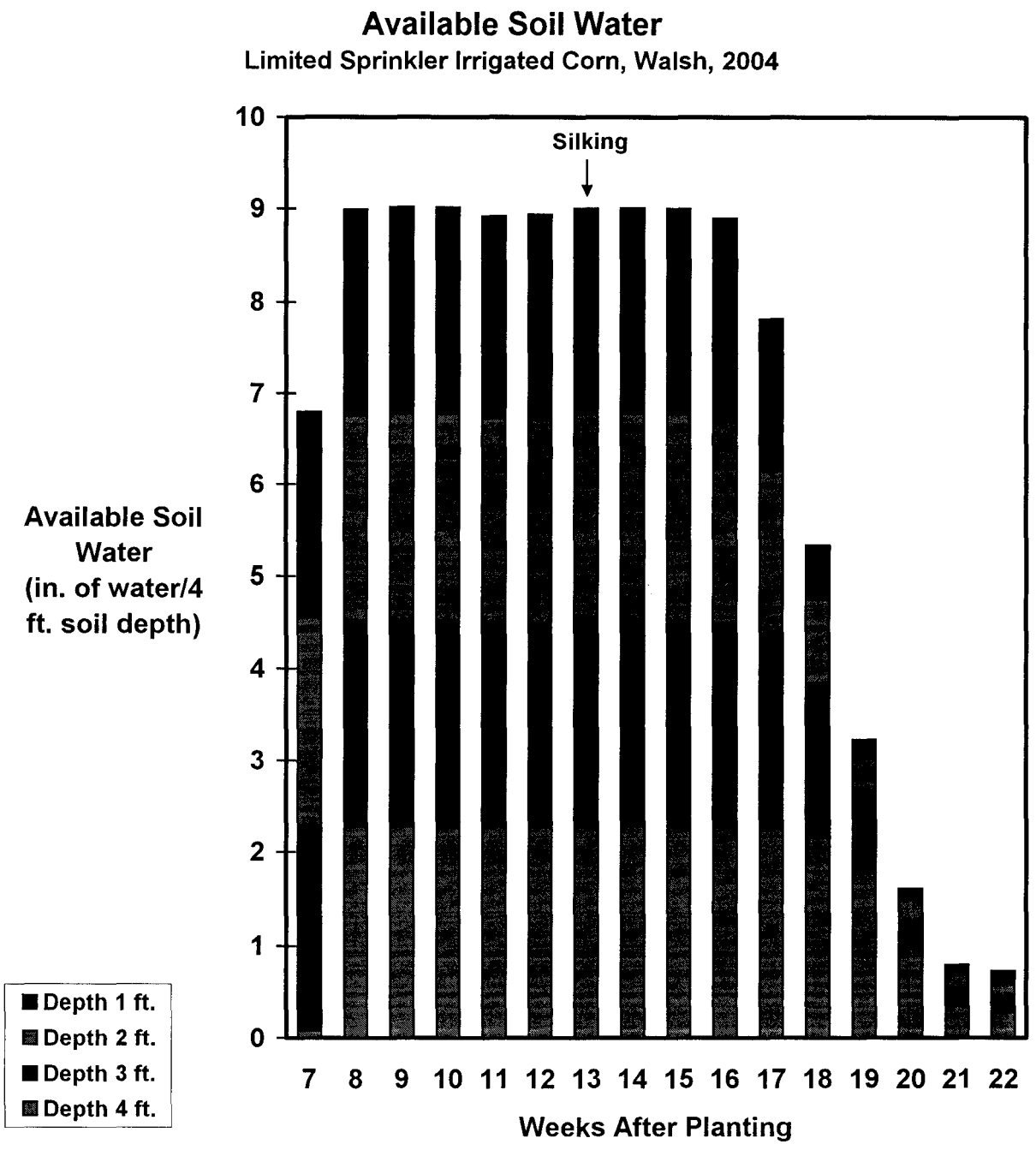

Fig. . Available soil water in limited sprinkler irrigation corn at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 17.34 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Limited Sprinkler Irrigation Grain Sorghum Study at Walsh, 2004

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

PURPOSE: To identify grain sorghum hybrids that produce highest yields given sprinkler limited irrigation.

RESULTS: The highest yielding hybrid, Pioneer 85G01, produced 121 Bu/A. The lowest yielding hybrid, Garst 5750, produced 95 Bu/A. The latest maturing hybrid tested, Mycogen 697, had the lowest test weight of 52 Lb/Bu.

PLOT: Four rows with 30" row spacing, at least 600' long. SEEDING DENSITY: 53,000 Seeds/A. PLANTED: May 25. HARVESTED: November 9.

IRRIGATION: Five sprinkler rotations applied 7.5 acre-in/A of total water.

PEST CONTROL: Preemergence Herbicides: Roundup 16 Oz/A, Atrazine 1.0 Lb AI/A; Post Herbicides: Banvel 4 Oz/A, Saber 10 Oz/A. CULTIVATION: Once. INSECTICIDE: None.

FIELD HISTORY: Last Crop: Wheat. 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	0.01	115	3	0	5
June	7.65	624	12	1	35
July	3.49	780	13	1	66
August	3.10	639	6	0	97
September	2.45	573	9	0	127
October	0.55	249	0	0	152
Total	17.34	2980	43	2	152

\1 Growing season from May 25 (planting) to October 25 (first freeze, 29 F).
\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 wet and cool from mid-June to the end of the season. Even though the season was much cooler than normal, the first freeze was two weeks later than average and only one hybrid failed to fully mature. Grain yields were good.

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

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------PPM----------				
0-8"	7.8	0.6	1.6	38	2.1	413	0.8	4.3
8"-24"				9				
Comment	Alka	Vlo	Hi	VHi	VLo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	----------Lb/A----------			
Recommended	0	40	0	0
Applied	135	20	0.3	0

Yield Goal: 110 Bu/A.
Actual Yield: 112 Bu/A.

Table .Limited Sprinkler Irrigation Grain Sorghum, Plainsman Research Center, Walsh, 2004.

Brand	Hybrid	Plant Density	50% Flowering Date	Plant Height	Seed Moisture Content	Test Weight	Grain Yield
		Plants/A (1000X)		In	%	Lb/Bu	Bu/A
PIONEER	85G01	41.7	8/14	43	14.5	58	121
GOLDEN HARVEST	H-390W	36.1	8/16	45	14.6	58	120
SORGHUM PARTNERS	NK 5418	38.5	8/14	42	13.6	56	120
PIONEER	86G08	33.7	8/13	49	14.7	58	119
SORGHUM PARTNERS	KS 585	37.3	8/16	40	15.2	56	117
NC+	5B89	36.5	8/11	48	14.1	59	117
GARST	5624	43.3	8/14	48	15.2	57	115
TRIUMPH	TR 438	42.5	8/12	43	14.6	59	114
WALTER MOSS	M-1927 ER	39.7	8/12	40	13.7	58	112
FONTANELLLE	4532	42.5	8/17	50	13.7	60	112
NC+	6C21	30.0	8/16	40	15.1	59	112
MYCOGEN	627	38.9	8/14	47	14.0	55	111
MYCOGEN	697	33.7	8/20	50	15.2	52	110
TRIUMPH	TR 459	38.9	8/15	46	15.1	59	109
FONTANELLLE	5615	36.1	8/14	39	15.0	58	109
DEKALB	DKS 42-20	31.6	8/15	44	14.2	57	106
WALTER MOSS	M-1929 MB	32.9	8/17	43	13.6	57	105
DEKALB	DK-44	34.4	8/15	42	16.7	57	105
GOLDEN HARVEST	H-279	38.5	8/11	43	13.6	56	104
GARST	5750	37.3	8/12	44	15.2	58	95
Average		37.2	8/14	44	14.6	57	112
LSD 0.20							7.3

Planted: May 25; Harvested: November 9.
50% Flowering Date: minimum date on which a hybrid flowers on half of its population.
The limited sprinkler irrigation grain sorghum received 7.5 acre-in of applied water.
Yields were corrected to 14.0% seed moisture content.

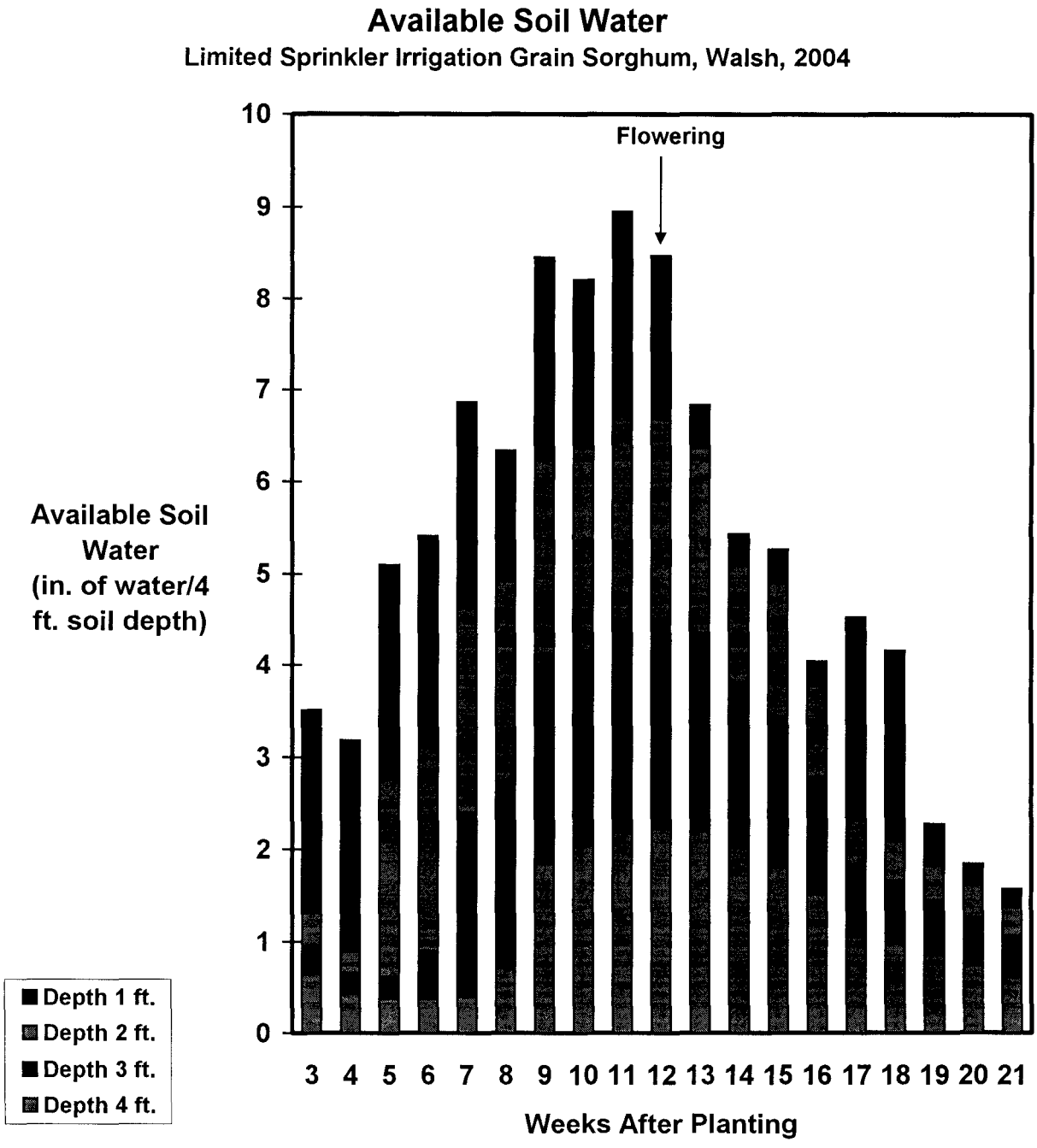

Fig. . Available soil water in limited sprinkler irrigation grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 17.34 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Corn Borer Resistant and Nonresistant Hybrid Comparisons, Walsh, 2004

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

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

RESULTS: Only the nonresistant corn borer hybrids displayed any corn borer damage. Corn borer infestation was low and corn borer damage was minor. Only one of the nonresistant hybrids had any first generation shot hole damage, and it was only 3% of its population. This year we recorded the lowest second-generation corn borer damage for the nonresistant hybrids: 10 to 13% stock hole damage and 3 to 5% plant lodging. Although the corn borer damage was light, the two nonresistant hybrids yielded significantly less than the test average.

DISCUSSION: All 14 Bt hybrids tested showed excellent resistance to corn borer. However, there was only mild corn borer damage observed on the nonresistant hybrids. The mild infestation may be attributed to extensive area-wide use of Bt hybrids. Grain yield lost from Southwestern Corn Borer lodging was so devastating and Bt gene insertion so effective in controlling the corn borer that grower acceptance and use of Bt technology may have caused an overall population decline of corn borer. 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.

Table .Limited Sprinkler Irrigated Corn, Corn Borer Ratings, Plainsman Research Center, 2004.

Firm	Hybrid	50% Silking Date	Plant Density	1st Gen Shot Holes	2nd Gen Stock Holes	2nd Gen Plant Lodging	Test Weight	Grain Yield
			Plants/A (X 1000)				Lb/Bu	Bu/A
FONTANELLE	7951 YGCB	22-Jul	23.6	0	0	0	59	171
GOLDEN HARVEST	H-9250 Bt/RR	24-Jul	27.2	0	0	0	62	170
MYCOGEN	2T801 (Bt/RR)	26-Jul	27.0	0	0	0	59	162
GARST	8377 YG1/RR	24-Jul	24.4	0	0	0	59	162
ASGROW	RX 752 YG	21-Jul	27.4	0	0	0	59	162
GOLDEN HARVEST	H-9360 Bt	24-Jul	24.2	0	0	0	59	160
PIONEER	34N45 (Bt)	19-Jul	24.4	0	0	0	60	159
DEKALB	DKC 63-52 (Bt/RR)	21-Jul	26.6	0	0	0	59	158
MYCOGEN	2E762 (Bt/RR)	24-Jul	24.6	0	0	0	58	155
TRIUMPH	1416 Bt	25-Jul	24.8	0	0	0	58	154
PIONEER	33B51 (Bt)	25-Jul	25.6	0	0	0	62	152
DEKALB	DKC 60-17	22-Jul	24.0	0	13	5	59	143
TRIUMPH	1120 Bt/RR	21-Jul	22.0	0	0	0	58	143
GARST	8292 YG1	25-Jul	22.6	0	0	0	61	142
ATLAS	2H718	23-Jul	25.2	3	10	3	58	139
FONTANELLE	7700 YGCB	19-Jul	23.8	0	0	0	60	137
Average		22-Jul	24.8	0	1	0	59	154
LSD 0.20				1.2	1.2	1.2		8.3

Planted: April 28; Harvested: December 12.
Grain Yield corrected to 15.5% moisture content.
Twelve sprinkler rotations applied a total of 18.0 acre-in./A of water.

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 (DynaGro DG 5478 Bt/RR) on May 17 at 15,000 Seed/A, sunflower (Mycogen 8377NS) on June 25 at 17,000 Seed/A, grain sorghum (Mycogen 1482) on June 25 at 35,000 Seed/A, mung bean (Berkins) on June 29 at 17 Lb/A, and proso millet (Huntsman) on June 29 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 20 Oz/A (two applications). We harvested the crops with a self-propelled combine equipped with a digital scale: millet, September 10; grain sorghum, November 27; corn, October 8; mung bean, October 7; and sunflower, October 21.

Results and Discussion

This is the second year of this dryland crop rotation sequencing study. Last year all crops were planted in fallow to establish the crop rotation, and this year the crops were planted into the five crop stubbles and fallow. Before beginning this study, we speculated on which crop residue would produce the highest total production for this season. We decided that moisture was the limiting factor. Therefore, those crops with residual moisture after harvest and whose stubble captured the most moisture during the fallow period would produce the highest total yield. Obviously, fallow with no crop water use the previous year would have the highest stored soil moisture, and therefore produce the highest crop production for the current crops. Crops planted into millet would produce the second highest total yield, because millet's shallow rooting depth and its long fallow period (it was the first crop to be harvested). Mung bean would be third with its shallower rooting depth than the three remaining crops (sunflower, corn and grain sorghum); it would have some residual moisture remaining after harvest and perhaps some residual N as well. Crops following corn would be fourth, because it had a longer fallow period than grain sorghum. Grain sorghum would be fifth and sunflower last, because sunflower is known to extract soil water deeper and drier than other crops in this study. In short, our ranking of crop stubble that we believed would produce the

highest total production was: 1) fallow, 2) millet, 3) mung bean, 4) corn, 5) grain sorghum, and 6) sunflower. This year, the actual order of crop stubble with the highest total crop production was: 1) grain sorghum, 2) fallow, 3) millet, 4) mung bean, 5) corn, 6) sunflower. For the most part, our stubble ranking was quite close, except for one glaring error: we ranked grain sorghum stubble next to last, when in fact the crops planted into it produced the highest total production. We still believed that moisture was the key to the success of grain sorghum stubble; however, the previous winter was dry. We received only 11.75 in. of snow with 1.10 in. of moisture from November to March, much less than half of our typical winter moisture. Not until the crops this year were harvested and snow fell were we able to see the moisture advantage for grain sorghum stubble. When we have snow, it often comes with strong winds. The snow blows off the shorter and less dense crop stubbles and accumulates in the grain sorghum stubble. This snow accumulation effect is most evident with the first snows after grain sorghum harvest when most of the sorghum leaves are still intact.

The oil content percentages of the sunflower crops were dependent on previous crop stubbles. The sunflower crops following millet and mung bean had the highest oil contents, and corn and fallow had the lowest oil contents. The oil content of the sunflower crops following the previous crop stubbles were: millet, 39.0%; mung bean, 38.6%; sunflower, 37.3%; grain sorghum, 36.2%; fallow, 34.9%; and corn, 34.0%. There appears to be no readily explainable pattern for the variation of oil content percentages. The two crop stubbles with expected high residual N and water were millet and fallow, these same two stubbles had among the highest differences in sunflower oil content.

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. Millet with the highest variable net income for both years of our study is an underutilized crop in Southeastern Colorado.

Table .-Crop Rotation Sequence Study, Yield Summary 2004.

Previous Crop	2004 Crop: Grain Sorghum	Millet	Corn	Mung Bean	Sunflower	Fallow	2004 Average Total Production
	----------Lb/A----------						
Grain Sorghum	2856	3080	2520	898	1311	0	2133
Millet	2016	2632	1624	566	981	0	1564
Mung Bean	1736	2800	1400	488	1116	0	1508
Corn	1400	2576	1512	612	1021	0	1424
Sunflower	448	2296	728	478	439	0	878
Fallow	2408	2744	2800	690	1275	0	1983
Average	1811	2688	1764	622	1024	0	1582
LSD 0.20	688.8	257.6	896.0	174.0	397.9		

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

2003 Crop	Total Variable Net Income for 2003 and 2004 Crops: 2004 Crop: Grain Sorghum	Millet	Corn	Mung Bean	Sunflower	Fallow	Average Variable Net Income
	----------$/A----------						
Grain Sorghum	196.66	280.57	154.41	159.06	237.63	-7.32	204.20
Millet	187.82	274.55	140.71	146.72	218.89	-7.32	192.27
Corn	62.99	168.14	33.34	48.27	120.64	-7.32	85.21
Mung Bean	70.14	176.85	24.29	31.14	127.31	-7.32	84.48
Sunflower	21.32	143.33	-4.91	26.86	42.79	-7.32	44.41
Fallow	62.35	141.94	46.74	19.79	114.84	-19.82	73.17
Average	100.21	197.56	65.76	71.97	143.68	-9.40	113.96

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

Table .-Grain Sorghum: Crop Rotation Sequencing Study, Walsh, 2004.

Previous Crop	Seed Yield	Gross Income	2004 Variable Net Income	2003 Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A
Grain Sorghum	51	100.98	90.69	105.97	196.66
Millet	36	71.28	60.99	126.83	187.82
Mung Bean	31	61.38	51.09	19.05	70.14
Corn	25	49.50	39.21	23.78	62.99
Fallow	43	85.14	74.85	-12.50	62.35
Sunflower	8	15.84	5.55	15.77	21.32
Average	32	64.02	53.73	46.48	100.21
LSD 0.20	12.3	24.61	20.65		

Planted: Grain Sorghum (Mycogen 1482) on June 25, 2004 at 35,000 Seed/A.
Grain Sorghum Seed Cost: $2.50/A ($1.00/lb).
Harvested: Grain Sorghum November 27, 2004.
Grain Sorghum Market Price $1.98/Bu.
Weed Control: Banvel, 4 oz; Saber, 11 oz; Penetrant II, 4 oz.
Chemical Cost: $3.79/A; applied July 22; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.

Table .-Millet: Crop Rotation Sequencing Study, Walsh, 2004.

Previous Crop	Grain Yield	Gross Income	2004 Variable Net Income	2003 Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A
Grain Sorghum	55	184.80	174.60	105.97	280.57
Millet	47	157.92	147.72	126.83	274.55
Mung Bean	50	168.00	157.80	19.05	176.85
Corn	46	154.56	144.36	23.78	168.14
Sunflower	41	137.76	127.56	15.77	143.33
Fallow	49	164.64	154.44	-12.50	141.94
Average	48	161.28	151.08	46.48	197.56
LSD 0.20	4.6	15.46	14.48		

Planted: Millet (Huntsman) on June 29, 2004 at 18 Lb/A.
Millet Seed Cost: $2.41/A ($7.50/Bu).
Harvested: Millet on September 10, 2004.
Millet Market Price $3.36/Bu.
Weed Control: Banvel, 4 oz; Saber, 11 oz; Penetrant II, 4 oz;
Chemical Cost: $3.79/A; applied July 22; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.

Table .-Mung Bean: Crop Rotation Sequencing Study, Walsh, 2004.

Previous Crop	Seed Yield	Gross Income	2004 Variable Net Income	2003 Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A
Grain Sorghum	898	89.80	53.09	105.97	159.06
Millet	566	56.60	19.89	126.83	146.72
Corn	612	61.20	24.49	23.78	48.27
Mung Bean	488	48.80	12.09	19.05	31.14
Sunflower	478	47.80	11.09	15.77	26.86
Fallow	690	69.00	32.29	-12.50	19.79
Average	622	62.20	25.49	46.48	71.97
LSD 0.20	174.0	17.40	7.13		

Planted: Mung Bean (Berkins) on June 29, 2004 at 17 Lb/A.
Mung Bean Seed Cost: $6.80/A ($40/cwt).
Harvested: Mung Bean on October 7, 2004.
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; applied July 22; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.

Table .-Corn: Crop Rotation Sequencing Study, Walsh, 2004.

Previous Crop	Seed Yield	Gross Income	2004 Variable Net Income	2003 Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A
Grain Sorghum	45	97.20	48.44	105.97	154.41
Millet	29	62.64	13.88	126.83	140.71
Fallow	50	108.00	59.24	-12.50	46.74
Corn	27	58.32	9.56	23.78	33.34
Mung Bean	25	54.00	5.24	19.05	24.29
Sunflower	13	28.08	-20.68	15.77	-4.91
Average	32	68.04	19.28	46.48	65.76
LSD 0.20	16.0	34.56	13.39		

Planted: Corn (DynaGro DG 5478 Bt/RR) on May 17, 2004 at 15,000 Seed/A.
Corn Seed Cost: $22.50/A ($1.50/1000 Seeds).
Harvested: Corn on October 8, 2004.
Corn Market Price $2.16/Bu.
Weed Control: Roundup Ultra Max, 20 oz/A; Choice, 4 oz/A (two applications).
Chemical Cost: $18.26/A; applied June 29 & July 22; Application Cost $8/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.

Table .-Sunflower: Crop Rotation Sequencing Study, Walsh, 2004.

Previous Crop	Seed Yield	Gross Income	2004 Variable Net Income	2003 Variable Net Income	Total Variable Net Income
	Bu/A	$/A	$/A	$/A	$/A
Grain Sorghum	1311	157.32	131.66	105.97	237.63
Millet	981	117.72	92.06	126.83	218.89
Mung Bean	1116	133.92	108.26	19.05	127.31
Corn	1021	122.52	96.86	23.78	120.64
Fallow	1275	153.00	127.34	-12.50	114.84
Sunflower	439	52.68	27.02	15.77	42.79
Average	1024	122.86	97.20	46.48	143.68
LSD 0.20	397.9	47.75	37.77		

Planted: Sunflower (Mycogen 8377NS) on June 25, 2004 at 17,000 Seeds/A.
Sunflower Seed Cost: $12.75/A ($0.75/1000 Seeds).
Harvested: Sunflower on October 21, 2004.
Millet Market Price $0.12/Lb.
Weed Control: Prowl, 48 oz; Spartan, 2 oz.
Chemical Cost: $12.91/A; applied June 11; Application Cost $4/A.
Variable Net Income: Gross Income - Seed Cost - Weed Control.

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 dryland 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. Sandbur is 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 and without rotary hoe incorporation in a split-plot design with three replications on Richfield Silty Loam soil. All herbicide treatments had 1.0 Lb/A of Atrazine and all were applied on May 28 at 10 Gal/A with 110° flat fan nozzles spaced 18 in. apart and half the 20 ft. by 1250 ft. plots were rotary hoed for herbicide incorporation the same day. The site was planted June 23 with PIONEER 87G57 at 35,000 Seeds/A. To control broadleaf weeds, we sprayed Banvel 4 Oz/A and Saber 10 Oz/A and cultivated once.

Results and Discussion

The microencapsulated herbicide treatments produced significantly higher yields than the Atrazine check (Table 16). The microencapsulated herbicide treatments provided from $8/A to $12/A more net income than the Atrazine check. All three microencapsulated treatments produced the same yield, 57 Bu/A; therefore the herbicide treatment that produced the highest variable net income was the microencapsulated treatment with the least cost, the Micro-Tech and Atrazine combination. The same yield for all three microencapsulated herbicides is surprising since the Micro-Tech and Atrazine combination had the lowest sandbur control rating, 10 to 16% less than the other two microencapsulated treatments.

Rotary hoeing incorporation likewise increased sandbur control rating by 10% compared to without rotary hoeing incorporation, but again, there was no yield increase with rotary hoeing (Table 17). The lack of yield response to rotary hoeing and the cost of rotary hoeing make without rotary hoeing incorporation more profitable.

In order to fully evaluate herbicides it is important to include, not only weed control, but also, chemical cost and grain yield. Recording only weed control efficacies for evaluation of herbicides produces a skewed, even misleading, economic picture. For example, the efficacy of Bicep Lite II Magnum for grain sorghum production appears the best choice if weed control is the only criteria. However, Micro-Tech and Atrazine combination produced the same grain yield at a lower chemical cost, giving it the highest net return.

Table 16.-Sandbur Control in Dryland Grain Sorghum at Walsh, 2004.

Herbicide Treatment	Rate	Sandbur Control	Test Weight	Grain Yield	Chem. Cost	Var. Net Income
	*/A	%	Lb/Bu	Bu/A	$/A	$/A
Bicep Lite II Magnum (rate applied 1.0 lb atrazine)	1.5 qt	66	58	57	20.06	89.30
G-Max Lite (rate applied 1.0 lb atrazine)	1.5 qt	60	59	57	19.85	89.51
Micro Tech & Atrazine	2.5 qt 1.0 lb	50	58	57	16.14	93.22
Atrazine	1.0 lb	24	57	44	2.38	81.24
Average		50	58	54	14.61	88.32
LSD 0.05		12.5		5.4		

Planted: June 23, Pioneer 87G57 at 35,000 Seeds/A; Harvested: November 5.
Herbicide Treatments applied May 28, 2004.
Variable Net Income: Treatment Yield x $1.98/Bu - Chemical Cost - Application Cost ($3.50/A). All treatments were cultivated.

Table 17.-Sandbur Control in Dryland Grain Sorghum Rotary Hoe Compaison at Walsh, 2004.

Herbicide Treatment	Sandbur Control	Test Weight	Grain Yield	Hoeing Cost	Var. Net Income
	%	Lb/Bu	Bu/A	$/A	$/A
All Herbicide Treatments with Rotary Hoeing	55	58	54	4.00	84.81
All Herbicide Treatments w/o Rotary Hoeing	45	58	54	0.00	88.81
Average	50	58	54	2.00	86.81
LSD 0.05	5.4		4.1		

Planted: June 23, Pioneer 87G57 at 35,000 Seeds/A; Harvested: November 5.
Herbicide Treatments and Rotary Hoeing incorporation applied May 28, 2004.
Variable Net Income: Treatment Yield x $1.98/Bu - Average Chemical Cost - Application Cost ($3.50/A) - Rotary Hoeing Cost ($4.00/A). All treatments were cultivated.

Bindweed Control in Sunflower and Grain Sorghum, 2004

Kevin Larson 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 fields. We tested preplant herbicides to control bindweed. To determine residual effects of the herbicide treatments on the crop without bindweed interference, we also applied the herbicide treatments to a non-bindweed site. To determine residual longevity of the herbicide treatments on the crop, we planted both bindweed and non-bindweed sites with multiple planting dates.

Materials and Methods

The 40-acre study field had a Silty Clay Loam soil with a history of heavy bindweed infestation on east half (bindweed site) and very little bindweed on the west half (non-bindweed site). We further divided the field north and south; we planted grain sorghum in the north half of the field and sunflower in the south half of the field. We applied seven 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, and control (no bindweed herbicide) with a 40 ft. boom sprayer at 10 gal/A on May 17, 2004 to both sites. Before the herbicide treatments were applied, we sprayed the entire field with 20 oz/A of glyphosate and 75 lb N/A. For weed control, other than bindweed, we sprayed Atrazine 1.0 lb/A to the grain sorghum side and Prowl 48 oz/A to the sunflower side. We planned five planting dates with 10-day increments, but because the weather was too dry or too wet we had uneven planting date intervals and fewer planting dates than planned. We planted grain sorghum (Mycogen 1482) at 35,000 seeds/A on five planting dates: May 18, May 27, June 7, June 25, and June 30. We planted sunflower (Mycogen 8377NS) at 17,000 seeds/A on four planting dates: May 18, May 27, June 7, and July 1 (the May 18 planting date had very poor emergence and was abandoned). Bindweed control ratings were performed on June 7 and June 28. 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 December 3, 5, and 6 for sorghum, and October 25 and 27 for sunflower with a self-propelled combine equipped with a digital scale. Yields were moisture adjusted to 14% for sorghum and 10% for sunflower.

Results

For the sunflower bindweed site, three herbicide treatments: Hi Dep, 2,4-D LoVol, and LandMaster BW produced significantly higher yields and incomes than the control ($P > 0.20$). These same three herbicide treatments and Spartan also produced significantly higher yields and incomes than the control in the sunflower non-bindweed site ($P > 0.20$). For sunflower, both the bindweed and non-bindweed sites significantly increase yield with each planting date: July 1 > June 7 > May 27. Overall the non-bindweed site yielded 303 lb/A more than the bindweed site. Hi Dep is the only herbicide treatment in the bindweed site to produce significantly more income than the control for all three planting dates. In the bindweed site, Banvel yielded less than the

control for May 27 and June 7 planting dates, but by the July 1 planting date (45 days after application) Banvel produced significantly more yield and income than the control. For the non-bindweed site, none of the treatments had more income than the control for the May 27 planting date; by the June 7 planting date, three herbicides: LandMaster BW, Spartan, and LoVol had higher incomes than the control; and by the July 1 planting date, all but the Paramount and COC treatment produced more income than the control.

For the grain sorghum bindweed site, only one herbicide treatment, Hi Dep, produced significantly more income than the control ($P > 0.20$). For the grain sorghum in the non-bindweed site, only one herbicide treatment, LandMaster BW, produced significantly higher income than the control ($P > 0.20$). Both the bindweed and non-bindweed sites displayed similar grain sorghum yield response to planting dates: June 25 = June 7 > June 30 = May 27 > May 18 ($P > 0.05$). Overall, the bindweed site produce 1 bu/A more than the non-bindweed site. For the bindweed site, Hi Dep produced significantly higher yields and incomes than the control for the last three planting dates (June 7, June 25, and June 30), but no herbicide treatment had significantly higher income than the control for the first two planting dates (May 18 and May 27). For the non-bindweed site, LandMaster BW produced significantly higher yields and incomes than the control for June 7 and June 25 planting dates. For the non-bindweed site, Banvel at the June 7 planting date is the only other herbicide treatment to produce both significantly higher yield and income than the control. No herbicide treatment in the grain sorghum non-bindweed site had significantly higher income than the control for May 18, May 27, and June 30 planting dates.

Discussion

Bindweed control was more crucial for sunflower production than it was for grain sorghum production. Sunflower yield was much higher without bindweed infestation, and when bindweed was present three herbicide treatments: Hi Dep, LandMaster BW, and LoVol produced higher yields and incomes than the control. These same three herbicide treatments and Spartan produced higher sunflower yields and incomes than the control in the site without bindweed. The Prowl that was applied to control all other weeds besides bindweed allowed pigweed to flourish. The preplant herbicide treatments that controlled the pigweed and cause little crop damage (Hi Dep, LandMaster BW, LoVol, and Spartan) produced higher yields and incomes than the control in the site without bindweed.

It took 45 days after application in sunflower for 8 oz/A of Banvel (5.5 days per oz) to produce higher yield and income than 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. The large, 25-day, planting date gap between our third plant date (20 days after application) and fourth planting date (45 days after application) did not allow us to accurately evaluate the residual longevity of the Banvel treatment.

Sunflower seed and oil yields increased with later planting dates. The overall average seed yield increase for planting dates was 327 lb/A from May 27 to June 7 and 108 lb/A from June7 to July 1. The sunflower oil content percentages increased with later planting dates: May 27, 36.7%; June 7, 37.4%; and July 1, 41.7%. Oil content increasing with later planting dates is in contrast to results from our previous sunflower planting date studies. From our previous sunflower planting date studies, we report that

oil content percentages decreased with later planting dates. The dry conditions for the earliest planting dates (May 18 and May 27) undoubtedly contributed to the low plant stands and low yields for both sunflower and grain sorghum.

The overall grain sorghum yield response to planting dates was high yields from mid-to -later planting dates (June 7 and June 25), while the earliest planting date (May 18) produced the least yield. Dry conditions early in the season reduced plant stand and yield of the May 18 and May 27 planting dates. Test weight from June 30, the latest grain sorghum planting date, was 3 to 7 lb/bu less than the other planting dates. The low test weight from the June 30 planting date indicates that the seed was not fully mature before first freeze and yields were reduced.

Grain sorghum yield and income was not as responsive to bindweed control. Only the Hi Dep treatment controlled bindweed at a low enough cost to produce more yield and income than the control. In the grain sorghum site without bindweed, LandMaster BW is the only herbicide that provided higher yield and income than the control. We observed that Atrazine, applied to the entire grain sorghum site and used to control all other weeds besides bindweed, was better at controlling pigweed than Prowl, the herbicide applied to the entire sunflower site.

Table .-Chemical Control of Bindweed in Sunflower (Bindweed Site), Walsh 2004.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/7	Bindweed Control Rated 6/28	Plant Stand	Seed Yield	Variable Net Income
	*/A	$/A	%	%	%	Lb/A	$/A
Hi Dep	16 oz	2.31	81	63	76 (+19)	1260	144.89
2,4-D LoVol 6	16 oz	2.23	71	58	75 (+20)	1193	136.93
LandMaster BW	54 oz	6.86	80	67	78 (+20)	1228	136.50
Spartan	2 oz	5.20	72	40	76 (+21)	1117	124.84
Control	----	0.00	5	3	79 (+13)	1067	124.04
Banvel	8 oz	3.75	65	68	61 (+33)	1082	122.09
Paramount + COC	5.33 oz/1 qt	15.75	63	73	66 (+23)	1141	117.17
Average		5.16	62	53	73 (+21)	1155	129.49
LSD 0.20			14.6	8.4	3.1 (**)	100.3	11.24

Variable Net Income: Seed Yield x Sunflower Price ($0.12/lb) - Chemical Cost - Application ($4/A).
Herbicide Treatments were applied May 17, 2004.
Plant Stand (+) values are plant stand increases from May 27 (PD2) to June 7 (PD3) planting dates.
PD X Treatment interaction significant at the 0.01% level.

Table .-Planting Dates for Bindweed Control in Sunflower (Bindweed Site), Walsh 2004.

Planting Date	Days After Application	50% Flowering Date	Plant Stand	Seed Moisture	Test Weight	Seed Yield	Gross Income
			%	%	Lb/Bu	Lb/A	$/A
PD 4 July 1	45	25-Aug	89	10.7	28	1317	158.04
PD 3 June 7	20	8-Aug	84	Below 8	27	1233	147.96
PD 2 May 27	10	8-Aug	62	Below 8	28	917	110.04
Average	25	13-Aug	78	8.8	28	1156	138.68
LSD 0.20			1.3			58.8	7.06

Gross Income: Seed Yield x Sunflower Price ($0.12/lb).
Herbicide Treatments were applied May 17, 2004.

Table .-Chemical Control of Bindweed in Sunflower (Non Bindweed Site), Walsh 2004.

Treatment	Rate	Chemical Cost	Plant Stand	Plant Stand Increase	Seed Yield	Gross Income	Variable Net Income
	*/A	$/A	%	%	Lb/A	$/A	$/A
LandMaster BW	54 oz	6.86	82	10	1662	199.44	188.58
Spartan	2 oz	5.20	81	13	1553	186.36	177.16
2,4-D LoVol 6	16 oz	2.23	83	13	1509	181.08	174.85
Hi Dep	16 oz	2.31	78	13	1469	176.28	169.97
Banvel	8 oz	3.75	78	20	1343	161.16	153.41
Paramount + COC	5.33 oz/1 qt	15.75	83	13	1406	168.72	148.97
Control	----	0.00	84	5	1272	152.64	148.64
Average		5.16	81	12	1459	175.10	165.94
LSD 0.20			3.3	***	124.8	14.98	14.19

Gross Income: Seed Yield x Sunflower Price ($0.12/lb).
Variable Net Income: Gross Income- Chemical Cost - Application Cost ($4/A).
Herbicide Treatments were applied May 17, 2004.
Plant Stand increase from May 27 Planting Date (PD2) to June 7 Planting Date (PD3).
PD X Treatment interaction significant at 0.001% level.

Table .-Planting Dates for Bindweed Control in Sunflower (Non Bindweed Site), Walsh 2004.

Planting Date	Days After Application	50% Flowering Date	Plant Stand	Seed Moisture	Test Weight	Seed Yield	Gross Income
			%	%	Lb/Bu	Lb/A	$/A
PD4 July1	45	25-Aug	89	10.7	28	1633	195.96
PD3 June 7	20	8-Aug	84	Below 8	27	1541	184.92
PD2 May 27	10	8-Aug	71	Below 8	28	1203	144.36
Average	25	13-Aug	81	8.8	28	1459	175.08
LSD 0.20			1.1			67.8	8.14

Gross Income: Seed Yield x Sunflower Price ($0.12/lb).
Herbicide Treatments were applied May 17, 2004.

Table .-Bindweed Control in Sunflower (Bindweed Site), May 27 Planting Date (PD2), Walsh 2004.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/7	Bindweed Control Rated 6/28	Plant Stand	Seed Yield	Variable Net Income
	*/A	$/A	%	%	%	Lb/A	$/A
Hi Dep	16 oz	2.31	81	63	66	1098	125.45
LandMaster BW	54 oz	6.86	80	67	68	980	106.74
2,4-D LoVol 6	16 oz	2.23	71	58	65	935	105.97
Control	----	0.00	5	3	73	882	101.84
Spartan	2 oz	5.20	72	40	65	907	99.64
Paramount + COC	5.33 oz/1 qt	15.75	63	73	55	913	89.81
Banvel	8 oz	3.75	65	68	45	703	76.61
Average		5.16	62	53	62	917	100.87
LSD 0.20			14.6	8.4	3.9	185.5	20.41

Variable Net Income: Seed Yield x Sunflower Price ($0.12/lb) - Chemical Cost -Application ($4/A).
Herbicide Treatments were applied May 17, 2004.
May 27 Planting Date (PD2) was planted 10 days after herbicide treatments were applied.

Table .Bindweed Control in Sunflower (Non Bindweed Site), May 27 Planting Date (PD2), Walsh 2004.

Treatment	Rate	Chemical Cost	Plant Stand	Plant Stand Increase	Seed Yield	Gross Income	Variable Net Income
	*/A	$/A	%	%	Lb/A	$/A	$/A
LandMaster BW	54 oz	6.86	78	10	1325	159.00	148.14
Hi Dep	16 oz	2.31	71	13	1272	152.64	146.33
Spartan	2 oz	5.20	75	13	1272	152.64	143.44
2,4-D LoVol 6	16 oz	2.23	76	13	1219	146.28	140.05
Control	----	0.00	81	20	1200	144.00	140.00
Banvel	8 oz	3.75	58	13	1052	126.24	118.49
Paramount + COC	5.33 oz/1 qt	15.75	56	5	1081	129.72	109.97
Average		5.16	71	12	1203	144.36	135.20
LSD 0.20			4.6		115.8	13.90	13.01

Variable Net Income: Seed Yield x Sunflower Price ($0.12/lb) - Chemical Cost.
Herbicide Treatments were applied May 17, 2004.
May 27 Planting Date (PD2) was planted 10 days after herbicide treatments were applied.
Plant Stand increase from May 27 Planting Date (PD2) to June 7 Planting Date (PD3).

Table .-Bindweed Control in Sunflower (Bindweed Site), June 7 Planting Date (PD3), Walsh 2004.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/7	Bindweed Control Rated 6/28	Plant Stand	Seed Yield	Variable Net Income
	*/A	$/A	%	%	%	Lb/A	$/A
LandMaster BW	54 oz	6.86	80	67	88	1412	158.58
Hi Dep	16 oz	2.31	81	63	85	1271	146.21
2,4-D LoVol 6	16 oz	2.23	71	58	85	1251	143.89
Spartan	2 oz	5.20	72	40	86	1198	134.56
Control	----	0.00	5	3	86	1133	131.96
Paramount + COC	5.33 oz/1 qt	15.75	63	73	78	1240	129.05
Banvel	8 oz	3.75	65	68	78	1124	127.13
Average		5.16	62	53	84	1233	138.77
LSD 0.20			14.6	8.4	3.9	116.0	13.06

Variable Net Income: Seed Yield x Sunflower Price ($0.12/lb) - Chemical Cost - Application ($4/A).
Herbicide Treatments were applied May 17, 2004.
June 7 Planting Date (PD3) was planted 20 days after herbicide treatments were applied.

Table .Bindweed Control in Sunflower (Non Bindweed Site), June 7 Planting Date (PD3), Walsh 2004.

Treatment	Rate	Chemical Cost	Plant Stand	Plant Stand Increase	Seed Yield	Gross Income	Variable Net Income
	*/A	$/A	%	%	Lb/A	$/A	$/A
LandMaster BW	54 oz	6.86	86	10	1774	212.88	202.02
Spartan	2 oz	5.20	88	13	1655	198.6	189.40
2,4-D LoVol 6	16 oz	2.23	89	13	1622	194.64	188.41
Hi Dep	16 oz	2.31	84	13	1483	177.96	171.65
Paramount + COC	5.33 oz/1 qt	15.75	79	20	1561	187.32	167.57
Control	----	0.00	86	13	1332	159.84	155.84
Banvel	8 oz	3.75	78	5	1363	163.56	155.81
Average		5.16	84	12	1541	184.97	175.81
LSD 0.20			3.0		179.0	21.48	20.42

Variable Net Income: Seed Yield x Sunflower Price ($0.12/lb) - Chemical Cost.
Herbicide Treatments were applied May 17, 2004.
June 7 Planting Date (PD3) was planted 20 days after herbicide treatments were applied.
Plant Stand increase from May 27 Planting Date (PD2) to June 7 Planting Date (PD3).

Table .-Bindweed Control in Sunflower (Bindweed Site), July 1 Planting Date (PD4), Walsh 2004.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/7	Bindweed Control Rated 6/28	Plant Stand	Seed Yield	Variable Net Income
	*/A	$/A	%	%	%	Lb/A	$/A
Hi Dep	16 oz	2.31	81	63	88	1412	163.13
Banvel	8 oz	3.75	65	68	86	1420	162.65
2,4-D LoVol 6	16 oz	2.23	71	58	88	1394	161.05
LandMaster BW	54 oz	6.86	80	67	88	1293	144.30
Spartan	2 oz	5.20	72	40	88	1247	140.44
Control	----	0.00	5	3	86	1186	138.32
Paramount + COC	5.33 oz/1 qt	15.75	63	73	83	1270	132.65
Average		5.16	62	53	87	1317	148.93
LSD 0.20			14.6	8.4	2.8	132.8	15.02

Variable Net Income: Seed Yield x Sunflower Price ($0.12/lb) - Chemical Cost - Application ($4/A).
Herbicide Treatments were applied May 17, 2004.
July 1 Planting Date (PD4) was planted 45 days after herbicide treatments were applied.

Table .Bindweed Control in Sunflower (Non Bindweed Site), July 1 Planting Date (PD4), Walsh 2004.

Treatment	Rate	Chemical Cost	Plant Stand	Plant Stand Increase	Seed Yield	Gross Income	Variable Net Income
	*/A	$/A	%	%	Lb/A	$/A	$/A
LandMaster BW	54 oz	6.86	94	8	1887	226.44	215.58
Spartan	2 oz	5.20	93	5	1732	207.84	198.64
2,4-D LoVol 6	16 oz	2.23	93	4	1685	202.20	195.97
Hi Dep	16 oz	2.31	93	9	1653	198.36	192.05
Banvel	8 oz	3.75	91	12	1616	193.92	186.17
Paramount + COC	5.33 oz/1 qt	15.75	88	2	1575	189.00	169.25
Control	----	0.00	88	10	1285	154.20	150.20
Average		5.16	91	7	1633	195.99	186.84
LSD 0.20			2.5		202.0	24.24	23.11

Variable Net Income: Seed Yield x Sunflower Price ($0.12/lb) - Chemical Cost.
Herbicide Treatments were applied May 17, 2004.
July 1 Planting Date (PD4) was planted 45 days after herbicide treatments were applied.
Plant Stand increase from June 7 Planting Date (PD3) July 1 Planting Date (PD4).

Table .-Chemical Control of Bindweed in Grain Sorghum (Bindweed Site), Walsh 2004.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/7	Bindweed Control Rated 6/28	Plant Stand	Grain Yield	Variable Net Income
	*/A	$/A	%	%	%	Bu/A	$/A
Hi Dep	16 oz	2.31	81	59	63	49	90.31
Paramount + COC	5.33 oz/1 qt	15.75	63	73	70	46	70.74
2,4-D LoVol 6	16 oz	2.23	71	58	66	39	70.20
Banvel	8 oz	3.75	65	62	62	39	69.47
LandMaster BW	54 oz	6.86	80	67	67	39	66.56
Control	----	0.00	5	5	70	36	66.49
Spartan	2 oz	5.20	72	47	60	38	65.84
Average		5.16	62	53	65	41	71.37
LSD 0.20			14.6	8.4	2.1	3.7	6.44

Variable Net Income: Grain Yield x Grain Sorghum Price ($1.98/bu) - Chemical Cost.
Herbicide Treatments were applied May 17, 2004.
There was a very highly significant treatment x planting date interaction (***).

Table .-Planting Dates for Bindweed Control in Grain Sorghum (Bindweed Site), Walsh 2004.

Planting Date	Days After Application	50% Flowering Date	Plant Stand	Seed Moisture	Test Weight	Grain Yield	Gross Income
			%	%	Lb/Bu	Lb/A	$/A
PD4 June 25	38	4-Sep	95	14.2	55	60	118.60
PD3 June 7	20	26-Aug	80	14.9	56	55	109.69
PD5 June 30	43	7-Sep	94	14.4	52	37	73.85
PD2 May 27	10	23-Aug	32	15.0	56	31	61.97
PD1 May 18	1	13-Aug	27	15.3	57	19	38.41
Average	22	27-Aug	65	14.8	55	41	80.51
LSD 0.20			4.3			5.7	11.29

Gross Income: Grain Yield x Grain Sorghum Price ($1.98/bu).
Herbicide Treatments were applied May 17, 2004.

Table .-Chemical Control of Bindweed in Grain Sorghum (Non Bindweed Site), Walsh 2004.

Treatment	Rate	Chemical Cost	Plant Stand	Plant Stand Increase	Grain Yield	Gross Income	Variable Net Income
	*/A	$/A	%	%	Bu/A	$/A	$/A
LandMaster BW	54 oz	6.86	64	51	44	87.12	76.26
Banvel	8 oz	3.75	62	56	41	80.19	72.44
2,4-D LoVol 6	16 oz	2.23	67	45	40	78.21	71.98
Hi Dep	16 oz	2.31	65	50	39	77.42	71.11
Control	----	0.00	68	45	37	73.26	69.26
Spartan	2 oz	5.20	66	57	39	77.22	68.02
Paramount + COC	5.33 oz/1 qt	15.75	68	48	41	81.58	61.83
Average		5.16	66	50	40	79.28	70.13
LSD 0.20			2.7	***	3.7	7.31	6.47

Gross Income: Grain Yield x Grain Sorghum Price ($1.98/bu).
Variable Net Income: Gross Income- Chemical Cost - Application Cost ($4/A).
Herbicide Treatments were applied May 17, 2004.
Plant Stand increase from May 27 Planting Date (PD2) to June 7 Planting Date (PD3).

Table .-Planting Dates for Bindweed Control in Grain Sorghum (Non Bindweed Site), Walsh 2004.

Planting Date	Days After Application	50% Flowering Date	Plant Stand	Seed Moisture	Test Weight	Grain Yield	Gross Income
			%	%	Lb/Bu	Bu/A	$/A
PD4 June 25	38	4-Sep	93	14.5	56	55	109.30
PD3 June 7	20	26-Aug	83	15.0	57	51	101.77
PD2 May 27	10	23-Aug	33	15.2	57	35	68.31
PD5 June 30	43	7-Sep	91	14.2	51	33	64.35
PD1 May 18	1	13-Aug	27	15.5	58	26	51.08
Average	22	27-Aug	66	14.9	56	40	78.96
LSD 0.20			4.3			4.0	7.92

Gross Income: Grain Yield x Grain Sorghum Price ($1.98/bu).
Herbicide Treatments were applied May 17, 2004.

Table .-Bindweed Control in Grain Sorghum (Bindweed Site), Planting Date 1 (PD1), Walsh 2004.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/7	Bindweed Control Rated 6/28	Plant Stand	Grain Yield	Variable Net Income
	*/A	$/A	%	%	%	Bu/A	$/A
Control	----	0.00	5	5	31	20	36.39
Hi Dep	16 oz	2.31	81	59	21	21	35.47
Banvel	8 oz	3.75	65	62	22	21	34.62
Spartan	2 oz	5.20	72	47	21	21	32.78
2,4-D LoVol 6	16 oz	2.23	71	58	25	15	23.87
Paramount + COC	5.33 oz/1 qt	15.75	63	73	39	21	21.63
LandMaster BW	54 oz	6.86	80	67	28	16	20.42
Average		5.16	62	53	27	19	29.31
LSD 0.20			14.6	8.4	5.5	9.2	14.34

Variable Net Income: Grain Yield x Grain Sorghum Price ($1.98/bu) - Chemical Cost - Application.
Herbicide Treatments were applied May 17, 2004.
May 18 Planting Date (PD1) was planted 1 day after herbicide treatment application.

Table .-Bindweed Control in Grain Sorghum (Non Bindweed Site), Planting Date 1 (PD1), Walsh 2004.

Treatment	Rate	Chemical Cost	Plant Stand	Plant Stand Change	Grain Yield	Gross Income	Variable Net Income
	*/A	$/A	%	%	Bu/A	$/A	$/A
Paramount + COC	5.33 oz/1 qt	15.75	26	14	38	75.44	55.69
LandMaster BW	54 oz	6.86	19	14	30	59.00	48.14
Control	----	0.00	36	2	25	49.70	45.70
2,4-D LoVol 6	16 oz	2.23	24	14	24	46.73	40.50
Banvel	8 oz	3.75	26	-2	24	47.72	39.97
Hi Dep	16 oz	2.31	24	9	22	42.97	36.66
Spartan	2 oz	5.20	34	-6	23	45.54	36.34
Average		5.16	27	6	26	52.44	43.28
LSD 0.20			10.7		7.1	14.06	11.82

Gross Income: Grain Yield x Grain Sorghum Price ($1.98/bu).
Variable Net Income: Gross Income- Chemical Cost - Application Cost ($4/A).
Herbicide Treatments were applied May 17, 2004.
May 18 Planting Date was planted 1 day after herbicide treatment application.
Plant Stand change from May 18 Planting Date (PD1) to May 27 Planting Date (PD2).

Table .-Bindweed Control in Grain Sorghum (Bindweed Site), Planting Date 2 (PD2), Walsh 2004.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/7	Bindweed Control Rated 6/28	Plant Stand	Grain Yield	Variable Net Income
	*/A	$/A	%	%	%	Bu/A	$/A
Hi Dep	16 oz	2.31	81	59	24	34	61.41
LandMaster BW	54 oz	6.86	80	67	38	34	55.87
2,4-D LoVol 6	16 oz	2.23	71	58	39	31	55.35
Control	----	0.00	5	5	43	28	52.03
Paramount + COC	5.33 oz/1 qt	15.75	63	73	33	35	49.55
Spartan	2 oz	5.20	72	47	23	29	48.02
Banvel	8 oz	3.75	65	62	24	28	47.49
Average		5.16	62	53	32	31	52.82
LSD 0.20			14.6	8.4	7.6	8.9	15.16

Variable Net Income: Grain Yield x Grain Sorghum Price ($1.98/bu) - Chemical Cost - Application.
Herbicide Treatments were applied May 17, 2004.
May 27 Planting Date (PD2) was planted 10 day after herbicide treatment application.

Table .-Bindweed Control in Grain Sorghum (Non Bindweed Site), Planting Date 2 (PD2), Walsh 2004.

Treatment	Rate	Chemical Cost	Plant Stand	Plant Stand Change	Grain Yield	Gross Income	Variable Net Income
	*/A	$/A	%	%	Bu/A	$/A	$/A
Hi Dep	16 oz	2.31	33	9	36	71.48	65.17
Control	----	0.00	38	2	33	64.75	60.75
Spartan	2 oz	5.20	28	-6	35	69.70	60.50
LandMaster BW	54 oz	6.86	33	14	36	70.49	59.63
Banvel	8 oz	3.75	24	-2	34	67.32	59.57
2,4-D LoVol 6	16 oz	2.23	38	14	33	64.94	58.71
Paramount + COC	5.33 oz/1 qt	15.75	40	14	35	68.71	48.96
Average		5.16	33	6	34	68.20	59.04
LSD 0.20			7.3		7.6	15.05	13.20

Gross Income: Grain Yield x Grain Sorghum Price ($1.98/bu).
Variable Net Income: Gross Income- Chemical Cost - Application Cost ($4/A).
Herbicide Treatments were applied May 17, 2004.
May 27 Planting Date was planted 10 days after herbicide treatment application.
Plant Stand change from May 18 Planting Date (PD1) to May 27 Planting Date (PD2).

Table .-Bindweed Control in Grain Sorghum (Bindweed Site), Planting Date 3 (PD3), Walsh 2004.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/7	Bindweed Control Rated 6/28	Plant Stand	Grain Yield	Variable Net Income
	*/A	$/A	%	%	%	Bu/A	$/A
Hi Dep	16 oz	2.31	81	59	79	71	134.86
Paramount + COC	5.33 oz/1 qt	15.75	63	73	85	65	108.55
2,4-D LoVol 6	16 oz	2.23	71	58	80	53	99.50
LandMaster BW	54 oz	6.86	80	67	83	55	98.24
Banvel	8 oz	3.75	65	62	80	50	90.66
Control	----	0.00	5	5	84	46	86.68
Spartan	2 oz	5.20	72	47	70	48	85.64
Average		5.16	62	53	80	55	100.59
LSD 0.20			14.6	8.4	3.8	10.6	19.39

Variable Net Income: Grain Yield x Grain Sorghum Price ($1.98/bu) - Chemical Cost - Application.
Herbicide Treatments were applied May 17, 2004.
June 7 Planting Date (PD3) was planted 20 day after herbicide treatment application.

Table .-Bindweed Control in Grain Sorghum (Non Bindweed Site), Planting Date 3 (PD3), Walsh 2004.

Treatment	Rate	Chemical Cost	Plant Stand	Plant Stand Change	Grain Yield	Gross Income	Variable Net Income
	*/A	$/A	%	%	Bu/A	$/A	$/A
Banvel	8 oz	3.75	80	56	55	109.69	101.94
LandMaster BW	54 oz	6.86	84	51	57	112.27	101.41
Hi Dep	16 oz	2.31	83	50	54	107.32	101.01
2,4-D LoVol 6	16 oz	2.23	83	45	51	101.18	94.95
Spartan	2 oz	5.20	85	57	52	101.97	92.77
Paramount + COC	5.33 oz/1 qt	15.75	88	48	55	109.69	89.94
Control	----	0.00	83	45	43	85.54	81.54
Average		5.16	84	50	53	103.95	94.79
LSD 0.20			3.2		11.4	22.57	20.39

Gross Income: Grain Yield x Grain Sorghum Price ($1.98/bu).
Variable Net Income: Gross Income- Chemical Cost - Application Cost ($4/A).
Herbicide Treatments were applied May 17, 2004.
June 7 Planting Date was planted 20 days after herbicide treatment application.
Plant Stand change from May 27 Planting Date (PD2) to June 7 Planting Date (PD3).

Table .-Bindweed Control in Grain Sorghum (Bindweed Site), Planting Date 4 (PD4), Walsh 2004.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/7	Bindweed Control Rated 6/28	Plant Stand	Grain Yield	Variable Net Income
	*/A	$/A	%	%	%	Bu/A	$/A
Hi Dep	16 oz	2.31	81	59	95	72	136.05
Paramount + COC	5.33 oz/1 qt	15.75	63	73	97	70	118.65
2,4-D LoVol 6	16 oz	2.23	71	58	95	57	107.42
Spartan	2 oz	5.20	72	47	94	59	107.03
Banvel	8 oz	3.75	65	62	93	55	100.16
LandMaster BW	54 oz	6.86	80	67	94	55	98.83
Control	----	0.00	5	5	96	52	98.17
Average		5.16	62	53	95	60	109.47
LSD 0.20			14.6	8.4	2.7	8.2	14.96

Variable Net Income: Grain Yield x Grain Sorghum Price ($1.98/bu) - Chemical Cost - Application.
Herbicide Treatments were applied May 17, 2004.
June 25 Planting Date (PD4) was planted 38 day after herbicide treatment application.

Table .-Bindweed Control in Grain Sorghum (Non Bindweed Site), Planting Date 4 (PD4), Walsh 2004.

Treatment	Rate	Chemical Cost	Plant Stand	Plant Stand Change	Grain Yield	Gross Income	Variable Net Income
	*/A	$/A	%	%	Bu/A	$/A	$/A
LandMaster BW	54 oz	6.86	95	11	63	124.34	113.48
2,4-D LoVol 6	16 oz	2.23	94	11	58	114.05	107.82
Banvel	8 oz	3.75	91	11	56	110.29	102.54
Hi Dep	16 oz	2.31	93	10	53	105.14	98.83
Control	----	0.00	94	11	51	101.77	97.77
Spartan	2 oz	5.20	91	6	54	106.33	97.13
Paramount + COC	5.33 oz/1 qt	15.75	93	5	52	103.75	84.00
Average		5.16	93	9	55	109.38	100.22
LSD 0.20			3.0		8.7	17.23	15.85

Gross Income: Grain Yield x Grain Sorghum Price ($1.98/bu).
Variable Net Income: Gross Income- Chemical Cost - Application Cost ($4/A).
Herbicide Treatments were applied May 17, 2004.
June 25 Planting Date was planted 38 days after herbicide treatment application.
Plant Stand change from June 7 Planting Date (PD3) to June 25 Planting Date (PD4).

Table .-Bindweed Control in Grain Sorghum (Bindweed Site), Planting Date 5 (PD5), Walsh 2004.

Treatment	Rate	Chemical Cost	Bindweed Control Rated 6/7	Bindweed Control Rated 6/28	Plant Stand	Grain Yield	Variable Net Income
	*/A	$/A	%	%	%	Bu/A	$/A
Hi Dep	16 oz	2.31	81	59	95	46	83.98
Banvel	8 oz	3.75	65	62	94	41	73.83
2,4-D LoVol 6	16 oz	2.23	71	58	93	36	64.46
LandMaster BW	54 oz	6.86	80	67	95	36	59.63
Control	----	0.00	5	5	95	32	59.36
Paramount + COC	5.33 oz/1 qt	15.75	63	73	95	38	55.69
Spartan	2 oz	5.20	72	47	93	33	55.35
Average		5.16	62	53	94	37	64.61
LSD 0.20			14.6	8.4	2.7	4.9	8.56

Variable Net Income: Grain Yield x Grain Sorghum Price ($1.98/bu) - Chemical Cost - Application.
Herbicide Treatments were applied May 17, 2004.
June 30 Planting Date (PD5) was planted 43 day after herbicide treatment application.

Table .-Bindweed Control in Grain Sorghum (Non Bindweed Site), Planting Date 5 (PD5), Walsh 2004.

Treatment	Rate	Chemical Cost	Plant Stand	Plant Stand Change	Grain Yield	Gross Income	Variable Net Income
	*/A	$/A	%	%	Bu/A	$/A	$/A
Control	----	0.00	90	-4	33	64.94	60.94
LandMaster BW	54 oz	6.86	90	-5	35	69.70	58.84
2,4-D LoVol 6	16 oz	2.23	95	1	32	63.95	57.72
Banvel	8 oz	3.75	90	-1	33	65.34	57.59
Hi Dep	16 oz	2.31	91	-2	30	59.80	53.49
Spartan	2 oz	5.20	91	0	31	62.17	52.97
Paramount + COC	5.33 oz/1 qt	15.75	91	-2	33	65.34	45.59
Average		5.16	91	-2	33	64.46	55.31
LSD 0.20			1.6		5.0	9.90	8.38

Gross Income: Grain Yield x Grain Sorghum Price ($1.98/bu).
Variable Net Income: Gross Income- Chemical Cost - Application Cost ($4/A).
Herbicide Treatments were applied May 17, 2004.
June 30 Planting Date was planted 43 days after herbicide treatment application.
Plant Stand change from June 25 Planting Date (PD4) to June 30 Planting Date (PD5).

Long-Term N Effects on Wheat-Sunflower-Fallow Rotation, Walsh, 2004

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 September 26, 2003, and sunflower on June 25, 2004 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 February 27, 2004 for wheat and to only the N side July 30, 2004 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 Roundup 16 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 Roundup 16 Oz/A, Spartan 2 Oz/A, and Prowl 48 Oz/A. We harvested two replications of the 20 ft. by 1045 ft. plots on July 14 for wheat and November 4 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: Wheat had a significant yield response to N, but it was a negative response. The highest yielding N rate for wheat was no N fertilizer. The wheat produced only 6 to 8 Bu/A. Sunflower yield also responded negatively to increasing N rate. Sunflower yield responses to the residual N left by N fertilization of the wheat and to applied N were negative. Sunflower yields were good, 950 to 1200 Lb/A. For both wheat and sunflower, the no N fertilizer treatments produced the highest yields.

Discussion: This is the fourth 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 fourth year that the dryland wheat yields did not response to applied N. The non-response of wheat yields to increasing N rates can be explained by sufficient residual N for the first year and low yields for the last three years. For the last three years, moisture was the primary yield-limiting factor, not N. This year both low moisture and hail damage contributed to the very low wheat yields. The yield average range was only 6 to 15 Bu/A for the last three wheat crops.

This year the sunflower yields were good, but sunflower yields declined with increasing N rates. Sunflower displayed a similar negative yield response to both residual and applied N. Soil samples taken in the wheat stubble in the spring, show that there was moderate amounts of residual N in the top foot of soil from the 60 and 90 Lb N/A plots. There was sufficient residual N in the top two feet of soil in both the 60 and 90 Lb N/A rates that our yield goal of 1000 Lb/A required only an additional 5 Lb N/A. To reach our 1000 Lb/A yield goal for the residual N from the 0 and 30 Lb N/A rates, an additional 45 Lb N/A was recommended. Neither residual N nor applied N

contributed to sunflower yield. With only negative 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 last three consecutive years, wheat yields in this rotation were very low, 6 to 15 Bu/A. The low 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 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 highest yielding N rate for sunflower was the 0 Lb/A treatment with 1200 Lb/A. There has been no N applied to the 0 Lb N/A plots for 4 wheat crops and three sunflower crops. 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 tended to decrease with increasing N rate: 39.7%, 37.8%, 38.7%, and 35.9% for 0, 30, 60, and 90 Lb N/A, respectively. Oil content of the last two sunflower crops also decreased with increasing N rate. This negative correlation of oil content with N rate has been previously reported (Vigil and Bowman, 1998).

Literature Cited

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.

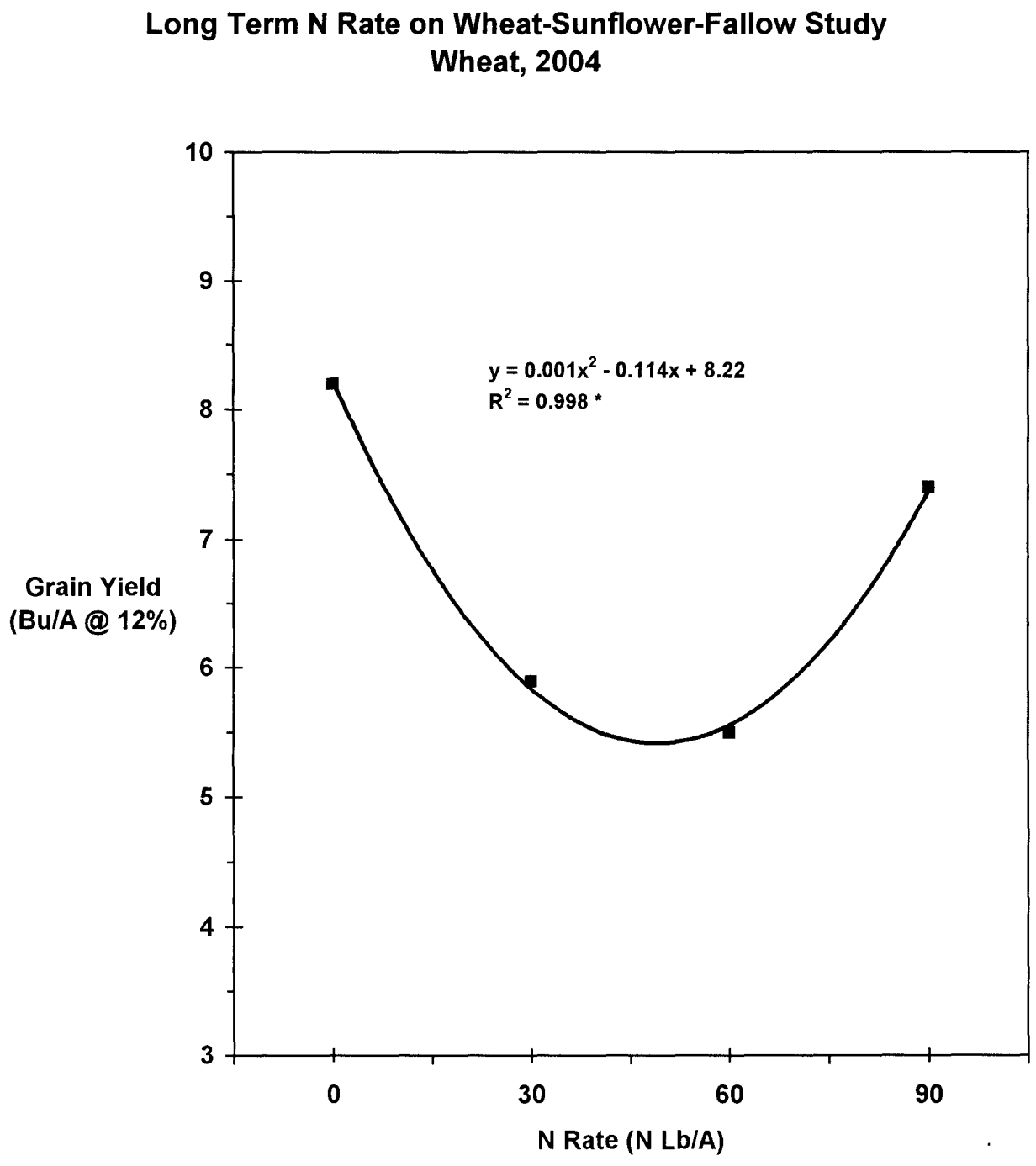

Fig. . N rate on dryland wheat in Wheat-Sunflower-Fallow rotation at Walsh. The N rates were 0, 30, 60, and 90 Lb N/A as 32-0-0. The wheat variety was Above sown at 50 Lb/A.

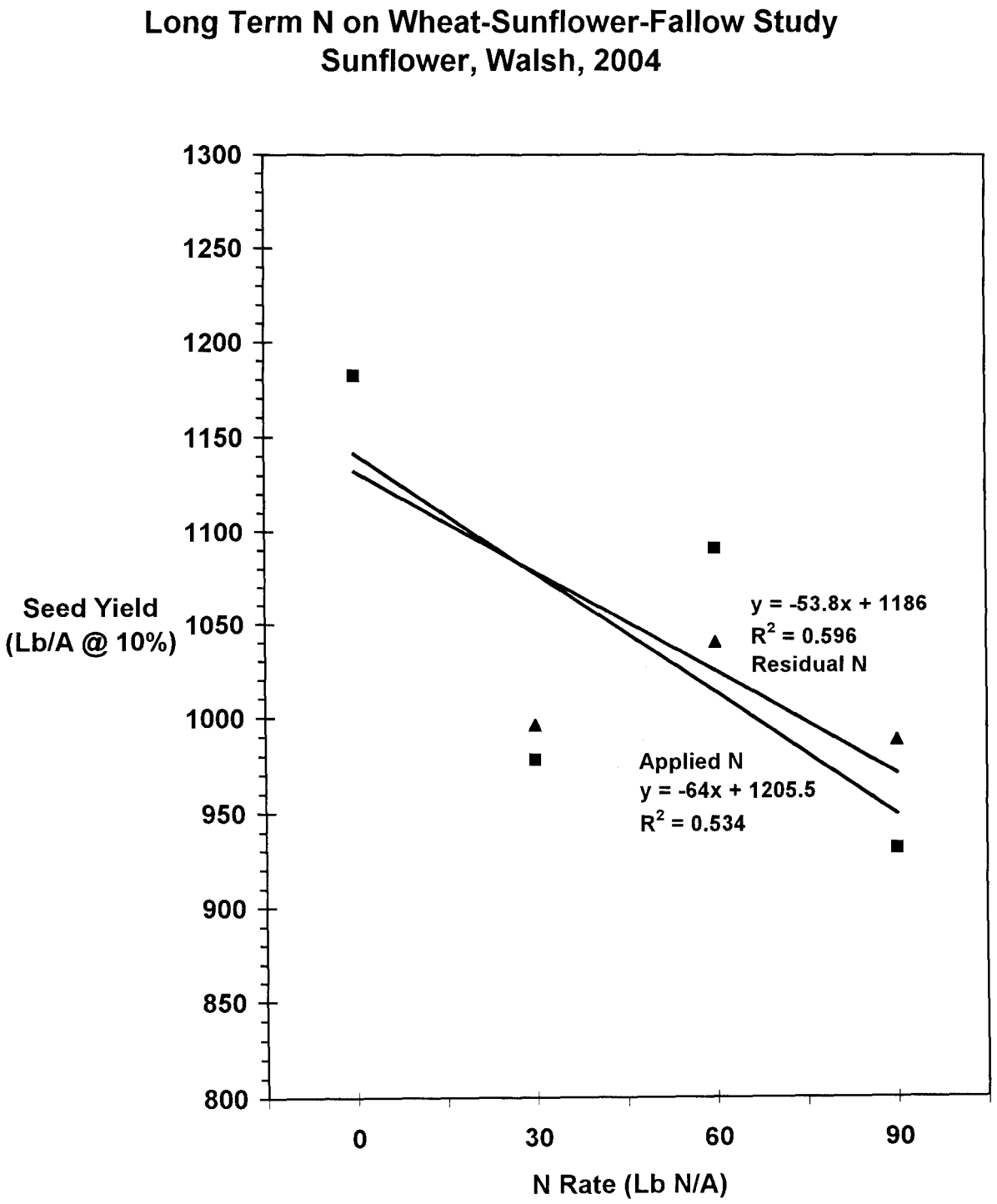

Fig. . N rate on dryland sunflower in Wheat-Sunflower-Fallow rotation at Walsh. The N rates were 0, 30, 60, and 90 Lb N/A as 32-0-0. Applied N is N applied to the sunflowers in the current season. Residual N is N applied to the wheat the previous season. The sunflower hybrid was MYCOGEN 8377NS planted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

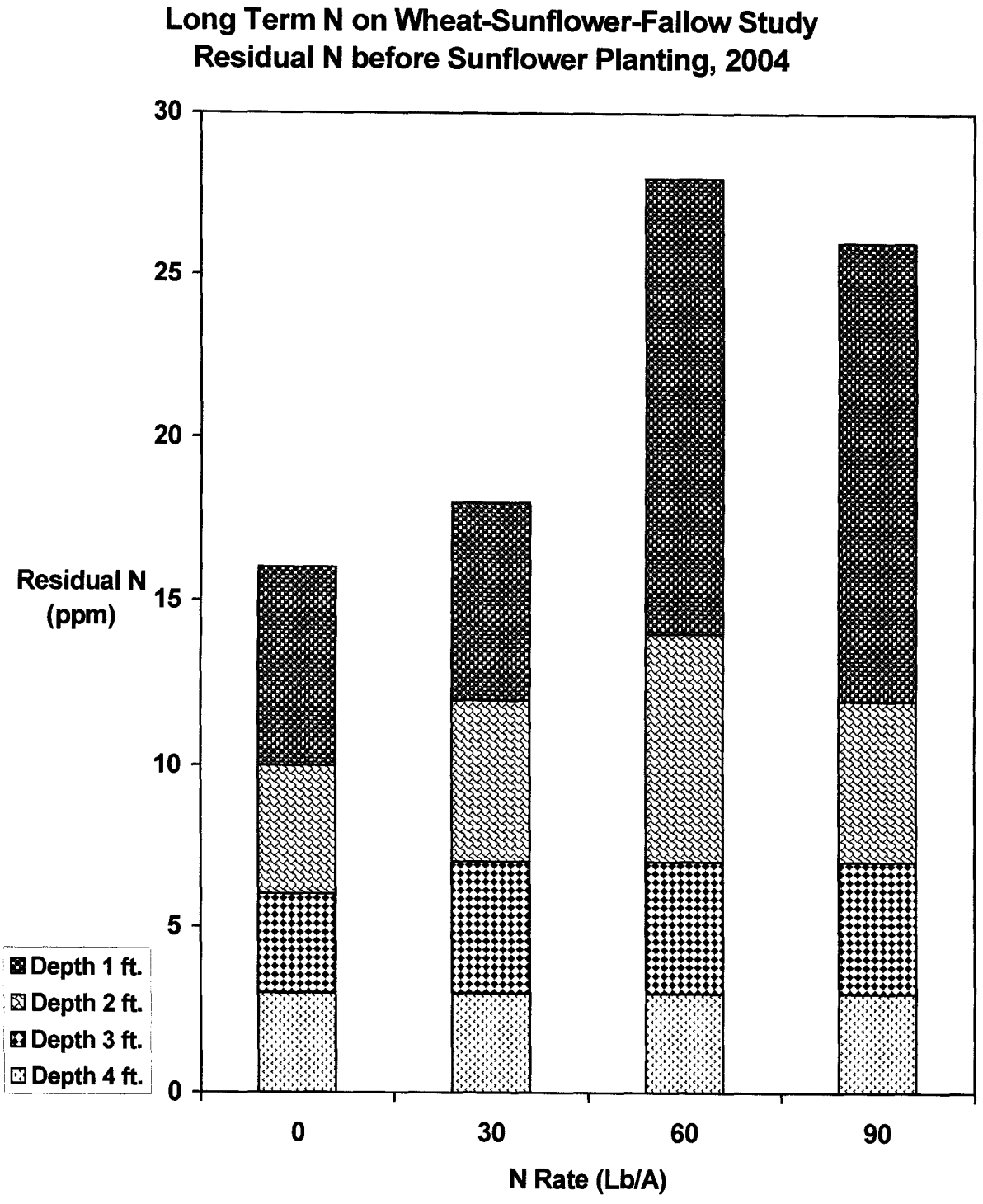

Fig. . Residual N from N rate applied to wheat on dryland Wheat-Sunflower-Fallow rotation at Walsh. The N rates were 0, 30, 60, and 90 Lb N/A as 28-0-0. Residual N was N applied to the wheat the previous season. No current season N was applied to the residual N plots for the sunflower crop. The soil samples were taken in the spring prior to sunflower planting.

Seedrow Poly Ammoniated Phosphate (10-34-0) on Dryland Sunflower

Kevin Larson and Dennis Thompson

Banding P fertilizer with the seed at planting (seedrow placement) has proven to be a very effective P fertilizing method for most dryland crops 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 crops 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). Growers have reported stand loss from seedrow 10-34-0 on sunflower. This study was conducted to determine the optimum rate of seedrow 10-34-0 for dryland sunflower.

Materials and Methods

We tested six rates of poly ammoniated phosphate (10-34-0) fertilizer banded with the sunflower seed on 30 in. row spacing in an alkaline Silty Clay Loam soil. The six rates were 0, 1.5, 3.0, 4.5, 6.0, and 7.5 gallons of 10-34-0/A, corresponding to phosphate levels of 0, 6, 12, 18, 24, and 30 Lb P_2O_5/A with nitrogen levels of 0, 1.8, 3.6, 5.4, 7.2, and 9.0 Lb N/A, respectively. The fertilizer was applied with a squeeze pump at 8.1 Gal/A and all fertilizer rates were diluted with water to their appropriate levels. The sunflower hybrid was Triumph 665 planted at 17,000 Seed/A on June 23. We harvested the 10 ft. by 500 ft. plots on November 11 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 treatment without seedrow P produced the highest yield and had the highest plant density. Seedrow application of 10-34-0 at any rate was detrimental to sunflower production. The reduction in sunflower yield and plant population to seedrow applied 10-34-0 indicates that a small amount of seedrow N is harmful to sunflower (even 2 Lb/A of N was too much). We are not suggesting that N and P are not important nutrients for high sunflower production, instead we are saying do not use seedrow applications of 10-34-0 on sunflower.

Sunflowers require relatively large amounts of P to manufacture oil. Since growers are paid for seed yield and oil content, it seems prudent to fertilize sunflowers with P. Placing the P fertilizer in the soil but away from the seed should provide the sunflower plant with its P requirements. More sunflower P fertilization research is needed.

Results from our Crop Rotation Sequencing and N Rates on Wheat-Sunflower-Fallow studies suggest that sunflower extracts all available soil moisture and leaves little for the subsequent crop. This indicates that sunflower in a dryland system should be grown no more than one in every four to six years to retrieve moisture and nutrients left by other crops. With abundant winter moisture refilling the soil water profile, more frequent sunflower insertion into the crop rotation cycle could be attempted.

Literature Cited

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

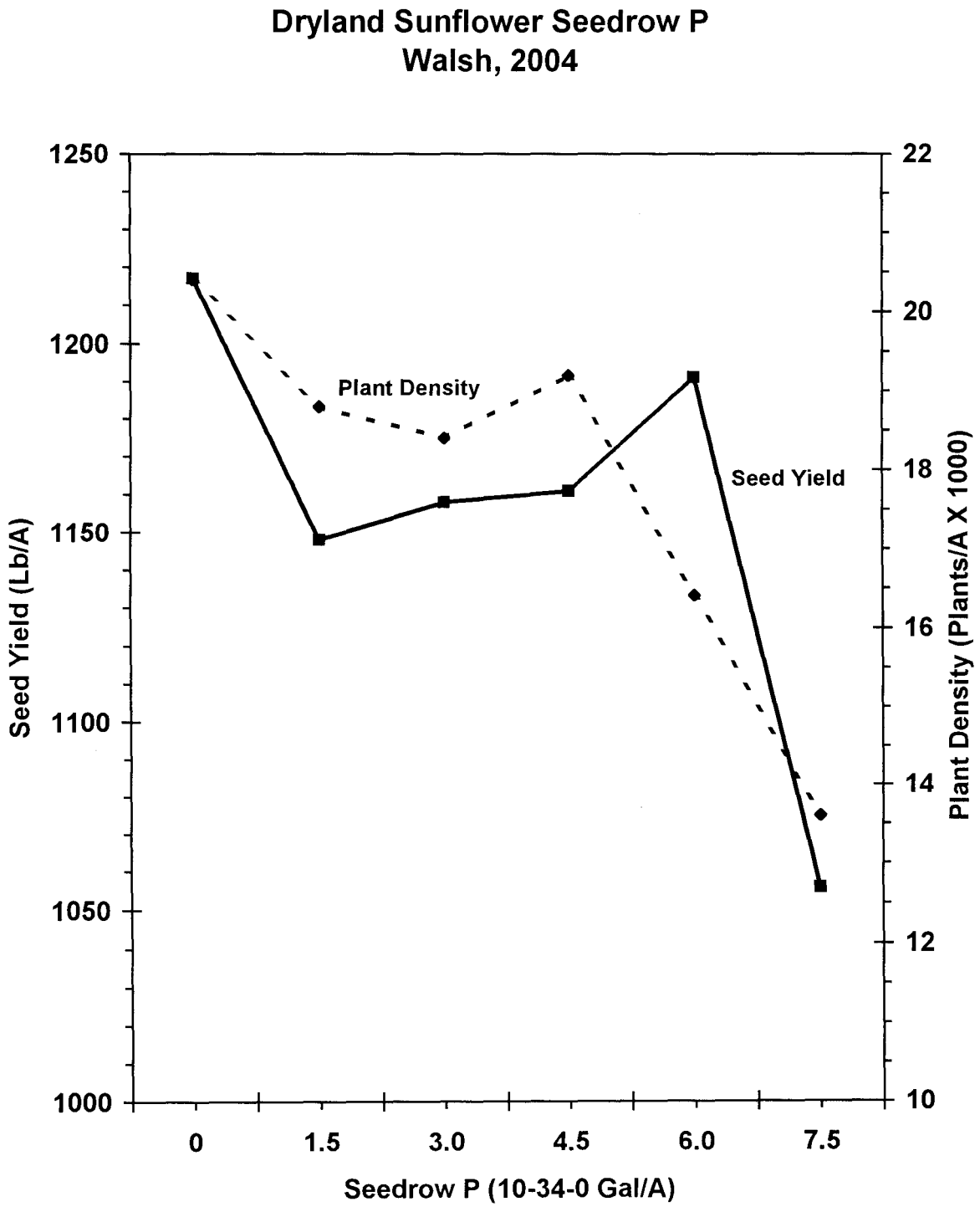

Fig. . Seedrow 10-34-0 on dryland sunflower at Walsh. TRIUMPH 665 was planted at 17,000 Seeds/A. The P and N fertilizer was 10-34-0, which contains 4 Lb P_2O_5/Gal and 1.2 Lb N/Gal.

Irrigated Sunflower Hybrid Performance Trial at Walsh, 2004

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, 650' long. SEEDING DENSITY: 24,000 Seed/A. PLANTED: May 21. HARVESTED: November 4.

IRRIGATION: Subsurface Drip Irrigated: total water applied 12.5 A-in./A.

PEST CONTROL: Preemergence Herbicides: Glyphosate 20 Oz/A, Spartan 2.0 Oz/A, Prowl 48 Oz/A. Post Emergence Herbicides: None. CULTIVATION: Once. INSECTICIDES: Warrior for head moth.

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

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	0.01	198	6	0	10
June	7.65	624	12	1	40
July	3.49	780	13	1	71
August	3.10	639	6	0	102
September	2.45	573	9	0	132
October	0.55	249	0	0	157
Total	12.12	3160	71	23	157

\1 Growing season from May 21 (planting) to October 25 (first freeze, 29 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in marginal soil moisture. Weed control was fair. Above normal precipitation for the growing season, wet and cool from mid-June to the end of the season. There was some sunflower moth damage due to late pesticide application. 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"	7.8	0.5	1.7	14	2.5	455	0.8	4.6
8"-24"				14				
Comment	Alka	VLo	Hi	Hi	VLo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	----------Lb/A----------			
Recommended	80	40	0	0
Applied	135	0	0	0

Yield Goal: 2500 Lb/A .
Actual Yield: 1929 Lb/A.

Table .-Drip Irrigated Sunflower, NuSun Variety Trial, PRC, Walsh, 2004.

Firm	Hybrid	50% Flowering	Plant Density	Seed Moisture	Test Weight	Oil	Seed Yield	Oil Yield
		Date	Plants/A (X1000)	%	Lb/Bu	%	Lb/A	Lb/A
TRIUMPH	s675	8/2	18.4	Below 8	30	44.2	2349	1038
MYCOGEN	8N352	7/29	19.6	Below 8	32	46.6	1936	902
TRIUMPH	s667	8/2	15.2	8.4	28	41.6	2024	842
MYCOGEN	8N421	7/31	17.2	Below 8	29	41.3	2006	828
MYCOGEN	8488NS	7/29	17.5	Below 8	29	40.7	2018	821
FONTANELLE	902NS	8/1	13.8	Below 8	26	41.6	1919	798
TRIUMPH	665	7/29	12.0	8.6	28	41.2	1937	798
TRIUMPH	636	8/2	13.6	8.5	25	39.8	2003	797
MYCOGEN	8D310	7/27	16.0	Below 8	28	37.9	2062	781
TRIUMPH	645	7/31	14.4	Below 8	25	41.7	1651	688
MYCOGEN	8377NS	7/28	12.4	Below 8	30	39.5	1704	673
MYCOGEN	8N429 CL	7/25	16.0	Below 8	27	36.0	1541	555
Average		7/30	15.5	Below 8	28	41.0	1929	794
LSD 0.20							207.0	85.2

Planted: May 21; Harvested: November 4.
Seed Yield adjusted to 10% seed moisture content.

Dryland Sunflower Hybrid Performance Trial at Vilas, 2004

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

PURPOSE: To identify high yielding hybrids under dryland conditions with 3200 sorghum heat units in a Sandy Clay soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 17,000 Seed/A. PLANTED: June 11. HARVESTED: October 22.

PEST CONTROL: Preemergence Herbicides: Roundup 16 Oz/A, Spartan 1.5 Oz/A, Prowl 48 Oz/A. Post Emergence Herbicides: None. 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	6.82	624	6	0	19
July	3.49	780	13	1	50
August	3.10	639	6	0	81
September	2.45	573	9	0	111
October	0.55	249	0	0	136
Total	16.41	2865	34	1	136

\1 Growing season from June 2 (planting) to October 25 (first freeze, 22 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in good soil moisture. Weed control was good. Above normal precipitation for the growing season, but very dry around flowering. Some hybrids had low plant densities. No insecticides were applied and sunflower moth and stem weevil damage was very high. The study averaged 31% plant lodging. Seed yields were poor.

SOIL: Sandy Clay 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"	7.3	0.3	1.0	6	1.8	203	0.6	6.0
8"-24"				6				
Comment	Alka	Vlo	Lo	Mod	VLo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	----------Lb/A----------			
Recommended	57	40	0	0
Applied	60	0	0	0

Yield Goal: 1200 Lb/A.
Actual Yield: 447 Lb/A.

Table .-Dryland Sunflower, NuSun Variety Trial, Vilas, 2004.

Firm	Hybrid	50% Flowering	Plant Density	Plants Lodged	Seed Moisture	Test Wt.	Seed Yield
		Date	Plants/A (X1000)	%	%	Lb/Bu	Lb/A
MYCOGEN	8N429 CL	8/11	11.9	19	Below 8	24	530
TRIUMPH	645	8/15	14.5	19	9.5	25	513
MYCOGEN	8377NS C*	8/15	11.3	26	Below 8	26	504
MYCOGEN	8N421	8/16	14.9	41	Below 8	26	499
MYCOGEN	8D310	8/13	16.2	30	Below 8	26	494
TRIUMPH	636	8/11	14.9	21	Below 8	25	480
MYCOGEN	8488NS	8/15	16.8	45	8.9	26	449
FONTANELLE	902NS	8/14	11.7	31	Below 8	25	448
TRIUMPH	665	8/16	15.8	28	Below 8	27	438
TRIUMPH	s667	8/17	10.9	30	9.6	25	395
MYCOGEN	8377NS	8/11	10.1	51	Below 8	27	317
TRIUMPH	s675	8/17	11.9	31	Below 8	25	301
Average		8/14	13.4	31	Below 8	26	447
LSD 0.20							94.0

Planted: June 11; Harvested: October 22.
Seed Yield corrected to 10% seed moisture content.
C* with Cruiser seed treatment.

Canola: Dormant Seeding Study, Walsh 2004

Kevin Larson and Dennis Thompson

Purpose: To test polymer seed coating and determine if winter and early spring seeding of canola would increase stand and yield.

Results and Discussion: On June 16, a hailstorm shattered seeds, dropped pods, and broke branches. The hailstorm lowered yield in this canola trial but yield losses were difficult to estimate. An adjacent wheat field had yield loss around 55%. This illustrates that canola cannot withstand hail near harvest.

This canola study was not harvested. Even without the hail damage, this spring-seeded canola trial would not have been worth harvesting because of severe weed and harlequin bug infestations. This canola trial never appeared as if it would be a high yielding study. Spring seeding canola and camelina is not a good fit for our environment.

Overall, the canolas, *Brassica napus* and *Brassica juncea* displayed slight increases in emergence and plant stand with the polymer seed coating. The polymer-coated seed was beneficial for the *Camelina sativa* with a noticeable increase in plant stand.

The January and February planting dates provided the highest emergence and plant stand percentages. Even with these winter planting dates, the canola camelina crops do not compete against early spring weeds such as kochia. Winter canola planted in the fall is much more competitive against early spring weeds.

In mid June a severe harlequin bug infestation occurred. This is the time when most of the planting dates of the spring-seeded canolas were flowering and pod-filling. The harlequin bugs would have caused significant yield losses. For fall-seeded winter canola, the timing of harlequin bug infestation is usually during late pod fill and yield losses are typically minor.

Canola would be a good candidate as a limited irrigated crop. This year, we had fair soil moisture at planting. Lack of soil moisture at planting is a common scenario, particularly for this shallow seeded crop. Because we frequently have dry conditions at planting, and recommend maximum planting depth for canola is only 1.5 in., irrigating after planting may be the only way to assure a stand.

Flowering dates are an important consideration because they reflect flowering and pod fill sensitivity to insect infestation timing. The two earliest planting dates, December 30 and January 23, flowered only one day a part. The last planting date, April 21, flowered about five weeks later than the first planting dates. This could be important because the timing of harlequin bug arrival and flowering may coincide. Insect damage at flowering and pod fill can greatly reduce yields.

Materials and Methods: We planted two canola species, *Brassica napus* and *Brassica juncea*, and *Camelina sativa* with and without polymer seed coating supplied by Blue Sun, Inc. on these planting dates: PD 1, December 30, 2003; PD 2, January 23, 2004; PD 3, February 23, 2004; PD 4, March 22, 2004, and PD 5, April 21, 2004 at 800,000 Seeds/A. The canola was planted with a 12 in. row-spaced drill to a depth of 1.5 inches. We had difficulty using the planter for the small-seeded camelina, therefore we

hand-broadcasted the camelina on top of the bed. We fertilized the site with 75 Lb N/A using a sweep plow prior to planting. No other fertilizers were applied. For weed control, we applied Treflan 24 Oz/A prior to planting. We furrow irrigated the site once in the spring. Because of hail damage and weed and harlequin bug infestations, the trial was not harvested.

Table .Canola, Dormant Seeding Study, Walsh, CO, 2004.

Plant Type	Polymer Coated Seed	Planting Date				
		Dec. 30 PD 1	Jan. 23 PD 2	Feb. 23 PD 3	Mar. 22 PD 4	Apr. 21 PD 5
		---------- % Emergence----------				
Brassica Napus	No	58	75	76	--	--
Brassica Napus	Yes	58	73	84	--	--
Brassica Juncea	No	12	38	48	--	--
Brassica Juncea	Yes	12	43	50	--	--
Camelina Sativa	No	0	0	0	--	--
Camelina Sativa	Yes	8	3	0	--	--
Emergence Average		25	39	43	--	--
		---------- % Plant Stand----------				
Brassica Napus	No	74	88	84	65	78
Brassica Napus	Yes	75	90	90	40	72
Brassica Juncea	No	53	82	83	54	64
Brassica Juncea	Yes	50	82	82	55	65
Camelina Sativa	No	2	1	2	27	24
Camelina Sativa	Yes	38	48	37	53	26
Average Stand		49	65	63	49	55
		----------50% Flowering Date----------				
Brassica Napus	No	15-May	15-May	20-May	30-May	21-Jun
Brassica Napus	Yes	13-May	15-May	18-May	29-May	23-Jun
Brassica Juncea	No	19-May	19-May	22-May	31-May	22-Jun
Brassica Juncea	Yes	20-May	19-May	22-May	30-May	22-Jun
Camelina Sativa	No	20-May	20-May	4-Jun	4-Jun	25-Jun
Camelina Sativa	Yes	20-May	21-May	22-May	3-Jun	25-Jun
Average Flowering Date		17-May	18-May	23-May	31-May	23-Jun

All treatments were planted with 800,000 Seeds/A.
A hailstorm on June 16 broke branches and shattered seeds. The study was not harvested.
% Emergence rating was taken April 1, 2004 before PD 4 and PD 5 had emerged.

National Winter and Spring Canola Variety Performance Trials, Walsh 2004

Kevin Larson, Charlie Rife, and Dennis Thompson

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

Results and Discussion: On June 16, a hailstorm shattered seeds, dropped pods, and broke branches resulting in approximately 70% seed loss in the winter canola. The hailstorm also lowered yield in the spring canola trial but yield losses were more difficult to estimate. An adjacent wheat field had yield loss around 55%. This illustrates that canola cannot withstand hail near harvest.

Neither the winter nor spring canola variety trials were harvested. Before the hail, the winter canola trial appeared as if it had the potential of 1500 Lb/A yield averages. Even without the hail damage, the spring canola trial would not have been worth harvesting because of severe weed and harlequin bug infestations. The spring canola trial never appeared as if it would be high yielding test. None of the spring canola varieties appeared to be well adapted to our environment.

Most of the plants of winter canola varieties survived the winter. The high winter survival average 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. This year, we had fair soil moisture at planting. Lack of soil moisture at planting is a common scenario, particularly for this shallow seeded crop. Because we frequently have dry conditions at planting, and recommend maximum planting depth for canola is only 1.5 in., irrigating after planting may be the only 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 36 winter canola varieties for the National Winter Canola Trial on September 5, 2003 at 6 Lb/A. We planted 16 spring canola varieties for the Regional Spring Canola Variety Trial on March 17, 2004 at 5 Lb/A. The two trials were planted with a 12 in. row-spaced drill to a depth of 1.5 inches in fair soil moisture. We fertilized the site with 75 Lb N/A using a sweep plow prior to planting and topdressed the winter canola with an additional 50 Lb N/A in March. No other fertilizers were applied. For weed control, we applied Treflan 24 Oz/A prior to planting. We furrow irrigated one time in the fall and one time in the spring with about 8 to 10 in./A of total water applied for the winter canola trials; the spring canola trials received only the spring irrigation. Because of hail damage and weed and harlequin bug infestations, the trials were not harvested.

National Winter Canola Trial, NVT, Walsh, CO 2004.

Line	Fall Stand 0-10	Winter Survival 0-10	50% Flowering Date	Plant Height In
Abilene	8.5	0.5	9-May	26
ARC90016-PR377	9.0	8.0	23-Apr	36
ARC91019-50-E2	9.5	6.5	1-May	33
ARC92004-1	9.5	4.0	11-May	36
ARC92007-2	8.5	3.0	8-May	29
Banjo	8.0	8.5	22-Apr	34
Casino	8.5	8.5	30-Apr	26
Ceres	6.5	4.5	5-May	23
Jetton	10.0	5.0	4-May	29
Kronos	10.0	5.5	25-Apr	26
KS2002	9.5	8.0	23-Apr	33
KS2004	9.5	9.5	23-Apr	27
KS2427	9.0	1.0	8-May	22
KS7436	9.5	8.5	22-Apr	35
KS8367	8.0	9.5	26-Apr	24
KS9124	9.0	10.0	23-Apr	37
KS9135	9.5	7.5	1-May	28
KS9183	9.0	7.5	25-Apr	35
Maestro	6.0	10.0	21-Apr	37
Plainsman	9.0	8.0	5-May	36
Rasmus	7.5	7.5	3-May	24
Sumner	8.5	7.5	26-Apr	21
SW 013062	9.0	0.5	10-May	32
SW 013154	7.5	7.5	5-May	36
SW 013186	9.0	3.5	2-May	35
SW 013022	8.5	3.0	3-May	25
SW 013121	9.0	2.5	5-May	26
SW 013173	8.5	0.5	29-Apr	24
SW 013211	9.5	4.0	5-May	29
SW 013253	7.0	1.0	11-May	21
Talent	9.0	8.0	1-May	32
Titan	6.5	7.5	27-Apr	36
Viking	8.0	2.0	7-May	35
VSX-2	8.0	7.5	1-May	22
Wichita	10.0	7.0	29-Apr	28
Wotan	8.5	7.0	3-May	33
Mean	8.6	5.8	30-Apr	30

Spring Canola, B. juncea, Variety Trial, Walsh, CO, 2004.

Line	Stand	50% Flowering
	0-10	Date
C13	7.0	8-Jun
C113	7.0	11-Jun
Blue-01-001	8.0	29-May
Blue-01-002	8.5	30-May
Blue-01-003	8.5	9-Jun
(W) Patriot RR	4.5	--
(W) HyLite 292 CL	4.5	--
Hyola 401	5.0	30-May
HyCLASS 905	8.5	10-Jun
HyCLASS 910	7.5	11-Jun
InVigor 4870	8.5	7-Jun
KAB 36	8.0	29-May
DK223	8.0	6-Jun
DKL3455	9.0	4-Jun
DKL3585	9.0	2-Jun
PHI-0401	8.5	30-May
PHI-04-02	9.5	31-May
PHI-04-03	8.5	25-May
PHI-04-04	3.0	8-Jun
PHI-04-05	7.5	2-Jun
Mean	7.4	3-Jun

Planted: March 17, 2004, 5 lb/A.
A hailstorm on June 16 broke branches and shattered seed. Not harvested.

Applied N for Cowpea Production, Walsh, 2004
Kevin Larson and Dennis Thompson

PURPOSE: To determine the effect of N on cowpea production.

MATERIALS and METHODS: We applied 45 Lb N/A as 32-0-0 on July 30, 2004 to inoculated cowpeas. We inoculated the Red Ripper cowpeas with Rhizobium at 1 lb. to 300 lb. of seeds. We planted the cowpeas on June 25 at 17 Lb Seed/A in 30 in. row spacings. To control weeds, we applied Pursuit at 1.08 Oz/A, and cultivated once. Using a row crop head we harvested on December 10 and weighed the seed with a digital scale.

RESULTS: The application of 45 Lb/A of N to cowpeas significantly increased seed yield (P > 0.10). Cowpea seed yield was very low.

DISCUSSION: This is our first attempt at raising cowpeas. The Red Ripper variety that we planted was more of a vine type than a bush type pea. Since it was a vine type pea, direct harvest, even with a row crop head, was difficult. The variety would have made a better forage pea than a grain pea. The Red Ripper cowpea is a late maturing cowpea. By the time it was ready for harvest, it had snowed and shattered many of its seeds. Applied N did increase yield, but yields were so low it made little difference. Next time we evaluate cowpeas, we will need to select nonshattering, earlier maturing, bush types.

Table .Applied N on Cowpea Study, Walsh, 2004.

N Application	Rate	Application Timing	Seed Yield
	Lb N/A		Lb/A
With N	45	Post	97
Without N	0	--	59
Orthogonal Contrast: Applied N significantly different than No N at 0.10 level.			0.10

Garbanzo Bean Weed Control Study, Walsh, 2004

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 on March 7, 2004 to the entire site and Spartan at 2.0 oz/A on May 15, 2004 to selective areas. We inoculated Dwelley, a Kabuli type garbanzo bean, with Rhizobium at 1 lb. to 300 lb. of seeds. We planted the beans on March 10 at 60 Lb Seed/A in 30 in. row spacings. No fertilizer was applied. Using a row crop head we harvested on December 10 and weighed the seed with a digital scale.

RESULTS: The Spartan and Pursuit combination produced significantly higher yield than Pursuit alone. Yields were very low due in part to a late harvesting date.

DISCUSSION: Weed control is a serious production problem for garbanzo beans. All too frequently, garbanzo bean fields are unharvestable because of weeds. Only two herbicides, Dual and Goal, specifically mention garbanzo beans on their labels; however, Treflan and Pursiut are registered for use on dry beans, and in my opinion garbanzo beans are dry beans. 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 no crop injury and controlled most of the broadleaf and grass weeds. There was some crop injury with the addition of Spartan. However, the addition of Spartan controlled some of the broadleaf weed left by Pursuit alone. Nonetheless, it is still important to choose a clean, weed free site so that the beans can be cultivated.

Garbanzo bean yields were very low. The cool, wet summer delayed their maturation. By the time they were ready for harvest, it had snowed and many of the beans had shattered.

Table .Garbanzo Bean Weed Control Study, Walsh, 2004.

Herbicide	Rate	Application Timing	Seed Yield
	*/A		Lb/A
Spartan and	2.0 oz	Post	207
Pursuit	1.08 oz	Pre	
Pursuit	1.08 oz	Pre	147

Orthogonal Contrast: Spartan + Pursuit significantly (*) different than Pursuit at 0.01 level.