Technical Report TR04-01 January 2004

Agricultural Experiment Station

Colorado State University
Knowledge to Go Places

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

Plainsman Research Center 2003 Research Reports

This Plainsman research booklet is dedicated to the founding members of the Plainsman Agri-Search Foundation. Three of the original Plainsman Agri-Search Foundation board members: Bill Wright, Dean Nichols, and Bernard Neill, have served continuously for 30 years. We thank these original members for their innovation, dedication, and guidance. We are proud to call them Lifetime Board Members.

From the beginning, to the present, through the future.

Plainsman Research Center, Research Reports for 2003

Content | Page

PLAINSMAN AGRI-SEARCH FOUNDATION BOARD

2003 Plainsman Research Center Staff and Personnel with Projects

Kevin Larson (719) 324-5643	Superintendent, Plainsman Research Center, Agricultural Experiment Station, Colorado State University.
Dennis Thompson (719) 324-5643	Technician III, Plainsman Research Center, Agricultural Experiment Station, Colorado State University.
Deborah Harn (719) 324-5643	Research Associate, RWA Project, Plainsman Research Center, Agricultural Experiment Station, Colorado State University.
Calvin Thompson (719) 324-5643	Farm Coordinator, Plainsman Research Center, Agricultural Experiment Station, Colorado State University.
Thia Walker (719) 336-7734	Area Entomologist, RWA Project, Plainsman Research Center, Agricultural Experiment Station, Colorado State University.
Tim Macklin (719) 336-7734	Area Cropping Systems Specialist, Southeast Area Cooperative Extension, Colorado State University.
Jerry Johnson (970) 491-1454	Extension Crop Specialist, Crop Testing Program Leader, Soil and Crop Sciences Department, Colorado State University.
Scott Haley (970) 491-6483	Associate Professor, Soil and Crop Sciences Department Wheat Breeder, Colorado State University.
Gary Peterson (970) 491-6804	Professor and Head, Soil and Crop Sciences Department, Colorado State University.
Dwayne Westfall (970) 491-6149	Professor, Sustainable Dryland Agroecosystem Management Project Leader, Soil and Crop Sciences Department, Colorado State University.
Phil Westra (970) 491-5219	Associate Professor, Weed Specialist, Cooperative Extension, Weed Science Department, Colorado State University.
Mark Brick (970) 491-6551	Professor, Bean Breeder, Soil and Crop Sciences Department, Colorado State University.

2003 CLIMATOLOGICAL SUMMARY
PLAINSMAN RESEARCH CENTER

Mon.	Temperature Max. F	Min. F	Max. Mean F	Min. Mean F	Mean F	Prec. In.	Greatest Day of Precip-atation	Snow-Fall in.	Greatest Snow Depth in.	Evapor-ation in.
Jan.	75	10	49.4	21.6	35.5	0.10	0.10	1.00	1.00	
Feb.	76	0	46.1	19.7	32.9	0.61	0.14	3.50	1.00	
Mar.	83	11	58.7	29.1	43.9	2.19	1.19	0.30	0.30	
Apr.	88	20	69.5	38.9	54.2	2.10	1.38	2.00	2.00	2.54
May	101	33	78.4	47.4	62.9	2.29	1.36	0.00	0.00	9.02
Jun.	96	41	80.7	55.6	68.2	6.89	1.51	0.00	0.00	5.09
Jul.	104	57	94.2	64.7	79.4	1.62	0.83	0.00	0.00	16.88
Aug.	104	54	92.4	61.1	76.8	2.72	1.26	0.00	0.00	11.80
Sep.	94	37	80.2	50.1	65.2	0.77	0.57	0.00	0.00	9.85
Oct.	92	22	75.7	42.4	59.1	0.08	0.06	0.00	0.00	7.44
Nov.	78	3	54.1	27.8	41.0	0.44	0.28	0.25	0.25	
Dec.	68	3	50.3	20.5	35.4	0.47	0.23	4.50	2.50	
TOTAL ANNUAL			69.14	39.91	54.54	20.28		11.55	7.05	

***NOTE: Evaporation read mid April through October 22nd.
Wind velocity is recorded at two feet above ground level.
Total evaporation from a four foot diameter pan for the period indicated.
Very High evaporation for month of July 16.88 inches, example shown below
July 27 evaporation was .90 inch per day - 9 days above .70 of an inch per day

	2003	2002
Highest temperature:	104 degrees on July 15th, 25th	106 degrees on Aug. 19th
Lowest temperature:	0 degrees on Feb. 7th	0 degrees on Mar. 2nd
Last freeze in spring:	32 degrees on Apr. 11th	31 degrees on Apr. 28th
First freeze in fall:	22 degrees on Oct.26th	32 degrees on Oct.13th
2003 frost free season:	199 frost free days	167 frost free days
Avg. for 20 years:	19.74 inches	Avg. for 19 years: 19.21 inches

Maximum Wind:

Jan.	40 mph on 1st/2nd/16th	July	36 mph on 6th
Feb.	36 mph on 3rd	Aug.	43 mph on 19th/20th
Mar.	43 mph on 20th, 28th	Sep.	41 mph on 18th
Apr.	59 mph on 16th	Oct.	37 mph on 11th
May	42 mph on 31st	Nov.	38 mph on 14th
Jun.	50 mph on 2nd	Dec.	45 mph on 16th

Introduction

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 dryland UVPT was comprised of 66 entries grown at 10 locations. Of the 66 entries in this trial, approximately half were named varieties and the other half were experimental lines. In addition to CSU varieties and experimental lines, the trial included public varieties from Nebraska, Oklahoma, Kansas, and Texas, and private varieties from Cargill-Goertzen and AgriPro. 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 and 12 inch-spaced rows at the other locations.

The irrigated IVPT was conducted at Rocky Ford, Ovid, and Fort Collins. The irrigated trials are managed for maximum yield and are seeded at 1.2 million seeds per acre with adequate fertilization to obtain or exceed 100 bushels per acre. The Ovid and Fort Collins trials were grown under sprinkler irrigation and the Rocky Ford trial was furrow-irrigated. All three irrigated trials provided excellent results. The Ovid trial was planted late to reflect results that might be obtained by planting winter whea after harvesting corn in northeastern Colorado.

Planting conditions in the fall of 2002, following the severe drought, ranged from adequate to excellen except at the Bennett and Genoa locations where planting conditions were extremely dry. The trial a Bennett partially emerged after the late March (2003) snowstorm but resulting stands were highly variable. Emergence at Genoa was uniform but only about half the desired level. In spite of generally good emergence and top soil moisture conditions at the other locations, poor sub-soil moisture levels throughout eastern Colorado were prevalent. Adequate fall and winter precipitation was followed by a dry spring and moderate drought stress conditions at Walsh, Lamar, Sheridan Lake, Cheyenne Wells, Burlington, Genoa, and Orchard. The spring drought was aggravated by limited sub-soil moisture.

Russian wheat aphid pressure was higher this year than in recent years, especially in east-central and southeastern Colorado. A new Russian wheat aphid biotype was identified that overcomes the resistance in all RWA-resistant varieties released to date. Found in several places in eastern Colorado, it is feared that this new biotype (denoted as "biotype B") will spread throughout the region and replace the original RWA biotype (denoted as "biotype A"). Russian wheat aphid damage was observed at Walsh, Bennett, and Fort Collins with sporadic infestations observed at several other locations. Wheat steak mosaic virus and high plains disease were not observed at any locations and slight barley yellow dwarf virus symptoms were only observed at one location. Stripe rust, which had been so severe in 2001, was observed at the dryland trials at Julesburg, Akron, Burlington, Genoa, and Orchard and the irrigated trials at Fort Collins and Ovid. Infestation levels at these locations were relatively light except at Akron (dryland) and Ovid (irrigated) where yields of some highly susceptible entries were reduced significantly. Leaf rust was observed at very low levels at some locations. Temperatures were quite moderate statewide throughout May and June except one brief event high temperature in late May. High temperatures began in early July and affected some of the more northern trials during the last two weeks of grain filling. Low grain protein content, indicative of low soil nitrogen levels, were observed in some parts of the state that had above average yields.

Hail played a major role in reducing yields in 2003. Trials at Walsh, Lamar, Sheridan Lake, Cheyenne Wells, Genoa, and Orchard were damaged, to varying degrees, by early and late June hail events.

Several locations received hail twice. These hail events led to more severe shattering than in previous years. All locations were harvested in 2003 but the UVPT summary table of results only includes six of the ten locations as emergence, drought, and hail conditions did not permit reliable variety yield comparisons at Bennett, Lamar, Sheridan Lake, and Genoa.

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. More complete information for each trial, including performance of the Colorado experimental lines, will be available on the Internet at the following sites:

http://www.colostate.edu/Depts/SoilCrop/extension/CropVar/wheat1.html
http://wheat.colostate.edu/vpt.html

Colorado winter wheat Uniform Variety Performance Trial summary for 2003.

	Location												2003			
	Akron		Burlington		Cheyenne Wells		Julesburg		Orchard		Walsh		Averages			
Variety[1]	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Yield	% of Trial Average	Test Wt	Pt Ht
	bu/a	lb/bu	bu/a	lb/bu	bu/a	lb/bu	bu/a	lb/bu	bu/a	lb/bu	bu/a	lb/bu	**bu/ac**	%	lb/bu	in
Yuma	93.4	59.5	56.0	56.9	42.5	59.4	75.9	59.0	33.0	61.4	17.2	59.7	**53.0**	109	59.3	28
Trego	92.8	61.0	48.3	59.7	41.9	60.3	74.0	60.7	35.3	63.3	24.9	60.5	**52.9**	109	60.9	26
Above	93.1	59.6	46.0	57.0	41.0	58.8	72.4	59.1	39.2	59.1	25.0	59.9	**52.8**	109	58.9	27
TAM 111	101.3	60.8	46.5	57.8	41.4	61.1	72.6	59.1	35.4	62.8	18.7	60.2	**52.6**	109	60.3	28
Ankor	90.4	58.1	45.2	57.5	41.8	58.6	73.5	58.4	37.3	61.4	22.8	60.2	**51.8**	107	59.0	29
Enhancer	94.9	60.2	48.0	55.8	42.8	60.5	76.8	58.2	32.4	61.5	14.0	59.2	**51.5**	106	59.2	31
Alliance	92.2	59.5	42.7	56.6	39.3	60.9	74.2	58.8	34.4	61.9	20.4	58.9	**50.5**	104	59.4	27
Avalanche	89.9	61.0	47.7	58.7	42.3	60.5	65.4	60.7	34.4	61.8	22.9	61.1	**50.4**	104	60.6	28
Yumar	91.0	60.2	50.2	58.1	38.7	58.7	77.0	59.6	29.1	61.2	16.0	60.5	**50.3**	104	59.7	28
Prairie Red	88.5	59.2	48.8	56.9	40.7	57.2	68.2	59.0	32.3	61.4	22.6	59.2	**50.2**	104	58.8	28
TAM 110	87.2	58.1	44.3	56.6	41.0	58.0	71.9	59.5	33.8	60.7	21.6	59.5	**49.9**	103	58.7	27
Akron	88.4	59.4	46.3	57.7	42.6	58.8	67.5	58.6	33.4	60.5	19.5	59.3	**49.6**	103	59.0	28
Stanton	92.2	60.3	41.7	58.4	39.7	59.3	69.9	59.0	31.7	62.1	21.0	60.5	**49.4**	102	59.9	29
AP502 CL	87.6	59.4	43.5	56.9	39.2	58.7	71.4	59.4	31.1	60.4	20.6	58.6	**48.9**	101	58.9	28
Ok101	88.4	60.0	46.6	56.9	37.8	59.1	69.5	58.9	33.1	61.6	17.1	60.2	**48.8**	101	59.4	29
Cisco	88.9	60.5	48.3	56.6	37.5	57.9	57.2	59.6	32.5	60.5	22.4	60.4	**47.8**	99	59.2	28
Lakin	81.5	57.9	48.2	57.2	38.8	60.3	71.0	58.0	34.1	62.0	13.2	59.9	**47.8**	99	59.2	28
2137	85.7	59.3	45.8	58.0	38.0	59.0	71.5	59.4	30.2	61.3	13.1	59.1	**47.4**	98	59.4	27
Ok102	84.7	60.5	44.8	57.6	39.8	58.5	64.1	59.5	30.7	61.9	19.2	60.3	**47.2**	98	59.7	27
Halt	85.4	58.3	41.7	56.0	33.1	59.6	71.5	58.0	30.5	61.0	17.8	59.1	**46.7**	96	58.7	27
Jagalene	90.6	61.4	41.7	57.6	37.9	58.1	67.3	59.6	26.7	63.0	15.4	61.0	**46.6**	96	60.1	27
Jagger	93.2	60.6	44.2	56.0	33.4	58.8	62.2	58.9	30.8	60.9	12.4	60.0	**46.0**	95	59.2	29
Kalvesta	87.8	59.8	40.8	56.2	35.2	59.7	66.0	58.6	31.4	61.6	14.1	59.5	**45.9**	95	59.2	27
Prowers 99	83.3	61.4	40.0	58.0	40.2	61.5	62.2	60.5	31.4	62.2	15.2	60.4	**45.4**	94	60.7	32
G980091-1	85.1	59.7	39.7	56.4	28.7	58.8	66.5	58.3	33.0	60.6	10.8	59.4	**44.0**	91	58.9	26
Venango	81.2	59.7	33.4	55.8	27.9	59.0	68.6	59.1	29.3	*	6.0	60.2	**41.1**	85	58.8	28
Thunderbolt	78.0	61.2	35.3	58.2	26.5	59.8	61.0	59.9	28.1	62.5	8.8	61.0	**39.6**	82	60.4	27
Average	**88.8**	**59.9**	**44.7**	**57.2**	**38.1**	**59.3**	**69.2**	**59.2**	**32.4**	**61.5**	**17.5**	**59.9**	**48.4**	**100**	**59.5**	**28**
$LSD_{(0.30)}$	4.6		2.7		3.9		3.1		2.8		2.4					

[1]Varieties in table ranked by the average yield over six locations in 2003.

*Inadequate grain for test weight determination.

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

	Averages						
Variety[1]	3-Yr	2-Yr	2003	2002	2001	3-Yr	2-Yr
	----------------Yield (bu/ac)----------------					--Twt (lb/bu)--	
Trego (HWW)	47.2	46.7 (3)	52.9	34.3	42.5	59.8	60.8
Enhancer	45.0	44.4	51.5	30.3	40.5	57.8	58.9
Stanton	45.0	43.8	49.4	32.6	41.1	58.4	59.9
Above (CL)*	44.5	46.7 (2)	52.8	34.5	37.3	57.4	59.0
Yuma	44.3	45.3 (5)	53.0	30.0	38.3	57.7	59.2
Alliance	44.3	44.5	50.5	32.5	39.1	57.8	59.2
Ankor	43.8	45.8 (4)	51.8	33.7	37.0	57.6	58.7
Jagger	43.8	41.3	46.0	31.7	41.5	58.1	59.2
Akron	43.7	44.1	49.6	33.2	38.4	57.7	58.8
Prairie Red	43.0	45.0	50.2	34.6	36.2	57.5	58.8
Avalanche (HWW)	42.8	44.1	50.4	31.6	36.7	59.2	60.6
Halt	42.8	42.7	46.7	34.7	38.1	57.4	58.6
Yumar	42.4	43.8	50.3	30.8	36.2	58.3	59.3
AP502 CL*	41.6	43.5	48.9	32.7	35.1	56.9	58.6
TAM 110	41.2	44.1	49.9	32.3	33.7	57.0	58.8
Prowers 99	41.1	40.9	45.4	31.8	36.8	59.5	60.3
Lakin (HWW)	40.8	43.2	47.8	33.9	33.9	58.3	59.3
2137	40.2	42.3	47.4	32.2	33.6	57.5	59.0
Venango	37.3	37.3	41.1	29.9	33.1	58.5	58.9
TAM 111	---	46.8 (1)	52.6	35.0	---	---	59.9
Jagalene	---	43.0	46.6	35.7	---	---	60.2
Ok101	---	42.8	48.8	30.9	---	---	59.2
Cisco	---	42.5	47.8	31.7	---	---	59.1
Thunderbolt	---	36.7	39.6	30.8	---	---	60.2

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

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

CL - CLEARFIELD wheat variety.

HWW - Hard white winter wheat variety.

Protein Content of UVPT Entries at Four Trial Locations for 2003.

Variety	Walsh	Burlington	Julesburg	Akron	Average
	Trial Locations				
Ok102	15.0	17.9	10.5	13.7	14.3
Kalvesta	13.8	19.5	10.6	12.8	14.2
Thunderbolt	14.4	17.8	10.7	13.6	14.1
Cisco	14.6	17.8	11.2	12.6	14.1
Lakin	14.4	16.2	8.5	14.5	13.4
G980091-1	13.4	17.4	9.5	12.8	13.3
Jagger	12.6	17.6	9.5	13.5	13.3
Halt	12.2	17.3	9.2	13.9	13.1
TAM 111	13.0	17.5	9.2	12.4	13.0
Venango	12.9	17.2	10.1	12.0	13.0
Stanton	13.5	17.7	8.6	11.9	12.9
Jagalene	12.2	17.6	9.0	12.7	12.9
Enhancer	13.3	17.4	9.4	11.1	12.8
AP502 CL	12.4	16.6	9.3	12.4	12.7
TAM 110	13.5	16.3	8.2	12.7	12.7
Prairie Red	11.8	16.2	9.6	12.8	12.6
Prowers 99	12.6	16.8	7.9	13.1	12.6
Above	12.0	16.1	9.1	13.3	12.6
Avalanche	12.7	16.3	9.5	11.4	12.5
Akron	11.9	16.2	8.0	13.0	12.3
Trego	11.4	16.8	8.5	12.5	12.3
2137	13.5	16.6	8.4	10.4	12.2
Ankor	10.8	16.4	8.4	13.2	12.2
Yumar	12.7	14.7	8.9	12.4	12.2
Ok101	12.2	15.7	8.1	12.0	12.0
Yuma	11.9	15.2	8.8	11.5	11.9
Alliance	11.0	15.5	7.8	11.8	11.5
Average	**12.8**	**16.8**	**9.1**	**12.6**	**12.8**
Minimum	**10.8**	**14.7**	**7.8**	**10.4**	**11.5**
Maximum	**15.0**	**19.5**	**11.2**	**14.5**	**14.3**

*Protein contents adjusted to 12% moisture basis.

Winter wheat Uniform Variety Performance Trial at Walsh in 2003[1].

Variety	Yield	Test Weight	Plant Height	Shatter[2]
	bu/ac	lb/bu	in	1-9
CO99W192	28.7	60.1	23	4
CO00D007	25.6	59.2	23	3
CO00016	25.1	59.1	24	4
Above	25.0	59.9	24	4
Trego	24.9	60.5	23	4
CO991350	24.5	58.4	23	3
CO980630	24.4	60.2	22	4
CO99W188	24.2	59.6	23	3
CO980607	24.0	60.2	19	4
CO99141	23.3	60.7	24	4
Avalanche	22.9	61.1	24	5
Ankor	22.8	60.2	24	3
CO00484	22.6	58.2	23	3
Prairie Red	22.6	59.2	23	3
Cisco	22.4	60.4	23	4
CO00501	22.4	59.2	24	3
CO99W277	22.4	59.6	26	3
CO99W183	22.3	58.9	23	3
CO991407	21.6	60.9	24	5
TAM 110	21.6	59.5	23	3
Stanton	21.0	60.5	23	5
CO00698	20.8	59.1	23	3
AP502 CL	20.6	58.6	23	3
CO99W329	20.5	60.0	23	4
CO980376	20.4	59.5	23	6
Alliance	20.4	58.9	24	5
CO00D011	20.3	59.3	21	5
CO00345	20.3	60.3	23	5
Akron	19.5	59.3	22	4
Ok102	19.2	60.3	22	4
CO991132	19.1	58.7	28	5
CO00W015	19.0	60.5	28	5
CO99W254	19.0	58.8	21	6
TAM 111	18.7	60.2	26	5
CO991057	18.6	58.8	22	3
CO00580	18.4	59.0	23	5
CO00480	18.1	58.9	24	4
CO00582	18.1	60.4	25	4
CO00579	18.1	57.9	23	3
Halt	17.8	59.1	24	5
CO00554	17.5	59.1	22	4
CO980684-1	17.3	60.1	24	7
CO99177	17.2	59.0	22	5
Yuma	17.2	59.7	22	5
Ok101	17.1	60.2	23	6
CO00523	16.6	58.3	23	4

Variety	Yield	Test Weight	Plant Height	Shatter[2]
	bu/ac	lb/bu	in	1-9
CO00796	16.6	60.0	24	4
CO00739	16.3	59.3	25	4
CO00347	16.2	60.0	23	5
Yumar	16.0	60.5	23	5
CO970547-7	15.6	59.9	21	6
Jagalene	15.4	61.0	24	8
Prowers 99	15.2	60.4	26	4
CO970547	14.9	60.6	24	5
Kalvesta	14.1	59.5	23	5
Enhancer	14.0	59.2	27	4
CO99314	13.9	60.7	21	5
CO00583	13.8	59.4	21	6
Lakin	13.2	59.9	23	5
2137	13.1	59.1	23	6
Jagger	12.4	60.0	26	6
CO970547-2	11.5	59.6	25	7
G980091-1	10.8	59.4	21	6
CO00335	9.7	60.2	25	8
Thunderbolt	8.8	61.0	22	8
Venango	6.0	60.2	23	8
Average	**18.7**	**59.7**	**23**	**5**
$LSD_{(0.30)}$	2.4			

[1]Trial conducted on the Plainsman Research Center; seeded 9/23/02 and harvested 7/01/03.
[2]Rating scale 1-9, with 1 = no shatter and 9 = severely shattered. Average of three replications.

Notes: Excellent moisture at planting, good stands. Brown wheat mites washed off by March 20 rain. Early spring drought stress. RWA found with Prowers 99 and Stanton showing effects as well as Biotype A susceptible varieties. Strong hail June 3. Hail again June 28. Lots of shattering.

Winter wheat Uniform Variety Performance Trial at Cheyenne Wells in 2003[1].

Variety	Yield	Grain Moisture	Test Weight	Plant Height	Shatter[2]
	bu/ac	%	lb/bu	in	1-9
CO00698	52.1	8.7	57.5	24	4
CO991350	50.1	9.3	58.5	25	2
CO980376	48.0	9.7	60.2	25	2
CO00D007	48.0	9.3	57.5	26	1
CO991057	47.1	9.5	58.8	26	3
CO980607	47.1	9.5	59.2	21	2
CO99W192	46.0	9.1	56.7	23	1
CO991407	45.5	9.6	59.1	25	3
CO99W183	44.8	9.0	57.7	23	3
CO00484	44.7	9.4	59.9	24	2
CO99W277	44.2	9.6	60.8	26	1
CO980630	44.0	9.6	60.0	23	3
CO00580	43.9	9.1	58.1	23	3
CO00016	43.9	9.4	58.5	24	1
CO980684-1	43.2	9.6	57.7	24	
Enhancer	42.8	9.7	60.5	26	5
CO00D011	42.7	10.1	60.0	21	2
Akron	42.6	9.8	58.8	25	2
CO00796	42.5	9.5	59.2	28	3
Yuma	42.5	9.8	59.4	24	4
Avalanche	42.3	9.9	60.5	23	1
Trego	41.9	10.1	60.3	21	1
Ankor	41.8	9.6	58.6	25	3
CO99W254	41.6	9.6	60.3	22	2
CO00480	41.4	9.2	58.9	27	2
TAM 111	41.4	10.3	61.1	25	2
Above	41.0	9.5	58.8	21	2
TAM 110	41.0	9.0	58.0	23	2
CO00501	40.9	9.4	59.1	24	2
Prairie Red	40.7	8.8	57.2	27	1
Prowers 99	40.2	10.6	61.5	27	4
CO970547-7	40.2	9.5	59.5	24	3
CO00345	39.8	9.6	60.4	23	2
CO00739	39.8	9.3	58.8	26	5
Ok102	39.8	9.1	58.5	22	2
Stanton	39.7	9.7	59.3	27	1
CO991132	39.5	9.5	59.3	27	
CO00554	39.4	9.1	57.7	24	2
Alliance	39.3	9.8	60.9	23	2
CO99W188	39.2	9.4	59.0	23	2
AP502 CL	39.2	9.0	58.7	21	2
CO00W015	39.0	9.8	59.3	25	2
Lakin	38.8	9.6	60.3	24	3
Yumar	38.7	9.9	58.7	26	4
CO00347	38.7	9.3	59.1	23	3
CO99141	38.2	9.3	59.9	22	2

Variety	Yield	Grain Moisture	Test Weight	Plant Height	Shatter[2]
	bu/ac	%	lb/bu	in	1-9
2137	38.0	9.6	59.0	25	2
Jagalene	37.9	8.7	58.1	21	3
Ok101	37.8	9.4	59.1	24	3
Cisco	37.5	9.2	57.9	24	4
CO00579	36.0	9.4	58.5	23	3
CO00523	35.6	9.7	59.2	25	4
Kalvesta	35.2	9.2	59.7	22	4
CO99W329	34.3	9.6	58.3	25	2
CO99314	33.9	9.4	59.4	22	4
Jagger	33.4	9.4	58.8	24	3
Halt	33.1	9.1	59.6	23	5
CO970547	32.4	9.1	59.0	26	4
CO00583	31.7	9.4	60.0	23	5
CO00582	31.3	9.5	58.8	25	4
CO99177	30.7	9.9	58.9	23	4
CO970547-2	29.8	9.6	59.3	27	8
G980091-1	28.7	9.5	58.8	23	5
Venango	27.9	9.4	59.0	23	8
CO00335	27.2	10.5	60.5	24	4
Thunderbolt	26.5	10.1	59.8	23	5
Average	**39.5**	**9.5**	**59.1**	**24**	**3**
$LSD_{(0.30)}$	3.9				

[1]Trial conducted on the Tom Heinz farm; seeded 9/17/02 and harvested 7/05/03.
[2]Rating scale 1-9, with 1 = no shatter and 9 = severely shattered.

Notes: Good stands. Good top soil moisture. Limited subsoil moisture. Some spring drought but caught some timely local precipitation leading to average yields and a good trial. Slight hail damage early June. Stripe rust present at very low levels.

Winter wheat Uniform Variety Performance Trial at Lamar in 2003[1].

Variety	Yield	Plant Height
	bu/ac	in
CO980630	28.1	21
CO00D007	23.9	20
Akron	23.8	24
CO991350	22.8	21
Enhancer	22.8	24
CO99W188	21.4	20
Prairie Red	21.2	19
Ankor	20.7	17
Ok102	20.7	22
TAM 111	20.7	17
CO991132	20.4	20
Cisco	20.1	20
Alliance	19.8	21
CO00739	19.8	23
Yuma	19.8	22
CO00698	19.4	19
Avalanche	19.3	18
CO00016	19.1	19
CO00W015	19.0	26
Yumar	17.9	18
CO00480	17.7	22
CO991057	17.3	19
CO980607	17.2	17
CO00501	16.6	19
Trego	16.5	20
Stanton	16.0	24
CO980376	15.8	23
CO99W192	15.3	21
CO00582	14.8	17
CO00484	14.3	20
CO00D011	13.8	16
CO00523	13.6	21
AP502 CL	13.5	23
CO99141	13.4	20
CO99177	12.5	20
TAM 110	12.2	19
Above	12.1	17
Halt	12.0	20
CO99W329	11.8	17
CO991407	11.7	15
CO00347	11.5	21
CO980684-1	11.5	23
2137	11.0	18
Ok101	11.0	20
CO99314	10.3	21
Kalvesta	10.3	21

Variety	Yield	Plant Height
	bu/ac	in
CO99W254	10.1	19
CO99W183	9.7	18
CO00580	9.6	21
Prowers 99	9.1	17
Jagalene	9.1	19
Jagger	9.0	22
CO00796	9.0	20
CO00583	8.4	19
CO00579	8.3	18
CO970547-2	8.0	
CO99W277	7.5	13
CO00335	7.3	20
CO970547	7.0	20
G980091-1	7.0	21
CO00554	6.9	16
Lakin	6.8	16
Venango	6.2	17
CO970547-7	5.8	14
Thunderbolt	4.8	23
CO00345	3.7	19
Average	**14.1**	**20**
$LSD_{(0.30)}$	6.0	

[1]Trial conducted on the John Stulp farm; seeded 9/18/02 and harvested 7/02/03.
*Insufficient grain available to determine individual plot test weights. Trial average was 57.4 lb/bu.

Notes: Good emergence. No subsoil moisture. Severe spring drought. Hail end of June. Lots of shattering.

Winter wheat Uniform Variety Performance Trial at Sheridan Lake in 2003[1].

Variety	Yield
	bu/ac
CO00484	20.0
CO00016	17.1
CO980630	16.4
CO991350	16.0
CO99W192	15.9
CO00D007	15.5
Alliance	15.2
CO980376	15.1
Halt	15.0
Ok102	14.7
CO980607	14.7
TAM 110	14.6
CO991057	14.4
CO00579	14.1
Avalanche	14.0
CO00D011	13.4
Stanton	13.4
CO99141	13.3
Above	13.2
CO00698	13.2
Trego	12.7
CO00W015	12.7
Ok101	12.6
CO00501	12.4
CO991407	12.3
2137	12.2
Yumar	11.9
Yuma	11.8
CO00554	11.7
CO99W188	10.9
CO00347	10.8
Akron	10.8
CO00739	10.8
CO00345	10.6
CO00523	10.2
Prowers 99	10.2
CO99W329	9.9
CO991132	9.5
CO00796	9.5
CO00582	9.1
Cisco	9.1
CO99314	9.0
TAM 111	8.9
CO99W183	8.9
G980091-1	8.7
CO99177	8.7

Variety	Yield
	bu/ac
CO99W254	8.6
CO970547-7	8.4
Kalvesta	8.3
CO00480	7.4
CO970547	7.0
Jagalene	7.0
CO00335	6.9
Enhancer	6.8
CO00583	5.7
CO980684-1	5.3
Venango	5.1
Jagger	5.0
Thunderbolt	4.9
CO970547-2	4.6
Average	**11.1**
$LSD_{(0.30)}$	1.8

[1]Trial conducted on the Eugene Splitter farm; seeded 9/17/02 and harvested 7/07/03.
*Insufficient grain available to determine individual plot test weights. Trial average was 57.4 lb/bu.

Notes: Uneven emergence. No subsoil moisture. Large Tordon residual circle in plots. Severe spring drought. Hail and shattering.

Colorado winter wheat Irrigated Variety Performance Trial summary for 2003.

	Location							2003				
	Fort Collins			Ovid		Rocky Ford		Averages				
Variety[1]	Yield	Test Wt	Protein Content[2]	Yield	Test Wt	Yield	Test Wt	**Yield**	% of Trial Average	Test Wt	Plant Ht	Lodging[3]
	bu/ac	lb/bu	%	bu/ac	lb/bu	bu/ac	lb/bu	**bu/ac**	%	lb/bu	in	1-9
Jagalene	128.0	60.4	14.2	100.6	57.6	116.8	59.3	**115.1**	116	59.1	37	4
Prairie Red	124.7	59.1	13.5	81.7	53.2	119.1	58.4	**108.5**	109	56.9	38	2
Wesley	113.1	57.6	15.3	91.7	58.2	116.6	60.0	**107.1**	108	58.6	35	1
Yuma	120.2	58.2	13.9	97.5	58.3	103.5	59.4	**107.1**	108	58.6	38	2
G980091-1	116.8	58.4	14.1	92.4	56.0	106.7	61.6	**105.3**	106	58.7	35	3
Cisco	119.9	60.6	14.2	88.3	57.9	101.0	58.4	**103.1**	104	59.0	38	3
Antelope	107.1	58.0	14.6	90.8	56.8	106.5	61.5	**101.5**	102	58.7	39	4
Ok101	115.2	58.9	13.3	79.8	53.1	107.7	59.4	**100.9**	101	57.1	39	3
G980122	117.4	58.9	15.6	78.3	54.4	105.6	60.5	**100.4**	101	57.9	38	2
Dumas	126.4	60.7	12.9	78.5	53.2	96.1	61.3	**100.3**	101	58.4	37	2
Platte	121.5	61.5	13.8	53.2	47.5	121.8	60.6	**98.8**	99	56.5	37	2
Kalvesta	116.8	59.3	14.7	74.7	52.9	101.3	60.7	**97.6**	98	57.6	39	2
2137	121.4	59.1	14.5	76.0	54.3	94.9	60.1	**97.4**	98	57.8	39	1
Ok102	113.8	58.9	15.1	73.9	54.0	101.0	60.4	**96.2**	97	57.8	38	1
Ankor	109.0	57.5	13.1	65.5	53.4	108.5	61.1	**94.3**	95	57.3	40	2
Venango	116.1	59.3	14.3	82.1	58.2	69.9	62.2	**89.4**	90	59.9	38	2
Arrowsmith	86.4	54.1	15.2	81.9	55.6	98.6	61.5	**89.0**	89	57.1	43	4
Nuplains	92.7	60.0	14.1	51.6	52.8	98.6	60.8	**81.0**	81	57.9	37	2
Average	**114.8**	**58.9**	**14.2**	**79.9**	**54.9**	**104.1**	**60.4**	**99.6**	**100**	**58.1**	**38**	**2**
Minimum			**12.9**									
Maximum			**15.6**									
$LSD_{(0.30)}$	7.6			9.4		6.8						

[1]Varieties in table ranked by the average yield over three locations in 2003.
[2]Protein contents adjusted to 12% moisture basis.
[3]Rating scale 1-9, with 1 = no lodging and 9 = completely lodged.

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

	Averages						
Variety[1]	3-Yr	2-Yr	2003	2002	2001	3-Yr	2-Yr
	--Yield (bu/ac)--					--Twt (lb/bu)--	
Wesley	102.8	100.6 (4)	107.1	91.0	108.2	59.8	58.9
Antelope (HWW)	99.7	95.6	101.5	86.9	109.7	60.1	58.8
Yuma	98.9	101.3 (3)	107.1	92.6	92.9	59.4	58.3
Prairie Red	98.5	103.1 (2)	108.5	94.9	87.0	58.5	57.5
2137	88.2	90.4	97.4	79.8	82.9	58.9	58.0
Venango	85.8	83.9	89.4	75.8	90.4	60.8	60.0
Nuplains (HWW)	83.2	84.4	81.0	89.5	80.3	59.7	58.8
Jagalene	---	106.1 (1)	115.1	92.5	---	---	59.4
Platte (HWW)	---	97.6 (5)	98.8	95.8	---	---	58.0
Ok101	---	97.4	100.9	92.2	---	---	57.2
Dumas	---	93.9	100.3	84.3	---	—	59.6
Ankor	—	92.1	94.3	88.8	---	---	56.7

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

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

HWW - Hard white winter wheat variety.

Dryland Wheat Strips for Forage and Grain Yield at Walsh, 2003

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

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

MATERIALS AND METHODS: Eighteen wheat varieties were planted on September 25, 2002 at 45 Lb Seed/A in 20 ft. by 1400 ft. strips with two replications. The soil test recommendation for 40 Bu/A wheat was 35 Lb N/A and 20 Lb P_2O_5/A and no other nutrients were required. 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 6 Oz/A was sprayed for weed control. Two 2 ft. by 2.5 ft. forage samples were taken at jointing (April 3) and at boot (May 1). 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 1 with a self-propelled combine and weighed them in a digital weigh cart. Grain yields were adjusted to 12% seed moisture content.

RESULTS: Above produced the highest grain yield with 31 Bu/A. Three of the top four varieties in grain yield had TAM 107 parentage, except the third highest producing variety Trego. Jagger produced the highest dry forage yields at jointing, 2540 Lb/A, and at boot, 6074 Lb/A. Grain yields were low to average because of a hail on June 3 shattered the grain. After three years of testing, only Jagger produced a higher average grain yield than TAM 107.

DISCUSSION: This year the best forage variety was Jagger; however, the grain yield of Jagger was very low due to hail damage, and therefore would not qualify as a good dual-purpose wheat. The best overall dual-purpose wheat variety was Trego. It had well above average forage yields and the second highest grain yield. This past wheat season was hot and 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 hot, dry, hail-damage conditions should be considered varieties of choice, and for the most part are TAM 107 derivatives and two white wheat siblings, Trego and Avalanche.

Table .Dryland Wheat Strips, Forage and Grain Yield at Walsh, 2003.

Variety	Jointing		Boot		Plant		Test	Grain
	Fresh Wt.	Dry Wt.	Fresh Wt.	Dry Wt.	Height	Residue	Weight	Yield
	------Lb/A------				In	Lb/A	Lb/Bu	Bu/A
Above	6942	2069	16361	5078	24	3778	61	31
Trego	7290	2130	16636	5350	24	3581	62	30
TAM 107	6515	1896	15396	4772	24	2927	61	29
Prairie Red	5252	1709	13472	4109	24	3024	60	29
T 81	6288	1794	16887	5165	25	3771	62	28
Avalanche	6422	2006	16002	5157	25	3614	62	28
TAM 110	6503	1944	17894	5630	24	3793	61	28
Stanton	6015	1809	15786	5058	24	3388	62	28
Ankor	6159	1796	16229	5213	24	3731	62	27
Ike	8035	2203	18837	5767	25	4134	61	26
CO 99177	7180	2243	16324	5436	25	4001	60	25
Akron	6125	1805	15880	4910	24	3224	61	25
Prowers 99	7256	2065	16628	5587	26	4435	62	23
Halt	5617	1633	13214	4491	23	2673	61	22
2137	5528	1645	16381	5241	24	2780	61	20
Enhancer	5801	1844	13904	4699	24	3341	61	19
Jagger	8605	2540	17180	6074	24	3452	61	17
Thunderbolt	4288	1311	12237	3722	24	3419	63	12
Average	6435	1913	15847	5081	24	3504	61	25
LSD 0.05	1306.0	376.2	2948.9	904.3		407.1		2.1

Planted: September 25, 2002; 45 Lb seed/A; 5 gal/A 10-34-0.
Jointing sample taken April 3, 2003.
Boot sample taken May 1, 2003.
Grain Harvested: July 1, 2003.
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, 2001-2003.

		Grain Yield					Yield as % of TAM 107 Average				
Firm	Variety	2001	2002	2003	2-Year Avg	3-Year Avg	2001	2002	2003	2-Year Avg	3-Year Avg
		--------------------Bu/A----------------------					------------------------%------------------------				
AgriPro	Thunderbolt	43	15	12	14	--	108	88	41	65	--
Colorado State	Akron	45	16	25	21	29	113	94	86	90	98
Colorado State	Halt	39	15	22	19	25	98	88	76	82	87
Colorado State	Prowers	47	--	23	35	--	118	--	79	98	--
Colorado State	Prairie Red	38	14	29	22	27	95	82	100	91	92
Colorado State	Above	--	12	31	22	--	--	71	107	89	--
Colorado State	Avalanche	--	11	28	20	--	--	65	97	81	--
Kansas State	Jagger	--	13	17	15	--	--	76	59	68	--
Kansas State	Ike	43	16	26	21	28	108	94	90	92	97
Kansas State	2137	34	13	20	17	22	85	76	69	73	77
Kansas State	Trego	57	15	30	23	34	143	88	103	96	111
Kansas State	Stanton	--	14	28	21	--	--	82	97	89	--
University of Nebraska	Alliance	49	12	--	31	--	123	71	--	97	--
Texas A & M	TAM 110	41	16	28	22	28	103	94	97	95	98
Texas A & M	TAM 107	40	17	29	23	29	100	100	100	100	100
Trio	T 81	--	11	28	20	--	--	65	97	81	--
Average		43	13	25	19	27					

Grain Yields were corrected to 12.0 % seed moisture content.

Irrigated Dual Purpose Wheat Planting Dates, Seeding Rates, Varieties at Walsh, 2003

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 4, 2002 (one treatment set for both forage and grain) and October 1, 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 65 Lb N/A to the September 4 planting date treatments and 20 Lb N/A to the October 1 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 12 A-in./A of total applied water, once after planting for stand establishment and once in early spring. We harvested the plots for grain on July 3, 2003 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 3 greatly reduced grain yields. Grain yields of TAM 107 and Custer were significantly higher than Jagger and Intrada for all planting date treatments ($P > 0.05$). The higher grain yields for TAM 107 and Custer were due to hail damage causing much more seed shattering for Jagger and Intrada. There was no significant grain yield difference between seeding rates, therefore the grain yield for the seeding rates were pooled for grain yield analysis. The average grain yield for the September 4 planting date was 2 Bu/A higher than the grain only October 1 planting date; whereas, the October planting date was 1 Bu/A less than the grain only October planting date.

Forage yields were not significantly different between varieties and their means were pooled for forage yield analysis. Forage yield for the 180 Lb/A seeding rate was significantly higher than the 120 lb/A rate for both planting dates, and the 180 Lb/A seeding rate was significantly higher than the 60 Lb/A rate for the October planting date ($P> 0.05$). There was no significant forage yield difference between 60 and 120 Lb/A seeding rates for the September planting date, but there was a significant difference between these seeding rates for the October planting date. The extra income gained from grazing the forage of September planting date, provided $38.57/A to $67.25/A more than October grain only planting date. Variable net income derived from forage was negative for all three seeding rates with the October planting date, ranging from -$6.26/A to -$0.17/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 $0.35/lb. We made these assumptions for our lease grazing: we started with 500 lb calves and they grazed for two months. On average, the calves weighed 560 lb and ingested 3% of their body weight (16.8 lb/day) and they gain 2 lb/day. The forage income using the lease grazing weight gain method had positive incomes for all the September planting date treatments and negative incomes for all the October planting date treatments, regardless of the forage value ($/lb gain) rate used. For the September planting date, the 60 Lb/A seeding rate produced more income at the $0.25/lb gain rate than the 120 lb/A or 180 lb/A seeding rates. The180 Lb/A seeding rate produced the highest income, $67/A, at the $0.35/Lb gain rate, although it was less than $4/A more than the 60 Lb/A rate.

There was a 2 Bu/A grain yield increase ($7/A using a grain price of $3.50/Bu) for the September planting date and a 1 Bu/A decrease (-$3.50/A) for the October planting date compared to the grain only October planting date. The September planting date averaged 1,505 Lb/A more forage than the October planting date. The average cost of forage for the September planting date was $15/A for 1,854 Lb/A or $16/Ton [$17/A to replace the N removed with forage (65 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 $7/A grain yield gain].

Of the four wheat varieties tested, TAM 107 and Custer produced significantly higher grain yield than either Intrada or Jagger. Jagger and Intrada had higher seed losses from hail damage than TAM 107 and Custer. The grain yield of TAM 107 was 5 Bu/A higher in the September planting date than the October planting date.

The October planting date did not produce sufficient forage to make grazing economically feasible. In fact, the highest forage yield (512 Lb/A) of the October planting date at the highest forage value ($0.35/Lb gain) lost money compared to harvesting grain only. The September planting date consistently produced high forage incomes for all seeding rates. All the forage treatments of the September planting date produced $39/A to $67/A more than grain harvest alone. Since there was little income difference between the 60 Lb/A and the 180 Lb/A rates for the September planting date, either seeding rate would provide high forage and grain income.

Table .Irrigated Dual Purpose Wheat Grain Yields at Walsh, 2003.

Variety	Planting Date			Varietal Average
	Sept 4	Oct 1	Oct 1 (grain only)	
	----------------------Bu/A----------------------			
TAM 107	38	32	33	34
Custer	32	32	35	33
Intrada	18	19	19	19
Jagger	22	18	18	19
Average	28	25	26	26
LSD 0.05	6.8	4.0	5.2	

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

Table .Irrigated Dual Purpose Wheat Forage Yields at Walsh, 2003.

Seeding Rate	Planting Date		Seeding Rate Average
	Sept 4	Oct 1	
	--------------------Lb/A--------------------		
60 lb/acre	1769	193	654
120 lb/acre	1699	342	680
180 lb/acre	2094	512	869
Average	1854	349	734
LSD 0.05	341.3	143.1	

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

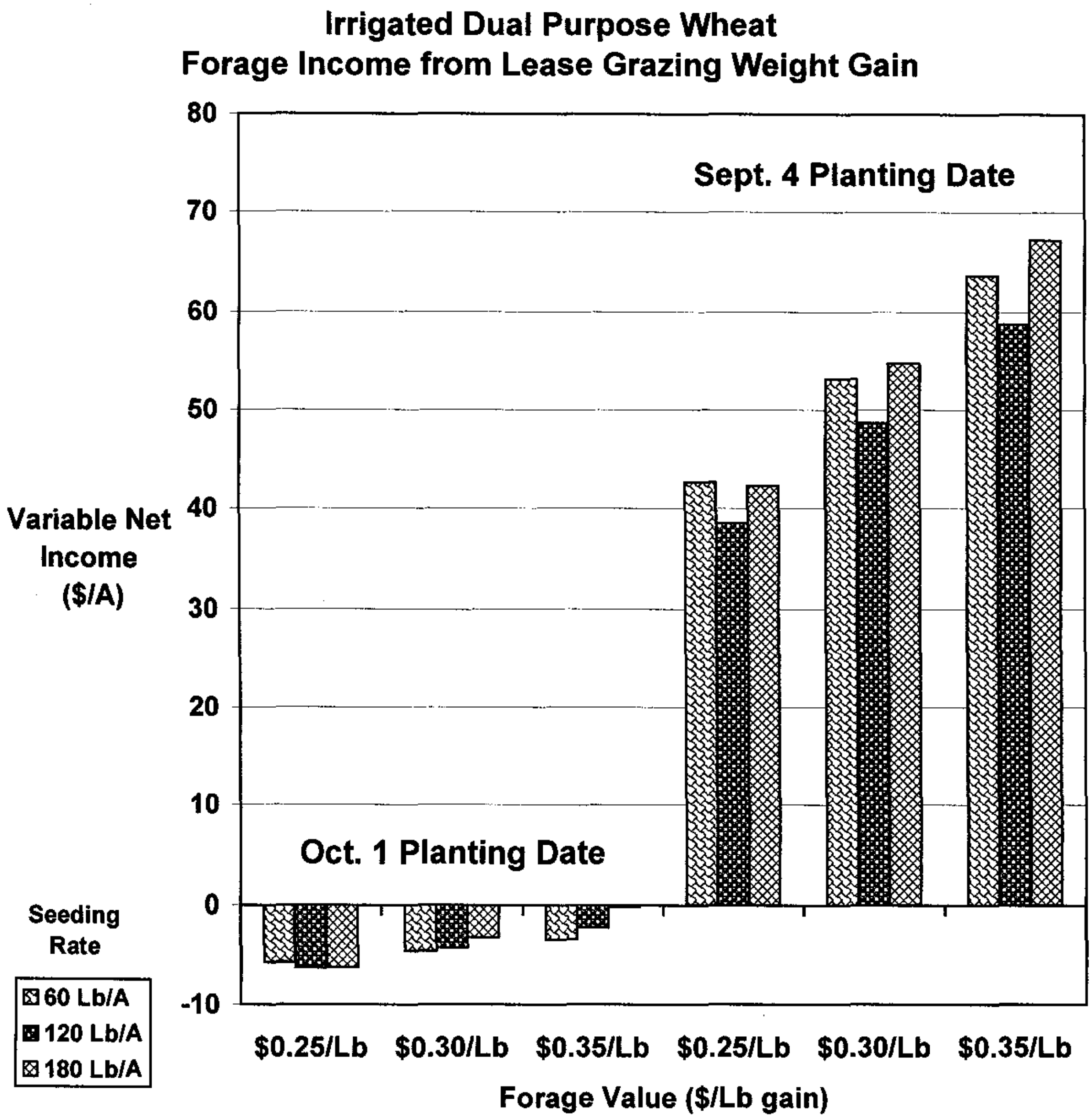


Fig. . Forage income from irrigated dual purpose wheat at Walsh. The planting dates were September 4 and October 1, 2002. The seeding rates were 60, 120, and 180 Lb/A. The forage values are on based on 2 Lb/day gain from 500 Lb calves grazing for two months with a price per Lb gain of $0.25/Lb, $0.30/Lb, and $0.35/Lb. Cost of forage was grain yield loss or gain at $3.50/Bu compared to October 1 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).

Dryland Wheat Seeding Rate at Walsh, 2003

Kevin Larson and Dennis Thompson

PURPOSE: To determine the optimum seeding rate for two wheat varieties, a Hard Red Winter Wheat and a Hard White Winter Wheat, under dryland conditions in Southeastern Colorado.

MATERIALS AND METHODS: Two wheat varieties, Prairie Red (Hard Red Winter Wheat), and Trego (Hard White Winter Wheat), were planted on September 23, 2002 at 15, 30, 45, and 60 Lb Seed/A, which corresponds to approximately 250,000, 500,000, 750,000, and 1,000,000 Seeds/A, in 10 ft. by 50 ft. plots with five replications. We fertilized with 50 Lb N/A with a sweep; no P fertilizer was applied. A mixture of Ally 0.1 oz/A and 2,4-D 0.38 Lb/A was sprayed for weed control. Aphids were only a minor problem. A hail on June 3 caused moderate shattering. We harvested the plots on July 2 with a self-propelled combine and weighed them in a digital scale. Grain yields were corrected to 12% seed moisture content.

RESULTS: Trego did not response to increasing seeding rates. Prairie Red achieved its optimum seeding rate at about 55 Lb/A. At the highest seeding rate Prairie Red produced a similar yield to Trego.

DISCUSSION: This is the first year that Trego and Prairie Red responded differently to seeding rates. Trego did not respond and Prairie Red displayed an optimum seeding rate. The difference between their responses may be due to the hail damage. Prairie Red is more hail tolerant than Trego. Prairie Red with less hail damage yielded proportional to the seeding rate, yields increased with increasing seeding rates. Higher populations of Trego may have suffered greater hail damage, for example, one hailstone could have damaged four times more tillers at the highest rate than at the lowest rate. Hail may have been a great equalizer, lowering the seeding rate yields of Trego to the same levels.

Last year under very dry conditions, both Trego and Prairie Red responded similarly to increasing seeding rate, and both varieties reached their optimum seeding rate at about 50 Lb Seed/A (830,000 Seeds/A). Two years ago with much higher precipitation, both Trego and Prairie Red increased yields with each incremental increase in seeding rate up to the highest seeding rate, 60 Lb/A. Since our upper seeding rate treatment was inadequate for achieving an optimum seeding rate in a wet year, and it was only marginally high enough in a dry year, we need to extent our highest seeding rate to at least 90 Lb/A to include seeding rate optimums in wet and dry years. The 2001-2002 wheat season was very dry, and the 50 Lb/A dryland seeding rate optimum obtained suggests that our dryland wheat seeding rates are typically too low for achieving maximum wheat yields, particularly in wet and average precipitation years.

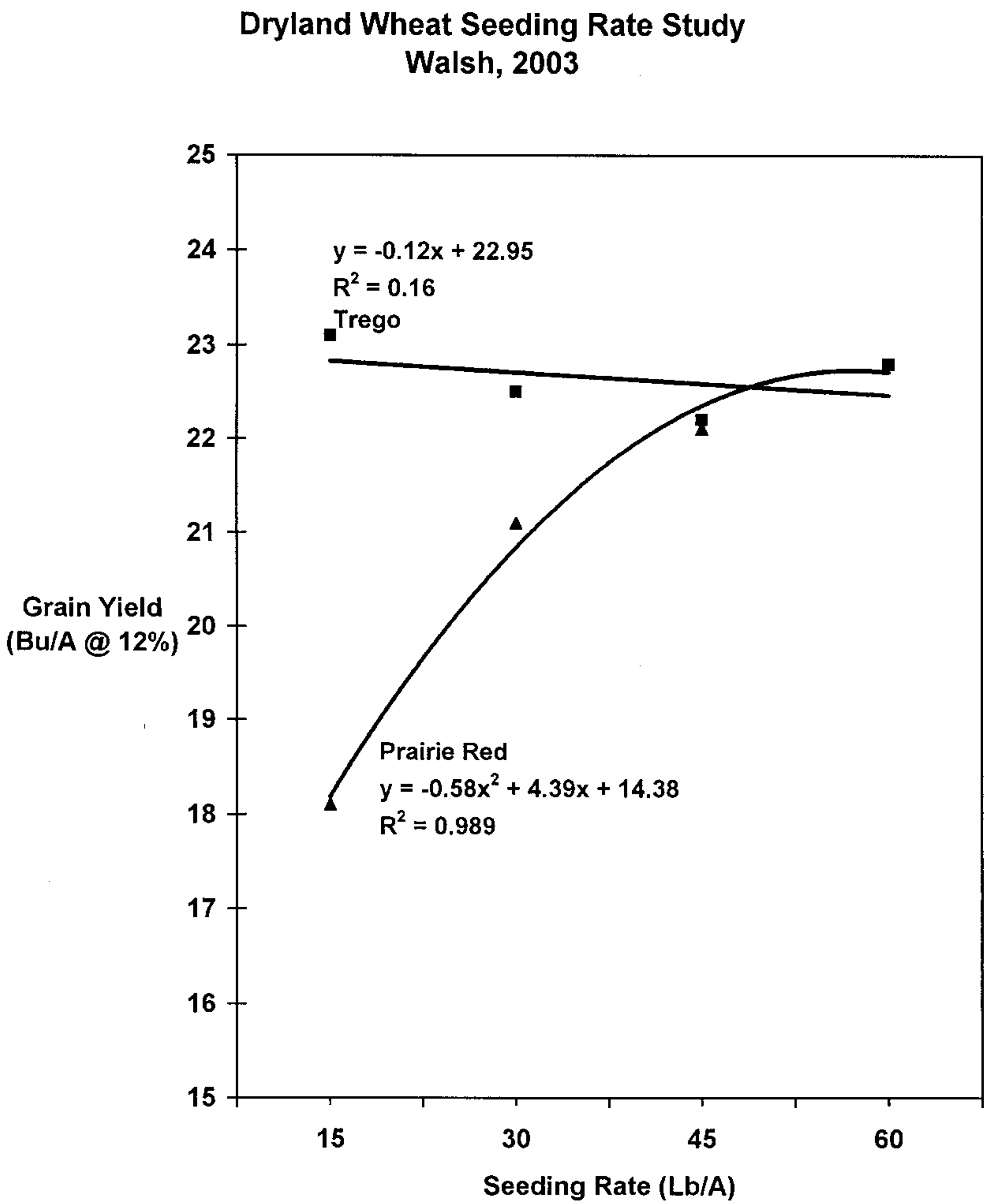


Fig. . Dryland wheat seeding rate at Walsh. The seeding rate tested were 15, 30, 45, and 60 Lb/ A which corresponds to 250, 500, 750, 1,000 Seeds/A X 1000. Two wheat varieties were planted: Trego (hard white wheat) and Prairie Red (hard red wheat).

P on Dryland Wheat, Long Term Study at Manter, 2003

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 46 Lb P_2O_5/A, yielding 43 Bu/A. Regression analysis shows the optimum P rate at about 70 Lb P_2O_5/A. With a wheat price of \$3.50/Bu and 10-34-0 cost of \$210/Ton, the 46 Lb P_2O_5/A treatment made \$17.24/A more the P fertilizer expense. There appears to be a small yield response from residual N.

DISCUSSION: This is the first wheat crop after we applied the one-time P fertilizer rates. This wheat crop is the second crop after P fertilization. There was an intervening grain sorghum crop before this wheat crop, but no yields were measured. The yield response from the 46 Lb P_2O_5/A rate more than paid itself (\$17.24/A return from \$31.50/A yield increase minus \$14.26/A P cost). 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. The slight N residual response suggests that, though N rates were low to moderate, N fertilization was more than sufficient for the grain sorghum and wheat crops.

MATERIALS AND METHODS: Lyndell Herron chiseled on 60 Lb N/A (as NH_3) with six phosphate fertilizer treatments: 0, 5.7, 11.4, 17.2, and 22.9 Gal/A of 10-34-0 (0, 23, 46, 69, and 92 Lb P_2O_5/A), using a 30 ft. dual placement N and P chisel applicator with 18 in. spaced shanks on July 13, 2001. An unfertilized check was also included as one of the treatments. Each treatment was replicated twice. Herron planted Trego in the 60 ft. by 500 ft. plots on September 23, 2002 at 35 Lb Seed/A. He applied about 25 Lb N/A to the wheat crop in early spring. We harvested the plots on July 3, 2003 with a self-propelled combine and weighed them in a digital grain cart. Seed yields were adjusted to 12% seed moisture.

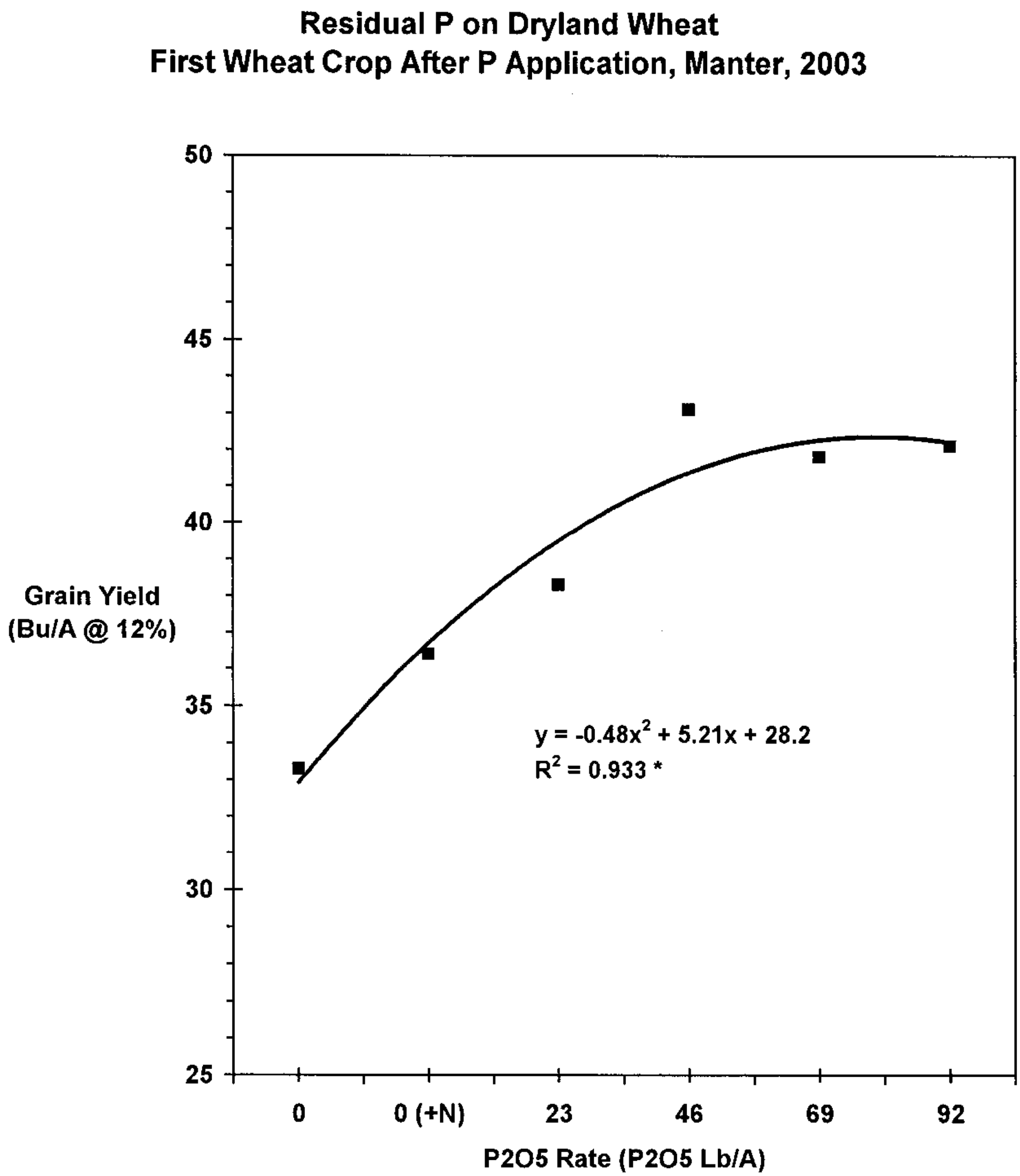


Fig. . Yield and test weight of long term P on dryland wheat, first wheat crop after P application, at Manter. P treatment are 0,23, 46, 69, 92, and 115 Lb P_2O_5/A applied with a chisel with shanks 18 in. apart to a 6 in. depth on July 31, 2000. Grain yields were adjusted to 12% seed moisture content.

N and P Placement and Timing of Dryland Winter Wheat Varieties

K. J. Larson and L. Herron [1]

Nitrogen fertilizer is commonly applied to winter wheat in the High Plains to achieve moderate to high yields. Typically, anhydrous N is applied in the summer or early fall with a tillage operation. Some growers apply liquid N in the spring if winter and spring moisture are high to take advantage of higher yielding condition. Phosphate fertilizer is less frequently used on winter wheat than N fertilizer. There are two main methods of P fertilization for calcareous soils: banding with the seed (seedrow) and banding with a knife (chisel). Banding N and P together is referred to as dual placement. We studied these common methods and timing of N and P fertilization (chisel N in fall, surface banding liquid N in spring, dual placement of N and P in fall, chisel P in fall, seedrow P at planting, and no fertilizer) on three varieties of winter wheat in Southwestern Kansas to determine which treatment produces the highest yield and variable net income. We included a comparison of with and without carpramid (Amisorb), a polymer reported to increase nutrient adsorption (Murphy and Sanders, 1998; Thompson, 2000), to the high rate dual placement P and N.

Wheat yield response to timing of N fertilization varies with moisture. Spring application of N was reported to increase wheat yields in higher moisture areas such as Illinois (Welch et al., 1966). In drier areas there tended to be little yield difference between fall and spring N applications, when using low or nonvolatile N fertilizers (Christensen and Meints, 1982; Kolberg et al., 1993). A three-year study conducted in Eastern Colorado reported yield and income advantage to spring-applied N compared to fall-applied N (Vaughan et al., 1990). Residual soil moisture and plant residue from the preceding crop also affected wheat yield response to N timing: wheat following grain sorghum produced the highest yields with a split N application (fall and late winter); whereas, when wheat followed soybean, preplant N produced higher yields than split N application (Kelley and Sweeney, 2000). Wheat fertilization recommendations state the advantages of fall-applied N (less expensive N source, applied with common tillage operation) and the advantages of spring-applied N (higher grain yield, increase in protein, timed to moisture conditions) (Sander, 1988; Davis et al., 1996).

Banding P fertilizer is recommended compared to broadcasting and incorporating P (Sander, 1988). The two most frequently used P banding methods are applying P with the seed at planting (seed) and knife application. Sander and Eghball (1999) reported that both P banding methods worked similarly with optimum wheat planting date, but seed placement produced higher yields than knife when planting was delayed.

Materials and Methods

The experimental design for our study was split-split-plot with three replications. We tested eight N and P placement and timing treatments as main plots (Table 1). Three winter wheat varieties: Akron, Lamar, and TAM 107 were the subplots. The variety subplots were further split into with and without seedrow 20 P_2O_5 (seedrow applied 5 gal 10-34-0/A) as the sub-subplots. We applied our chisel treatments using a 30 ft. dual placement N and P applicator chisel with 18 in. spaced knives during summer fallow prior to wheat planting. Seedrow P was applied at planting with the seed at 5 gal/A of 10-34-0 (20 P_2O_5/A, 6 lb N/A).

Table 1. Main Plot Treatments for Dryland Winter Wheat at Manter, 1997-2000.

Treatment	Timing	N Rate	P_2O_5 Rate	Treatments Applied 1997	1998	1999	2000
		lb/A	lb/A				
Chisel 50 N & 40 P_2O_5	Fall	62 [1]	40	--	--	x	x
Chisel 50 N & 40 P_2O_5 + 1 qt Amisorb	Fall	62 [1]	40	--	x [3]	x	x
Chisel 50 N & 20 P_2O_5	Fall	56 [2]	20	x	x	x	x
Chisel 50 N	Fall	50	0	x	x	x	x
Stream 50N	Spring	50	0	x	x	x	x
Chisel 20 P_2O_5	Fall	6	20	--	x	x	x
Chisel	Fall	0	0	x	x	x	x
No Fertilizer	None	0	0	x	x	x	x

[1] Total N is 62 lb N/A; 50 lb N/A from NH_3 and 12 lb N/A from 10-34-0.

[2] Total N is 56 lb N/A; 50 lb N/A from NH_3 and 6 lb N/A from 10-34-0.

[3] Chisel 50 N & 40 P_2O_5 + 1 qt Amisorb for 1998 was Chisel 50 N & 20 P_2O_5 + 1 qt Amisorb.

We planted the 10 ft. by 60 ft. plots during the last week of September – first week of October at 45 lb seed/A with three varieties of winter wheat: Akron, Lamar, and TAM 107. We applied the stream N treatment using 28-0-0 with a 40 ft. spray applicator with 18 in. spacing in March. We harvested the plots in late June and early July with a self-propelled combine equipped with a digital scale. We adjusted the seed yields to 12% seed moisture content. 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 CSU Soil Testing Lab for 1997 and 1998, and for 1999 and 2000 we sent them to the Servi-Tech Laboratory for analysis. To determine phosphorus availability, the CSU Soil Testing Laboratory uses the AB-DTPA test and the Servi-Tech Laboratory uses the Mehlich-3 test. The soil was a Richfield Silty Loam. The soil test recommendation for our 40 bu/A yield goal ranged from 0 to 40 lb N/A, and 40 lb P_2O_5/A was recommended each year. No other nutrients were required. The soil test analysis is as follows:

Table 2. Soil Analysis.

Year	pH	Salts mmhos/cm	OM %	N	P	K	Zn	Fe	Mn	Cu
				ppm						
1997	7.9	0.5	1.3	9	1.5	413	0.5	4.4	14.2	2.1
1998	8.0	0.6	1.3	28	1.6	305	0.4	7.0	18.1	4.3
1999	7.9	0.7	1.0	9	11	518	0.3	--	--	--
2000	7.9	0.6	1.1	10	13	488	0.4	--	--	--

N is from 0 to 24 in. depth; all other values are from 0 to 8 in. soil depth.

Results and Discussion

The soil test revealed a high residual N in 1998 (Table 2) and recommended that no N was needed for our 40 bu/A yield goal. There was only a 1 bu/A difference between the no N check and all the treatments with applied N. The chisel (without N) treatment was the only treatment that produced significantly less than the no N check. Therefore, we eliminated the 1998 results from our economic analysis, because of the high residual N and lack of response from applied N. The lack of N response in 1998 demonstrates the importance of soil sampling for determining fertilization needed to meet yield goals. The application of N to the high residual soil nitrate-N levels in 1998 did not increase grain yield, although the N fertilizer no doubt increased grain protein levels (Hartman et al., 2000; Vaughan et al., 1990; Westfall et al., 1996).

N and P Application and Timing Treatments

There were very highly significant yield differences between the application treatments for all years; however none of the interactions for the application treatments and varieties and seedrow P were significant (Table 3). The non-significant interactions suggest that the varieties and seedrow P responded similarly for all application treatments.

Table 3. Analysis of variance for winter wheat grain yield for 1997-2000 as affected by variety (V), seedrow P (P), and application treatment (T).

	Grain Yield			
Variable	1997	1998	1999	2000
Variety (V)	**	**	***	†
Seedrow P (P)	**	NS	***	***
P X V	†	NS	NS	**
Application Treatment (T)	***	***	***	***
T X V	NS	NS	NS	NS
T X P	NS	NS	NS	NS
T X P X V	NS	NS	NS	NS

>0.1, not significant (NS); †, 0.1; *, 0.05; **, 0.01; and ***, 0.001 probability levels.

We used these variable costs and price for the economic analysis: chisel application, \$5.00/A; stream application, \$3.50/A; anhydrous ammonia (NH_3), \$0.15/lb of N; urea ammonium nitrate (28-0-0), \$0.25/lb of N; poly ammonium phosphate (10-34-0), \$0.34/lb of P_2O_5; Amisorb, \$6.00/qt; and a wheat price of \$2.47/bu. Chisel 50 N provided the highest average variable net income, \$15.49/A, of all the application treatments tested (Table 4). Chisel 50 N & 20 P_2O_5 and chisel 50 N & 40 P_2O_5 produced the next highest variable net incomes, \$12.50/A and \$10.95/A, respectively. The average yield of the chisel 50 N & 40 P_2O_5 treatment was 2 bu/A more than the chisel 50 N & 20 P_2O_5 treatment, but the additional 20 lbs of P_2O_5/A fertilizer cost more than the 2 bu/A increase in yield obtained.

Grain yield and variable net income were higher for 50 lb N/A fall-applied than spring-applied (Table 4). The fall-applied (summer fallow-applied) chisel 50 N treatment averaged 3.5 bu/A more yield and $9.26/A more net income than the spring-applied stream 50 N treatment. A three-year, winter wheat study conducted in Eastern Colorado (Vaughan et al., 1990) reported grain yield, protein, and net return increases with spring-applied N compared to fall-applied N. We did not measure grain protein content for our study. In our area, protein premiums are only available during low protein years: high moisture, high yield years. For the four years of our study, the only protein premium year was 1999 (personal communication with local grain elevator managers). Grain yield from our study in 1999 was twice as high as the average of the other study years. Presumably, with a two-fold increase in yield and low soil residual nitrate-N (Table 2), the grain protein content for our 1999 crop would have been below 12% (Hartman et al., 2000) and probably similar to the average protein percentage harvested for the 1999 Kansas wheat crop of 11.5% (Kansas Agricultural Statistics Service, 1999). Therefore, for the four years of our study, no protein premium would have been available, or our harvested wheat crop would not have qualified for a protein premium.

Table 4. N and P Placement and Timing of Dryland Wheat at Manter, KS for 1997, 1999, and 2000.

Treatment	Timing	1997 Grain Yield	1999 Grain Yield	2000 Grain Yield	Treatment Cost	1997 Variable Net Income	1999 Variable Net Income	2000 Variable Net Income	Average Variable Net Income
		---------bu/A--------			--------------------------$/A-------------------------				
Chisel 50 N & 40 P_2O_5	Fall	--	83	43	26.10	--	6.01	15.89	10.95
Chisel 50 N & 40 P_2O_5 + Amisorb 1Qt/A	Fall	--	81	43	32.10	--	-4.93	9.89	2.48
Chisel 50 N & 20 P_2O_5	Fall	45	80	42	19.30	15.28	5.40	16.82	12.50
Chisel 50 N (NH_3 gas)	Fall	42	78	41	12.50	14.67	7.26	24.55	15.49
Stream 50 N (28-0-0)	Spring	39	79	36	16.00	3.76	6.23	8.70	6.23
Chisel 20 P_2O_5 (10-34-0)	Fall	--	73	26	11.80	--	-4.39	-11.80	-8.10
Chisel	Fall	31	69	25	5.00	-5.00	-7.47	-7.47	-6.65
No N Check		31	70	26	0.00	0.00	0.00	0.00	0.00
Average		38	77	35					
LSD 0.05		1.5	2.1	1.5					

N applied: Chisel N (NH_3 gas, incorporated), June; Stream N (liquid 28-0-0, surface banded), March. Treatment Cost: Chisel, $5/A; Stream, $3.50/A; NH_3, $0.15/lb; 28-0-0, $0.25/lb; 10-34-0, $0.34/lb; Amisorb, $6/qt. Wheat Price, $2.47/bu.

There was no grain yield increase with the addition of Amisorb to the high fertilizer application (chisel 50 & 40 P_2O_5) (Table 4). Since Amisorb, a fertilizer additive reported to increase the cation exchange capacity around the roots (Murphy and Sanders, 1998), provided no grain yield response at the 1 qt/A application rate tested, and costs $6.00/qt, it had a lower average variable net income than the same fertilizer application without Amisorb. In contrast to our lack of grain yield response from the addition of Amisorb, Thompson (2000) reported that the addition of Amisorb to seed-banded and foliar-sprayed fertilizers significantly increased winter wheat grain yields in all five of his study sites in Central Kansas. Reports similar to our results of no response from Amisorb, but on multiple crops, comes from studies in Eastern South Dakota on winter wheat, spring wheat, soybean, and corn that concluded the addition of Amisorb to fertilizer applications did not influence grain yields (Woodward et al., 1996 and 1997).

Two treatments, chisel 20 P_2O_5 and chisel, consistently had negative variable net incomes compared to the no N check (Table 4). The chisel treatment without fertilizer application was included to test tillage affects from chiseling. The chisel treatment reduced yield by less than 1 bu/A compared to the no N check and the chisel operation cost $5.00/A. The slight decrease in yield from chisel may be due to moisture loss from tillage.

Seedrow P

Seedrow P compared to no seedrow P produced very significant grain yield differences for all fertilizer responsive years (Table 3). The seedrow 20 P_2O_5 treatment produced 4 to 5 bu/A more and increased average variable net income by $3.38/A more than without seedrow P (Table 5). The grain yield response to seedrow P for our study is less than that reported for winter wheat in Southeastern Nebraska of 11 bu/A (Sander and Eghball, 1999). The 11 bu/A increase is derived from the two-year average of seed-applied P for September planting date to the no P fertilizer check.

Table 5. Grain Yield and Variable Net Income of Seedrow P Fertilizer on Dryland Wheat at Manter, KS, 1997, 1999, and 2000.

	Grain Yield				Average Variable
Placement	1997	1999	2000	Treatment Cost	Net Income
	--------------	bu/A	--------------	$/A	$/A
Seedrow 20 P_2O_5	40	79	37	6.80	3.38
No Seedrow P Fertilizer	35	75	33	0.00	0.00
Average	38	77	35		
LSD 0.05	2.4	1.6	0.6		

Seedrow P was applied at planting with the seed at 5 gal 10-34-0/A (20 lb P_2O_5/A).
Treatment Cost: P_2O_5, $0.34/lb. Wheat Price, $2.47/bu.

Seedrow P at 20 lb P_2O_5/A was a profitable fertilizer application: however, applying the same P rate with a chisel, chisel 20 P_2O_5, produced the lowest average variable net income of all the application treatments tested (Table 4). Since the chisel 20 P_2O_5 treatment was applied with knives spaced 18 in. apart to a depth of 6 in., the probability of wheat roots intercepting this band of P fertilizer is far less than when P fertilizer is banded with the seed (Sander and Eghball, 1999).

The interactions between variety and seedrow P produced significant grain yield differences in 1997 and 2000 (Table 3). This interaction between variety and seedrow P suggests that the varieties responded differently to seedrow P application. Akron had a greater grain yield response to seedrow P than TAM 107 or Lamar in 1997; grain yields of all three varieties responded similarly to seedrow P in 1999; grain yield response to seedrow P for Lamar was less than that for TAM 107 or Akron in 2000 (Fig. 1). The reason for grain yield response differences to seedrow P for the wheat varieties tested is unclear.

Winter Wheat Varieties

There were grain yield differences between the varieties for all four years of our study (Table 3). In two of four years (1997 and 1999), Akron produced significantly higher yield than Lamar (Table 6). For all four years of our study, TAM 107 produced higher yield than Akron and Lamar. These varietal yield rankings were reflected in the winter wheat variety studies conducted at the Plainsman Research Center in Southeastern Colorado at Walsh. The dryland winter wheat variety strips for forage and grain yield studies conducted at Walsh, Colorado from 1997 to 2000 reported that the grain yield of TAM 107 was either significantly greater than Lamar, or there was no significant difference between TAM 107 and either Lamar or Akron (data not shown).

Table 6. Grain Yields of Wheat Varieties Across N and P Placement and Timing Applications, Manter, KS, 1997-2000.

	Grain Yield			
Variety	1997	1998	1999	2000
	bu/A			
TAM 107	39	43	84	36
Akron	38	40	76	34
Lamar	35	39	70	35
Average	38	41	77	35
LSD 0.05	2.4	1.9	3.2	1.3

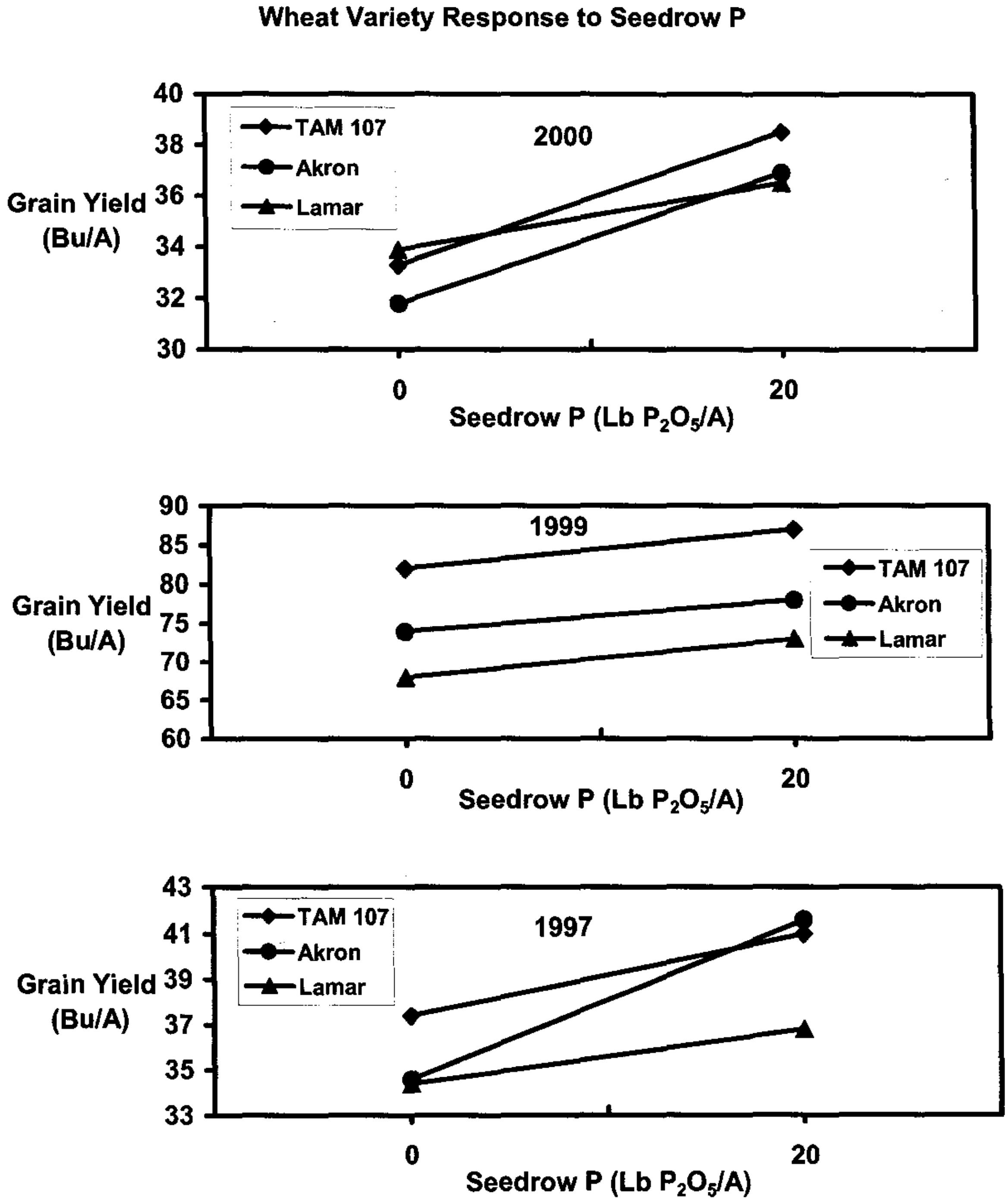


Fig. 1. Wheat variety response with and without seedrow P. Poly ammonium phosphate was applied with the seed at planting at 5 gal 10-34-0/A (20 lb P_2O_5/A, 6 lb N/A) to three hard red winter wheat varieties: TAM 107, Akron, and Lamar.

Conclusion

Amisorb did not increase winter wheat grain yields in our studies. There appears to be no economic advantage for adding Amisorb to fertilizers.

Of the three winter wheat varieties that we tested, TAM 107 was consistently higher yielding than Akron and Lamar.

The fall-applied chisel N application provided the highest variable net income of all the application methods tested. Fall-applied chisel N produced higher average yield and net income than spring-applied stream N. Multiple studies (Goos et al., 1982; Hartman et al., 2000; Sander, 1988; Vaughan et al., 1990; Westfall et al., 1996) report that spring-applied N increases wheat protein. Nonetheless, protein premiums are only available in our area when average protein levels are low, that is, high-precipitation, high-yield years. Protein premiums are not available for average and dry years when protein levels are high. The hard red winter wheat crop from Kansas and surrounding area determines the national protein premiums. There is little or no opportunity for N fertilization management for protein for the hard red winter wheat area of Kansas and surrounding area. We believe it is economically unwise to annually fertilize solely for potential protein premiums in our area. However, protein premiums for the hard red spring wheat crop of the Northern Plains can be a manageable, economically viable option (Hartman et al., 2000). The hard red winter wheat crop of Kansas and the surrounding area is harvested months before the hard red spring wheat crop of the Northern Plains, thus protein levels are known and N fertilization for protein premiums can be a practical and beneficial tool for wheat growers in the Northern Plains.

Dual placement of N and P produced high variable net incomes, second only to chisel N. The soil test analysis for our study site recommended a broadcast application of 40 lb P_2O_5/A. With dual N and P placement, the 20 lb P_2O_5/A rate, half the recommended rate, produced a higher variable net income than the 40 lb P_2O_5/A rate. With our low P soil analysis, as little as one-third the recommended broadcast rate may have been a sufficient P rate if seed-banded (Peterson et al., 1981). Banding P makes more P available for roots than broadcast P, especially in calcareous soils where lime binds the P.

The seedrow P application was a more effective P fertilizer banding method than chisel P. The probability of the roots coming into contact with seedrow-applied P is much greater than with chisel P (Sander and Eghball, 1999). Seedrow P averaged 4 to 5 bu/A more than no seedrow P. The combination of TAM 107, seedrow P, and chisel N produced the highest variable net income of the application treatments and varieties tested.

References

Christensen, N. W. and V. W. Meints. 1982. Evaluating N fertilizer sources and timing for winter wheat. Agron. J. 74:840-844.

Davis, J. G., D. G. Westfall, J. J. Mortvedt, and J. F. Shanahan. 1996. Fertilizing winter wheat. Fact Sheet 0.544. Colorado State Univ. Coop. Ext., Fort Collins.

Goos, R. J., D. G. Westfall, A. E. Ludwick, and J. E. Goris. 1982. Grain protein content as an indicator of N sufficiency for winter wheat. Agron. J. 74:130-133.

Hartman, M., R. McKenzie, and R. Andreiuk. 2000. High protein wheat production. Agdex 112/20-4. Alberta Agriculture, Food and Rural Development. http://www.agric.gov.ab.ca/agdex/100/112_20-4.html.

Kansas Agricultural Statistics Service. 1999. Wheat quality bulletin, 1999. NASS, USDA, KASS, and KDA. http://www.nass.usda.gov.81/ipedb/.

Kelley, K. W. and D. W. Sweeney. 2000. Effects of previous crop, nitrogen rate, and nitrogen method on nitrogen requirement for winter wheat. Kansas Fertilizer Research, 1999. Report of Progress 847. AES, CE, Kansas State Univ., Manhattan.

Kolberg, R. L., D. G. Westfall, G. A. Peterson, N. R. Kitchen, and L. Sherrod. 1993. Nitrogen fertilizer of dryland cropping systems. Colorado State Univ. Agric. Exp. Stn. Tech. Bull. TB 93-6.

Murphy, L. S. and J. L. Sanders. 1998. Amisorb in Great Plains crop production. Great Plains Soil Fertility Conference Proceedings, 1998. Denver, March 3-4, 1998. Vol. 7:214-219.

Peterson, G. A., D. H. Sander, P. H. Grabouski, and M. L. Hooker. 1981. A new look at row and broadcast phosphate recommendations for winter wheat. Agron. J. 73:13-17.

Sander, D. N. 1988. How to apply fertilizer to wheat. NebGuide G88-889-A. Coop. Ext., Institute of Agric. and Nat. Res., Univ. of Nebraska-Lincoln.

Sander, D. H. and B. Eghball. 1999. Planting date and phosphorus fertilizer placement effects on winter wheat. Agron. J. 91:707-712.

Thompson, C. A. 2000. Effects of liquid Amisorb on winter wheat in central Kansas. Kansas Fertilizer Research, 1999. Report of Progress 847. AES, CE, Kansas State Univ., Manhattan.

Vaughan, B., D. G. Westfall, and K. A. Barbarick. 1990. Nitrogen rate and timing effects on winter wheat grain yield, grain protein, and economics. J. Prod. Agric. 3:324-328.

Westfall, D. G., J. L. Havlin, G. W. Hergert, and W. R. Raun. 1996. Nitrogen management in dryland cropping systems. J. Prod. Agric. 9:192-199.

Woodard, H. J., A. Bly, and D. Winter. 1996. The effect of Amisorb applications on growth and yield parameters of corn, soybean, and hard red spring wheat in Eastern South Dakota. Project no. 23696A and B, 24196, and 24596. SDSU Soil Fertility Project Website. South Dakota State Univ., Brookings. http://www.plantsci.sdstate.edu/woodardh/soilfert.

Woodard, H. J., A. Bly, and D. Winther. 1997. Influence of Amisorb fertilizer additive in hard red winter wheat, hard red spring wheat, and corn during 1997. Project no. 26197, 24097, and 26697. SDSU Soil Fertility Project Website. South Dakota State Univ., Brookings. http://www.plantsci.sdstate.edu/woodardh/soilfert.

[1] L. Herron is a dryland wheat farmer in Southwestern Kansas at Manter.

K.J. Larson is a Research Scientist for Colorado State University Agricultural Experiment Station at the Plainsman Research Center in Walsh, Colorado.

For e-mail comments, contact the authors at Kevin.Larson@colostate.edu

Early Maturing Irrigated Grain Sorghum Hybrid Performance Test at Walsh, 2003

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 25), under drip-irrigated conditions with 2780 sorghum heat units in Silty Loam soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 87,100 Seed/A. PLANTED: June 25. HARVESTED: November 4.

EMERGENCE DATE: 5 days after planting. SOIL TEMP: 72 F.

IRRIGATION: Drip irrigated for 12 weeks with 10.1 A-in./A.

PEST CONTROL: Preemergence Herbicides: Roundup 16 Oz/A. Post Emergence Herbicides Clarity 4 Oz/A, Atrazine 1.0 Lb/A, COC 32 Oz/A. CULTIVATION: Once. INSECTICIDES: None.

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

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
June	1.03	137	6	1	6
July	1.62	963	28	13	37
August	2.72	829	24	3	68
September	0.77	495	3	0	98
October	0.08	359	2	0	124
Total	6.22	2783	63	17	124

\1 Growing season from July 1 (planting) to October 26 (first freeze, 22 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

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

COMMENTS: Planted in good soil moisture. Weed control was very good. Near normal precipitation for the growing season with a wet June and dry July and September months. No greenbug infestation. None of the hybrids lodged. Late freeze date. Yields and test weights were very good for late planting.

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	0.6	2.3	6	3.6	531	1.0	6.1
8"-24"				5				
Comment	Alka	VLo	VHi	Lo	Lo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	------------------Lb/A------------------			
Recommended	42	20	0	0
Applied	100	20	0.3	0

Yield Goal: 120 Bu/A.
Actual Yield: 117 Bu/A.

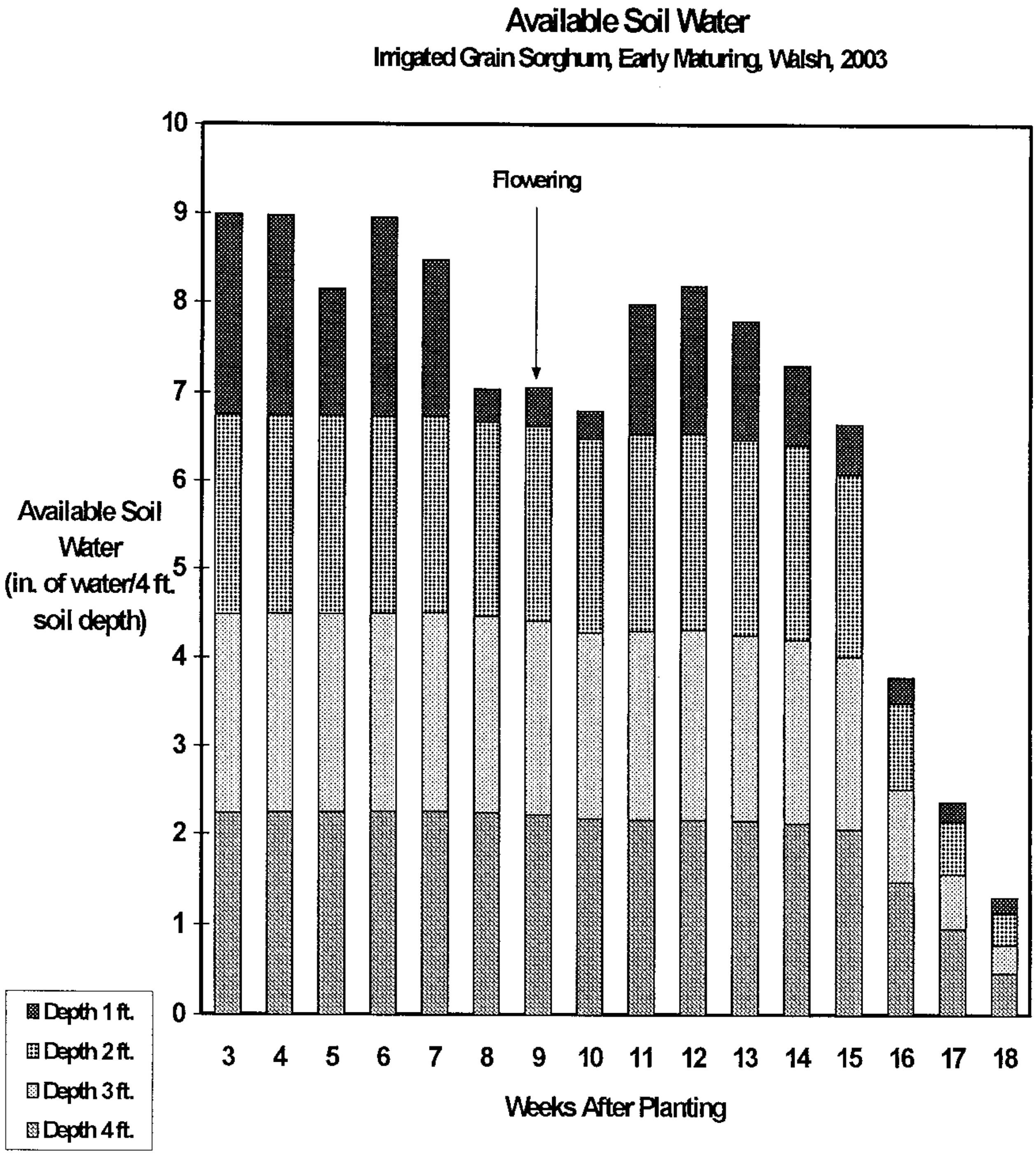


Fig. 1. Available soil water in drip irrigated grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 6.22 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .--Irrigated Grain Sorghum Early Maturing Hybrid Performance Test at Walsh, 2003. \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	%
NC+	NC+ 5B89	5	58		77	E	50	47.2	0	57	145	119
DEKALB	DKS 29-28	5	55		77	E	42	56.1	0	57	134	110
SORGHUM PARTNERS	KS 310	5	58		76	E/ME	48	48.4	0	56	128	105
ASGROW	Reward	5	56		74	E	40	58.1	0	57	123	102
DEKALB	DK-28E	5	53		72	E	43	50.7	0	57	122	100
TRIUMPH	TR X21725	5	52		70	E	45	55.8	0	58	108	89
SORGHUM PARTNERS	251	5	51		69	E	42	43.4	0	59	102	84
TRIUMPH	TR 438	5	61		84	ME	50	58.5	0	55	131	108
PIONEER	86G71	5	60		88	ME	45	48.0	0	58	127	105
ASGROW	Seneca	5	62		90	ME/M	46	46.5	0	56	124	103
SORGHUM PARTNERS	K35-Y5	5	60		85	ME	44	41.0	0	55	123	102
SORGHUM PARTNERS	1486	5	64		HD	M	44	48.0	0	52	122	100
(Check)	399 X 2737	5	67		SD	ML	47	42.6	0	48	88	72
Average		5	58	0	78	ME	45	49.6	0	56	121	
LSD 0.20											8.1	

\1 Planted: June 25; Harvested: November 4.

Yields are corrected to 14.0% seed moisture content.

DAP: Days After Planting or maturation of seed at first freeze (22 F, October 26).

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 .--Summary: Grain Sorghum Early Maturing Hybrid Performance Tests, 2001-2003.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2001	2002	2003	2-Year Avg	3-Year Avg	2001	2002	2003	2-Year Avg	3-Year Avg
		Bu/A					%				
ASGROW	Seneca	50	38	124	81	71	95	64	103	84	87
ASGROW	Reward	59	76	123	100	--	113	127	102	115	--
DEKALB	DK-28E	62	88	122	105	91	119	147	100	124	122
DEKALB	DKS 29-28	--	74	134	104	--	--	123	110	117	--
PIONEER	87G57	69	72	--	71	--	133	119	--	126	--
PIONEER	85Y34	44	64	--	54	--	85	107	--	96	--
PIONEER	86G71	--	63	127	95	--	--	106	105	106	--
SORGHUM PARTNERS	KS 310	49	69	128	99	82	94	116	105	111	105
SORGHUM PARTNERS	K35-Y5	53	60	123	92	--	102	101	102	102	--
SORGHUM PARTNERS	251	--	77	102	90	--	--	128	84	106	--
TRIUMPH	TR 438	53	--	131	92	--	102	--	108	105	--
(Check)	399 X 2737	39	21	88	55	49	79	36	72	54	62
Average		52	60	121	91	78					

Grain Yields were corrected to 14.0 % seed moisture content.

Dryland at Vilas for 2001; Irrigated at Walsh for 2002 and 2003.

Dryland Grain Sorghum Hybrid Performance Test at Vilas, 2003

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: 39,200 Seed/A. PLANTED: June 2. HARVESTED: November 5.

EMERGENCE DATE: 12 days after planting. SOIL TEMP: 68 F.

PEST CONTROL: Preemergence Herbicides: Roundup 16 Oz/A, Atrazine 0.63 Lb AI/A. Post Emergence Herbicides: Clarity 5 Oz/A, 2,4-D 0.28 Lb AI/A. CULTIVATION: Once. INSECTICIDE: 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	6.89	595	14	3	28
July	1.62	963	28	13	59
August	2.72	829	24	3	90
September	0.77	495	3	0	120
October	0.08	359	2	0	146
Total	12.08	3241	71	19	146

\1 Growing season from June 2 (planting) to October 26 (first freeze, 22 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

FIELD HISTORY: Last Crop: Sorghum. FIELD PREPARATION: Chisel.

COMMENTS: Planted in good soil moisture. Weed control was poor to fair. Below normal precipitation for the growing season, June was wet but the rest of the season was very dry. Seed set was poor because it was very hot and dry at flowering. No greenbug infestation. None of the hybrids lodged. Grain 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"	7.6	0.3	1.3	3	1.5	296	0.4	6.8
8"-24"				4				
Comment	Alka	Vlo	Mod	Lo	V Lo	VHi	V Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	-------------------Lb/A------------------			
Recommended	17	40	0	0
Applied	60	20	0	0

Yield Goal: 60 Bu/A.
Actual Yield: 16 Bu/A.

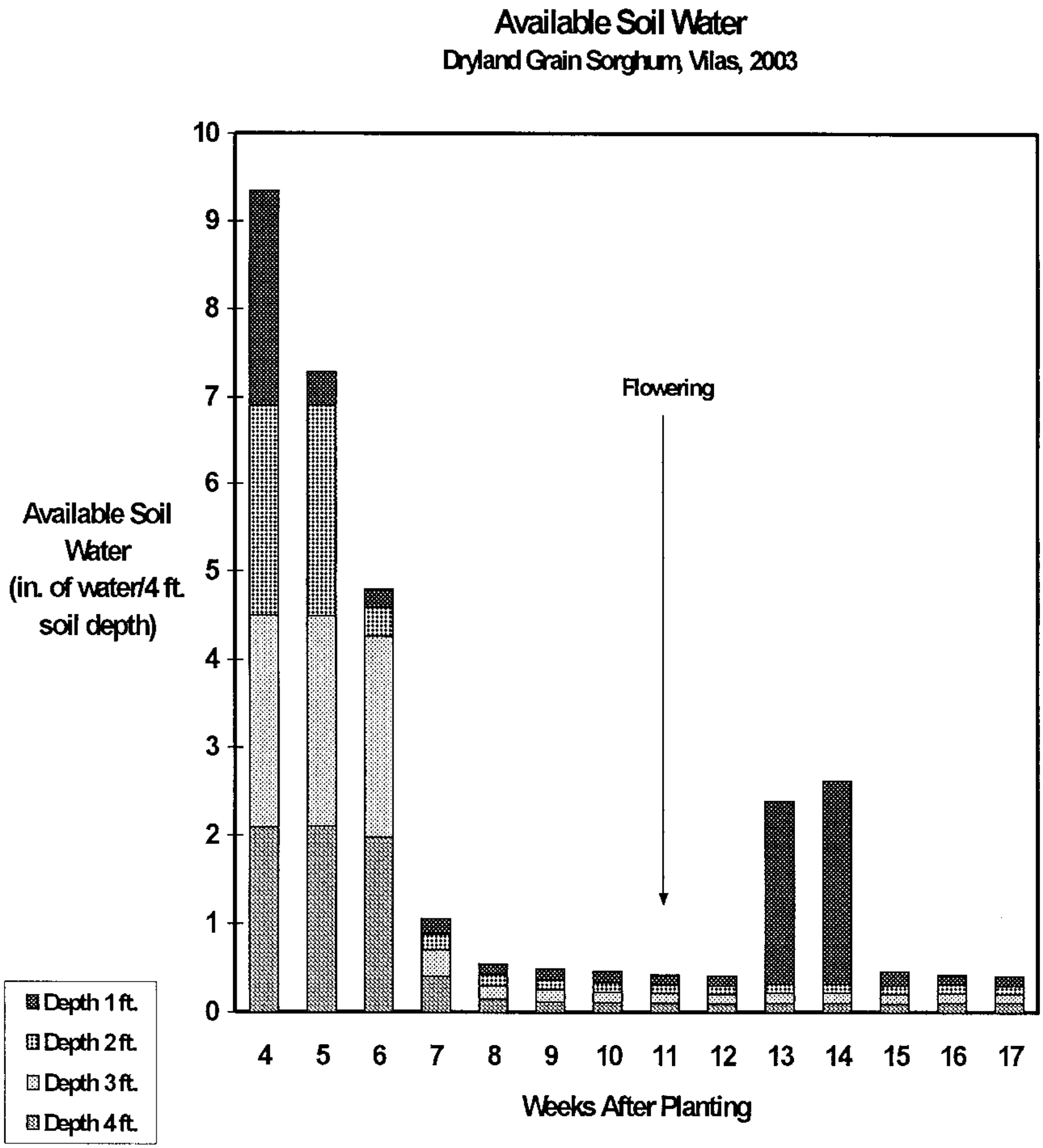


Fig. 2. Available soil water in dryland grain sorghum at Vilas. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 12.08 in. Any increase in available soil water between weeks is from rain.

Table .--Dryland Grain Sorghum Hybrid Performance Test at Vilas, 2003. \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	%
PIONEER	85G01	11	69	1859	116	ME/M	35	22.3	0	58	26	152
NC+	NC+ 5B89	13	68	1833	107	ME/E	34	26.3	0	57	25	148
MYCOGEN	627	12	70	1886	109	ME	34	20.1	0	57	24	143
DEKALB	X210	12	68	1833	107	ME	32	20.3	0	58	23	137
ASGROW	Pulsar	13	68	1833	113	ME	31	23.6	0	55	21	123
DEKALB	DK-44	14	71	1910	121	ME/M	35	25.4	0	56	20	118
SORGHUM PARTNERS	NK 5418	11	69	1859	108	ME	33	21.1	0	56	19	110
ASGROW	Seneca	13	71	1910	121	ME/M	34	19.0	0	58	17	102
SORGHUM PARTNERS	KS 310	13	67	1805	106	ME	32	18.6	0	56	16	97
DEKALB	DK-40y	14	71	1910	122	ME/M	34	23.2	0	57	14	84
DEKALB	DKS 36-00	12	67	1805	107	ME	29	20.7	0	57	9	55
SORGHUM PARTNERS	NK 7633	14	72	1930	124	M	36	20.3	0	53	20	116
SORGHUM PARTNERS	K59-Y2	11	78	2082	126	M	36	19.0	0	52	19	111
SORGHUM PARTNERS	NK 7655	12	78	2082	127	M	36	24.2	0	54	17	102
PIONEER	84G50	11	78	2082	128	M	36	23.2	0	53	13	80
SORGHUM PARTNERS	KS 585	11	76	2025	122	M	31	19.8	0	56	11	63
SORGHUM PARTNERS	K73-J6	14	77	2054	124	M	35	22.5	0	56	11	63
SORGHUM PARTNERS	1486	15	73	1951	124	M	33	16.7	0	54	9	52
(Check)	399 X 2737	11	79	2111	130	ML	32	14.9	0	56	15	90
PIONEER	84G62	13	78	2082	130	ML	34	23.2	0	56	14	82
SORGHUM PARTNERS	NK 8828	13	79	2111	132	ML	35	14.9	0	54	11	67
Average		13	73	1950	119	ME	34	20.9	0	56	17	
LSD 0.20											7.3	

\1 Planted: June 2; Harvested: November 5.

Yields are corrected to 14.0% seed moisture content.

DAP: Days After Planting or maturation of seed at first freeze.

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

GDD: Growing Degree Days for sorghum.

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

Table .--Summary: Dryland Grain Sorghum Hybrid Performance Tests at Vilas, 2001-2003.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2001	2002	2003	2-Year Avg	3-Year Avg	2001	2002	2003	2-Year Avg	3-Year Avg
		--Bu/A--					--%--				
ASGROW	Seneca	87	7	17	12	37	103	86	102	94	97
ASGROW	Pulsar	--	6	21	14	--	--	69	123	96	--
DEKALB	DK-40y	79	--	14	47	--	94	--	84	89	--
DEKALB	DK-44	82	7	20	14	36	97	81	118	100	99
DEKALB	DKS 36-00	--	5	9	7	--	--	59	55	57	--
MYCOGEN	627	87	9	24	17	40	103	111	143	127	119
PIONEER	8505	85	8	--	47	--	101	101	--	101	--
PIONEER	85G85	87	8	--	48	--	104	95	--	100	--
PIONEER	85Y34	82	5	--	44	--	97	64	--	81	--
PIONEER	84G62	105	11	14	13	43	124	140	82	111	115
SORGHUM PARTNERS	NK 8828	--	7	11	9	--	--	88	67	78	--
SORGHUM PARTNERS	NK 7633	--	10	20	15	--	--	119	116	118	--
SORGHUM PARTNERS	K73-J6	--	10	11	11	--	--	123	63	93	--
SORGHUM PARTNERS	KS 585	92	10	11	11	38	109	124	63	94	99
SORGHUM PARTNERS	K59-Y2	90	11	19	15	40	107	141	111	126	120
SORGHUM PARTNERS	KS 310	--	7	16	12	--	--	91	97	94	--
TRIUMPH	TR 438	72	8	--	40	--	86	98	--	92	--
TRIUMPH	TR 465	87	6	--	47	--	103	73	--	88	--
(Check)	399 X 2737	82	9	15	12	35	98	110	90	100	99
Average		84	8	17	13	36					

Grain Yields were corrected to 14.0 % seed moisture content.

Dryland Grain Sorghum Hybrid Performance Test at Walsh, 2003

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

PURPOSE: To identify high yielding hybrids under dryland conditions with 3450 sorghum heat units in a Silty Loam soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 39,200 Seed/A. PLANTED: May 22. HARVESTED: October 30.

EMERGENCE DATE: 10 days after planting. SOIL TEMP: 63 F.

PEST CONTROL: Preemergence Herbicides: None. Post Emergence Herbicides: Clarity 4.0 Oz/A, Buctril 16 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--------		
May	0.55	175	2	2	9
June	6.89	626	14	3	39
July	1.62	963	28	13	70
August	2.72	829	24	3	101
September	0.77	495	3	0	131
October	0.08	359	2	0	157
Total	12.63	3447	73	21	157

\1 Growing season from May 22 (planting) to October 26 (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 fair. Near normal precipitation for the growing season with a wet June and dry July and September months. No greenbug infestation. None of the hybrids lodged. Grain yields were fair.

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

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	---------------ppm---------------				
0-8"	7.7	0.6	2.3	14	2.0	395	0.6	5.2
8"-24"				5				
Comment	Alka	Vlo	Hi	Mod	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	50	20	0	0

Yield Goal: 45 Bu/A.
Actual Yield: 26 Bu/A.

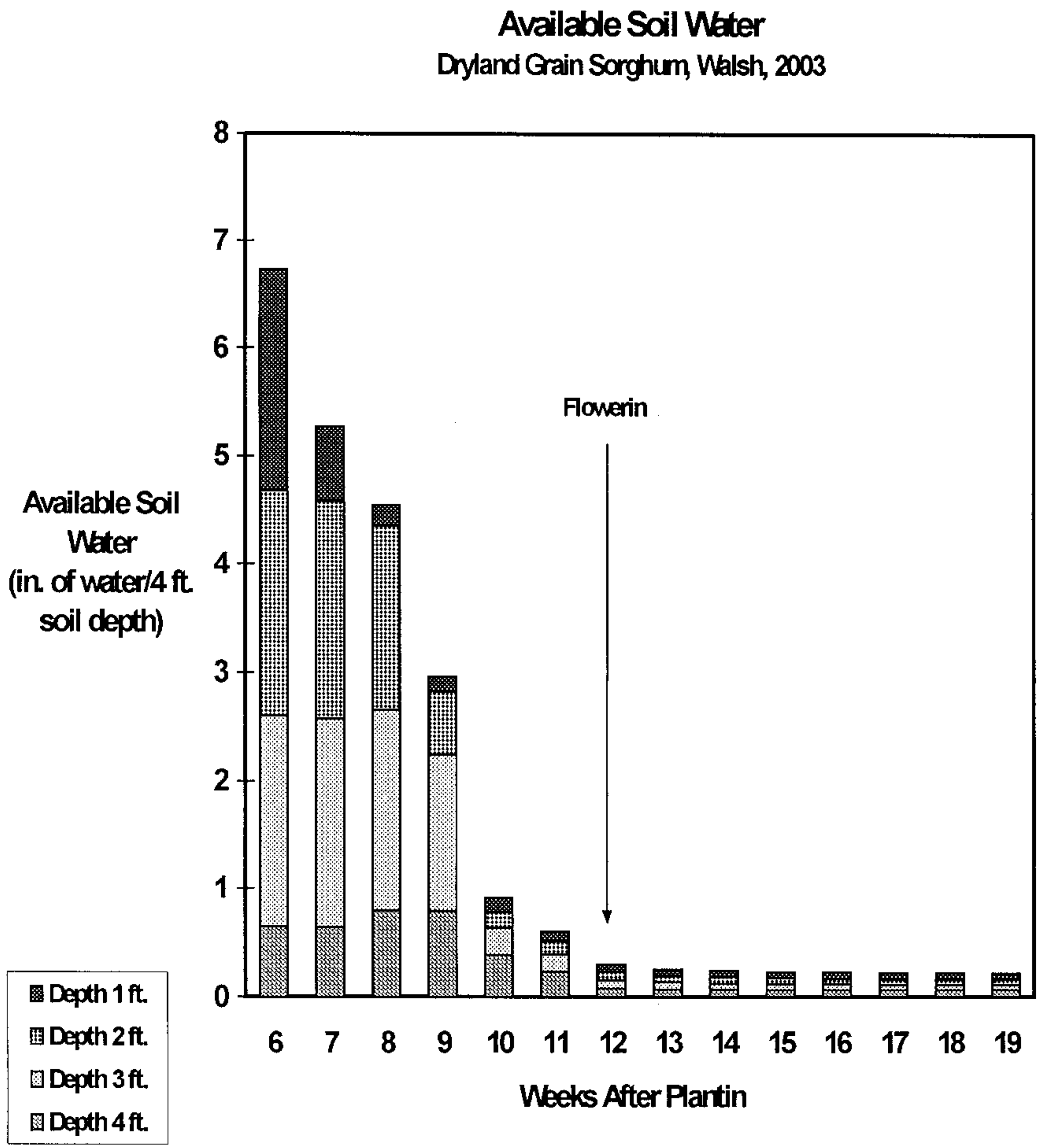


Fig. 3. Available soil water in dryland grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 12.63 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .--Dryland Grain Sorghum Hybrid Performance Test at Walsh, 2003. \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	%
TRIUMPH	TR 434	11	73	1847	119	E	41	13.6	0	61	28	110
SORGHUM PARTNERS	NK 5418	10	76	1949	120	ME	33	18.6	0	61	41	160
ASGROW	Seneca	10	79	2042	126	ME/M	39	19.8	0	63	36	140
MYCOGEN	627	11	77	1980	122	ME	40	16.7	0	60	36	139
ASGROW	Pulsar	10	75	1916	121	ME	33	16.3	0	60	34	131
NC+	NC+ 5B89	10	74	1882	120	ME/E	36	20.1	0	61	34	130
PIONEER	85G01	10	77	1980	127	ME/M	34	22.5	0	60	31	121
DEKALB	X210	10	77	1980	124	ME	39	13.6	0	62	29	114
DEKALB	DKS 36-00	11	74	1882	120	ME	32	17.4	0	61	29	113
TRIUMPH	TR 438	10	75	1916	120	ME	37	16.7	0	61	25	95
DEKALB	DK-40y	11	76	1949	125	ME/M	36	17.4	0	61	24	92
DEKALB	DK-44	10	77	1980	124	ME/M	39	16.7	0	61	23	91
SORGHUM PARTNERS	NK 7633	10	84	2193	137	M	43	13.9	0	62	36	142
NC+	NC+ 7C22	10	80	2068	131	M	37	14.7	0	61	27	104
SORGHUM PARTNERS	1486	10	80	2068	128	M	35	12.8	0	62	26	102
SORGHUM PARTNERS	K73-J6	10	85	2229	134	M/ML	34	19.4	0	60	18	70
SORGHUM PARTNERS	NK 7655	10	85	2229	135	M	38	19.0	0	62	15	59
SORGHUM PARTNERS	KS 585	10	84	2193	132	M	34	18.2	0	61	12	47
SORGHUM PARTNERS	NK 8828	12	86	2259	140	ML	44	15.5	0	60	25	97
PIONEER	84G50	10	87	2292	139	ML/M	37	21.7	0	59	18	70
SORGHUM PARTNERS	K59-Y2	10	87	2292	141	ML/M	34	16.7	0	59	17	64
(Check)	399 X 2737	10	90	2396	143	ML	34	18.2	0	60	15	56
PIONEER	84G62	10	89	2360	141	ML	33	19.8	0	58	13	51
Average		10	80	2082	129	M	37	17.4	0	61	26	
LSD 0.20											10.1	

\1 Planted: May 22; Harvested: October 30.

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 .--Summary: Dryland Grain Sorghum Hybrid Performance Tests at Walsh, 2001-2003.

Brand	Hybrid	Grain Yield 2001	Grain Yield 2002	Grain Yield 2003	Grain Yield 2-Year Avg	Grain Yield 3-Year Avg	Yield as % of Test Average 2001	Yield as % of Test Average 2002	Yield as % of Test Average 2003	Yield as % of Test Average 2-Year Avg	Yield as % of Test Average 3-Year Avg
		--Bu/A--					--%--				
ASGROW	Seneca	51	52	36	44	46	112	102	140	121	118
ASGROW	Pulsar	--	54	34	44	--	--	105	131	118	--
DEKALB	DK-40y	48	--	24	36	--	106	--	92	99	--
DEKALB	DK-44	35	56	56	56	49	77	109	109	109	98
DEKALB	DKS 36-00	--	57	29	43	--	--	112	113	113	--
MYCOGEN	627	55	58	23	41	45	121	112	91	102	108
NC+	NC+ 5B89	--	67	34	51	--	--	131	130	131	--
NC+	6B50	37	50	--	44	--	81	96	--	89	--
NC+	5B74E	52	47	--	50	--	114	91	--	103	--
PIONEER	8505	61	54	--	58	--	133	105	--	119	--
PIONEER	85Y34	54	57	--	56	--	118	110	--	114	--
PIONEER	85G85	55	61	--	58	--	121	119	--	120	--
PIONEER	84G62	37	59	13	36	36	82	115	51	83	83
SORGHUM PARTNERS	KS 310	53	42	--	48	--	116	81	--	99	--
SORGHUM PARTNERS	KS 585	31	60	12	36	34	67	117	47	82	77
SORGHUM PARTNERS	K59-Y2	37	55	17	36	--	80	107	64	86	--
SORGHUM PARTNERS	K73-J6	--	34	18	26	--	--	66	70	68	--
SORGHUM PARTNERS	NK 7633	--	48	36	42	--	--	93	142	118	--
SORGHUM PARTNERS	NK 8828	--	47	25	36	--	--	90	97	94	--
TRIUMPH	TR 438	48	59	25	42	44	105	115	95	105	105
(Check)	399 X 2737	31	41	15	28	29	68	79	56	68	68
Average		46	51	26	39	41					

Grain Yields were corrected to 14.0 % seed moisture content.

Irrigated Grain Sorghum Hybrid Performance Test at Hartman, 2003

COOPERATORS: Fred Williams Farm, Hartman, and Kevin Larson, Superintendent, Plainsman Research Center, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under irrigated conditions with 2750 sorghum heat units in a Silty Clay soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 113,250 Seed/A. PLANTED: June 12. HARVESTED: November 18.

EMERGENCE DATE: 8 days after planting. SOIL TEMP: 68 F.

PEST CONTROL: Preemergence Herbicides: None. Post Emergence Herbicides: Avalanche 0.5 Oz/A. CULTIVATION: Once. INSECTICIDE: None.

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

Summary: Growing Season Precipitation and Temperature \1
Holly, Prowers County.

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
June	1.19	424	6	0	18
July	1.14	957	26	18	49
August	2.83	859	26	5	80
September	0.82	488	3	0	110
October	0.05	12	0	0	116
Total	6.03	2740	61	23	116

\1 Growing season from June 12 (planting) to October 6 (first freeze, 28 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in good soil moisture. Weed control was very good. Below normal precipitation for the growing season with all monthly averages except August below normal. No greenbug infestation. Some of the hybrids lodged. Grain yields were good.

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

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	---------------ppm---------------				
0-8"	7.6	2.3	2.7	38	2.0	294	2.6	12.4
8"-24"				18				
Comment	Alka	Mod	VHi	VHi	VLo	VHi	Adeq	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	0.3	0

Yield Goal: 140 Bu/A.
Actual Yield: 109 Bu/A.

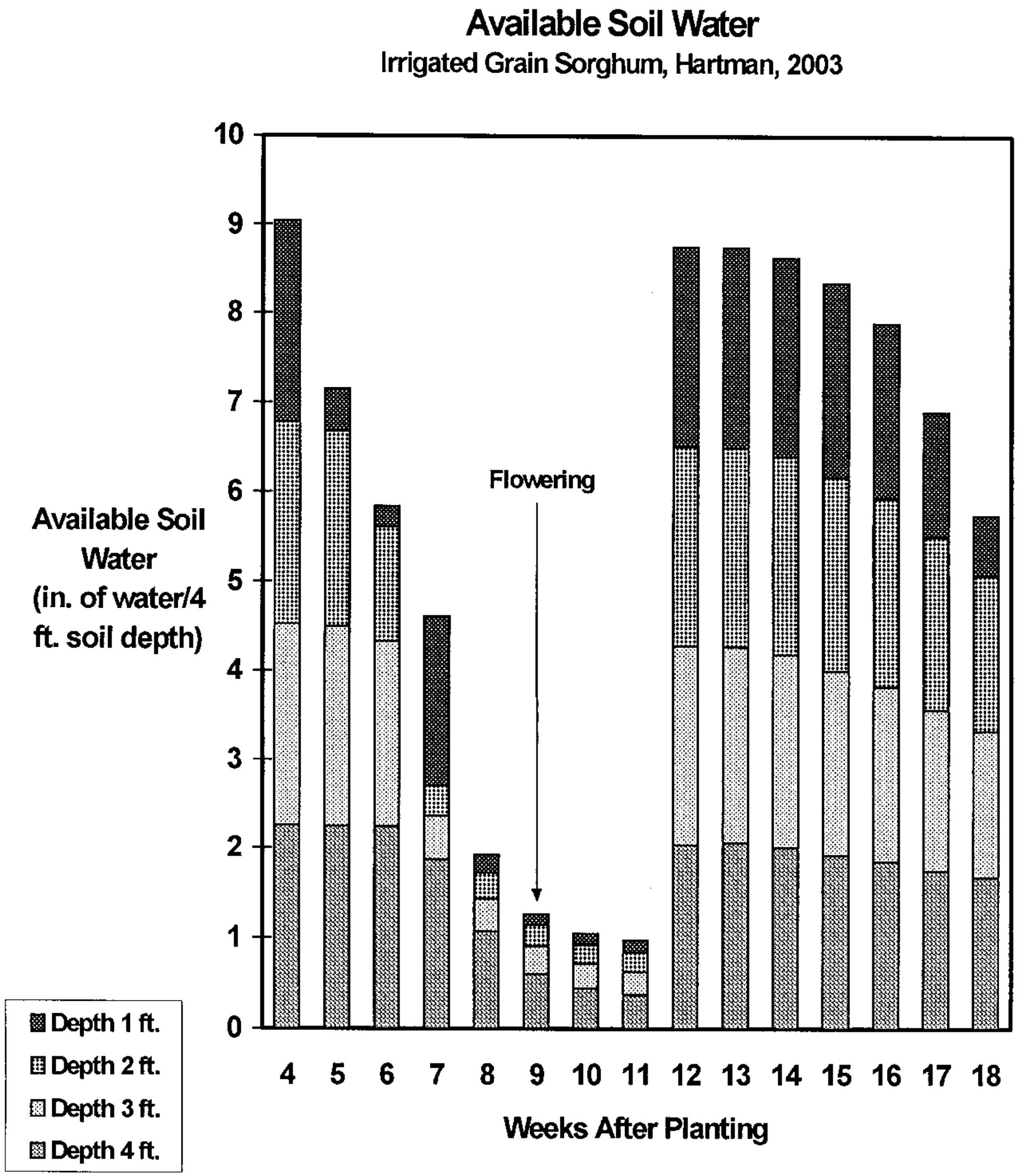


Fig. 4. Available soil water in irrigated grain sorghum at Hartman. Gypsum block measurements taken to 4 ft. with 1ft. increments. Total rainfall at Hartman from planting to first freeze was 6.03 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .--Irrigated Grain Sorghum Hybrid Performance Test at Hartman, 2003. \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	%
SORGHUM PARTNERS	251	8	49	1413	85	E	33	53.4	0	59	89	81
SORGHUM PARTNERS	KS 560Y	8	58	1689	99	ME/M	36	33.3	0	60	111	102
SORGHUM PARTNERS	KS 310	8	53	1532	90	ME	43	42.6	0	59	105	97
MYCOGEN	627	8	58	1689	99	ME	43	38.3	0	58	105	96
SORGHUM PARTNERS	K35-Y5	10	54	1566	93	ME	38	36.8	0	59	94	86
SORGHUM PARTNERS	KS 585	8	60	1740	101	M	40	39.9	0	60	129	118
SORGHUM PARTNERS	NK X633	8	61	1758	103	M/ML	43	53.1	0	59	114	105
SORGHUM PARTNERS	K59-Y2	8	63	1801	108	M	48	61.6	0	56	111	102
SORGHUM PARTNERS	K73-J6	8	62	1778	103	M/ML	46	56.9	0	58	98	90
PIONEER	84G62	8	66	1885	113	ML	45	49.6	0	57	131	120
NC+	NC+ 7R83	8	69	1977	116	ML/M	47	42.6	0	58	119	109
DEKALB	DKS 54-00	9	68	1945	116	ML	46	47.6	0	58	117	107
SORGHUM PARTNERS	NK 8828	9	69	1977	116	ML	44	38.7	0	57	112	102
(Check)	399 X 2737	8	63	1801	112	ML	41	49.6	0	59	111	102
SORGHUM PARTNERS	NK X654	8	64	1826	110	ML	43	50.3	0	60	106	97
ASGROW	A459	8	66	1885	113	ML/M	48	39.1	0	60	104	96
TRIUMPH	TR 481	8	65	1855	112	ML	48	54.2	0	59	100	91
Average		8	62	1772	105	M	43	46.3	0	59	109	
LSD 0.20											8.0	

\1 Planted: June 12; Harvested: November 18.

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 .--Summary: Irrigated Grain Sorghum Hybrid Performance Tests at Hartman, 2000, 2001, 2003.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2000	2001	2003	2-Year Avg	3-Year Avg	2000	2001	2003	2-Year Avg	3-Year Avg
		--------------------Bu/A------------------------					---------------------%--------------------------				
ASGROW	A459	139	130	104	117	124	105	94	96	95	98
DEKALB	DK-47	140	140	--	140	--	105	101	--	103	--
DEKALB	DK-53	127	143	--	135	--	95	103	--	99	--
DEKALB	DKS 54-00	--	128	117	123	--	--	93	107	100	--
MYCOGEN	627	--	126	105	116	--	--	91	96	94	--
NC+	NC+ 6B50	152	142	--	147	--	114	103	--	109	--
NC+	NC+ 7R83	--	141	119	130	--	--	102	109	106	--
PIONEER	84G62	178	162	131	147	157	134	117	120	119	124
PIONEER	85G85	138	142	--	140	--	103	103	--	103	--
SORGHUM PARTNERS	KS 585	135	155	129	142	140	102	112	118	115	111
SORGHUM PARTNERS	K59-Y2	--	135	111	123	--	--	98	102	100	--
SORGHUM PARTNERS	KS 73-J6	--	143	98	121	--	--	103	90	97	--
SORGHUM PARTNERS	NK 8828	--	144	112	128	--	--	104	102	103	--
TRIUMPH	TR 481	130	122	100	111	117	98	88	91	90	92
(Check)	399 X 2737	138	128	128	128	131	104	92	92	92	96
Average		133	138	109	124	127					

Grain Yields were corrected to 14.0 % seed moisture content.

Irrigated Grain Sorghum Hybrid Performance Test at Walsh, 2003

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

PURPOSE: To identify high yielding hybrids under irrigated conditions with 3400 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 23. HARVESTED: October 31.

EMERGENCE DATE: 8 days after planting. SOIL TEMP: 66 F.

IRRIGATION: Drip irrigated for 14 weeks with 11.8 A-in./A.

PEST CONTROL: Preemergence Herbicides: Roundup 16 Oz/A. Post Emergence Herbicides: Clarity 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--------		
May	0.55	157	2	2	8
June	6.89	626	14	3	38
July	1.62	963	28	13	69
August	2.72	829	24	3	100
September	0.77	495	3	0	130
October	0.08	359	2	0	156
Total	12.63	3429	73	21	156

\1 Growing season from May 23 (planting) to October 26 (first freeze, 22 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

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

COMMENTS: Planted in good soil moisture. Weed control was good. Near normal precipitation for the growing season with a wet June and dry July and September months. No greenbug infestation. None of the hybrids lodged. Grain yields were very 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	0.6	2.3	6	3.6	531	1.0	6.1
8"-24"				5				
Comment	Alka	VLo	VHi	Lo	Lo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------Lb/A------------------			
Recommended	42	20	0	0
Applied	100	20	0.3	0

Yield Goal: 125 Bu/A.
Actual Yield: 125 Bu/A.

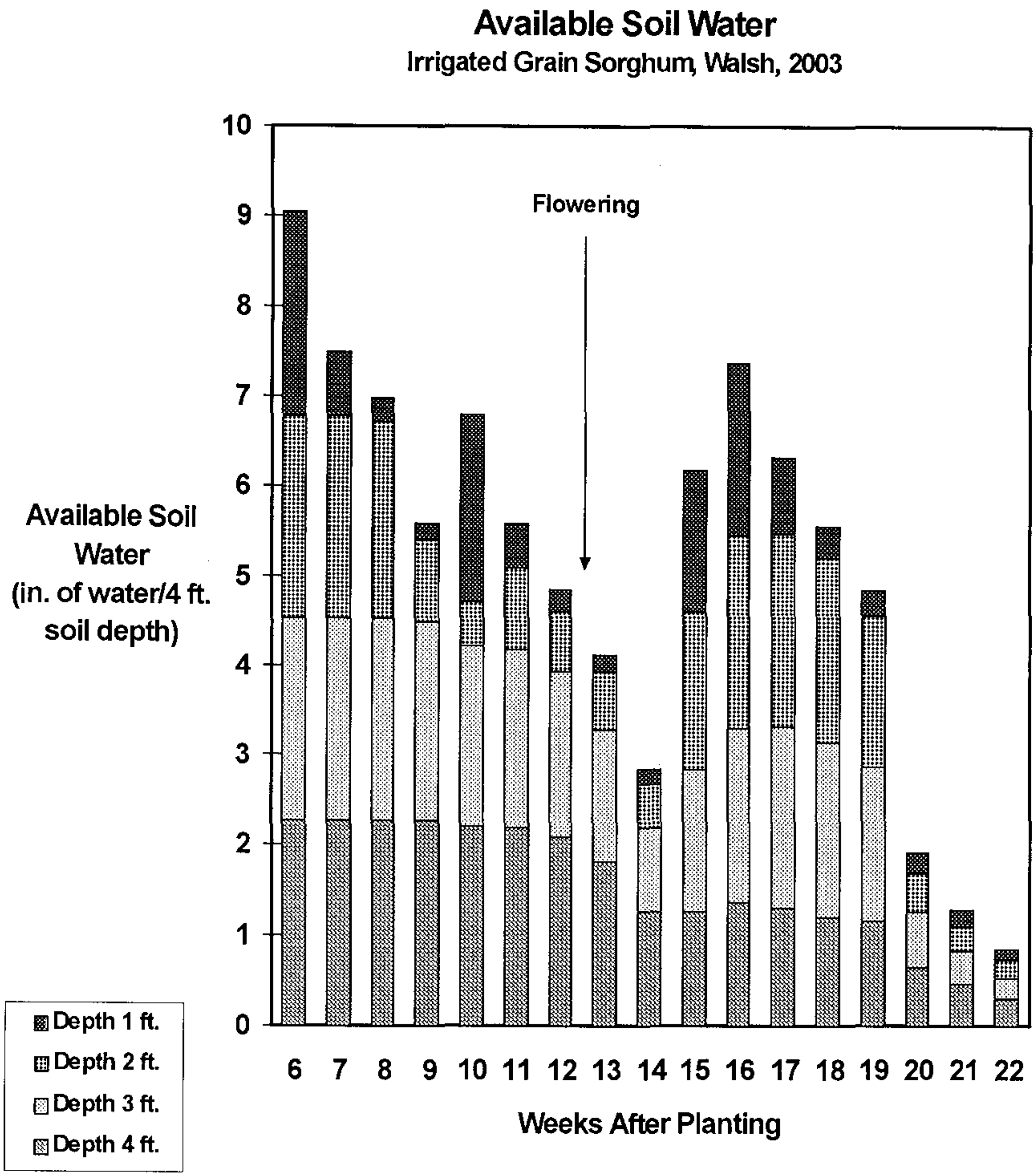


Fig. 4. Available soil water in irrigated grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 12.63 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .--Irrigated Grain Sorghum Hybrid Performance Test at Walsh, 2003. \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	%
SORGHUM PARTNERS	NK 5418	9	77	1993	124	ME	40	31.0	0	59	122	98
MYCOGEN	627	8	78	2021	126	ME	48	31.8	0	60	119	95
ASGROW	Seneca	8	80	2074	129	ME/M	45	33.7	0	61	117	94
SORGHUM PARTNERS	K73-J6	8	84	2162	134	M/ML	50	32.9	0	58	136	109
SORGHUM PARTNERS	KS 585	8	83	2139	133	M	46	33.3	0	60	123	98
SORGHUM PARTNERS	1486	9	82	2118	131	M	43	25.2	0	59	111	89
PIONEER	84G62	8	89	2299	146	ML	49	27.9	0	58	139	111
DEKALB	DKS 54-00	9	90	2327	147	ML	52	30.2	0	55	135	108
ASGROW	A 571	8	93	2413	151	ML	47	32.5	0	55	132	106
NC+	NC+ 7R83	8	92	2387	152	ML/M	50	29.4	0	55	128	103
SORGHUM PARTNERS	K59-Y2	8	88	2270	145	ML/M	51	26.7	0	56	127	102
SORGHUM PARTNERS	NK 7633	8	85	2186	140	ML	48	30.2	0	58	127	102
(Check)	399 X 2737	8	88	2270	145	ML	46	32.5	0	57	125	100
SORGHUM PARTNERS	NK 7655	8	85	2186	138	ML	47	26.7	0	57	120	96
DEKALB	DKS 53-11	9	85	2186	138	ML	50	25.2	0	60	119	96
SORGHUM PARTNERS	NK 8828	10	90	2327	149	ML	47	28.3	0	57	115	92
Average		8	86	2210	139	ML	47	29.8	0	58	125	
LSD 0.20											8.4	

\1 Planted May 23; Harvested: October 31.

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 .--Summary: Irrigated Grain Sorghum Hybrid Performance Tests at Walsh, 2001-2003.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2001	2002	2003	2-Year Avg	3-Year Avg	2001	2002	2003	2-Year Avg	3-Year Avg
		Bu/A					%				
ASGROW	A459	127	71	--	99	--	98	94	--	96	--
ASGROW	Seneca	--	73	117	95	--	--	96	94	95	--
DEKALB	DKS 54-00	161	76	135	106	124	105	101	108	105	105
MYCOGEN	627	151	--	119	135	--	98	--	95	97	--
NC+	NC+ 7R83	171	78	128	103	126	111	103	103	103	106
PIONEER	84G62	171	99	139	119	136	112	130	111	121	118
SORGHUM PARTNERS	KS 585	163	90	123	107	125	106	118	98	108	107
SORGHUM PARTNERS	K59-Y2	161	78	127	103	122	104	102	102	102	103
SORGHUM PARTNERS	KS 73-J6	161	74	136	105	124	105	98	109	104	104
SORGHUM PARTNERS	NK 7633	--	87	127	107	--	--	115	102	109	--
SORGHUM PARTNERS	NK 8828	156	57	115	86	109	102	75	92	84	90
TRIUMPH	TR 465	163	66	--	115	--	106	86	--	96	--
(Check)	399 X 2737	147	147	125	136	140	96	96	100	98	97
Average		154	76	125	101	118					

Grain Yields were corrected to 14.0 % seed moisture content.

Dryland Forage Sorghum Hybrid Performance Test at Walsh, 2003

COOPERATORS: Plainsman Agri-Search Foundation, 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 Silty Loam soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 69,700 Seed/A. PLANTED: May 23. HARVESTED: October 8.

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

PEST CONTROL: Preemergence Herbicides: None. Post Emergence Herbicides: Atrazine 1.0 Lb/A, Clarity 4 Oz/A, Buctril 16 Oz/A, COC 1Qt/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	0.55	175	2	2	9
June	6.89	626	14	3	39
July	1.62	963	28	13	70
August	2.72	829	24	3	101
September	0.77	495	3	0	131
October	0.08	91	0	0	139
Total	12.63	3179	71	21	139

\1 Growing season from May 22 (planting) to October 8 (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 good soil moisture. Weed control was fair. Near normal precipitation for the growing season with a wet June and dry July and September. No greenbug infestation. Forage yields were fair.

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

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8"	7.7	0.6	2.3	14	2.0	395	0.6	5.2
8"-24"				5				
Comment	Alka	VLo	VHi	Mod	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	50	20	0	0

Yield Goal: 10 Ton/A.
Actual Yield: 4.8 Ton/A @ 70% MC.

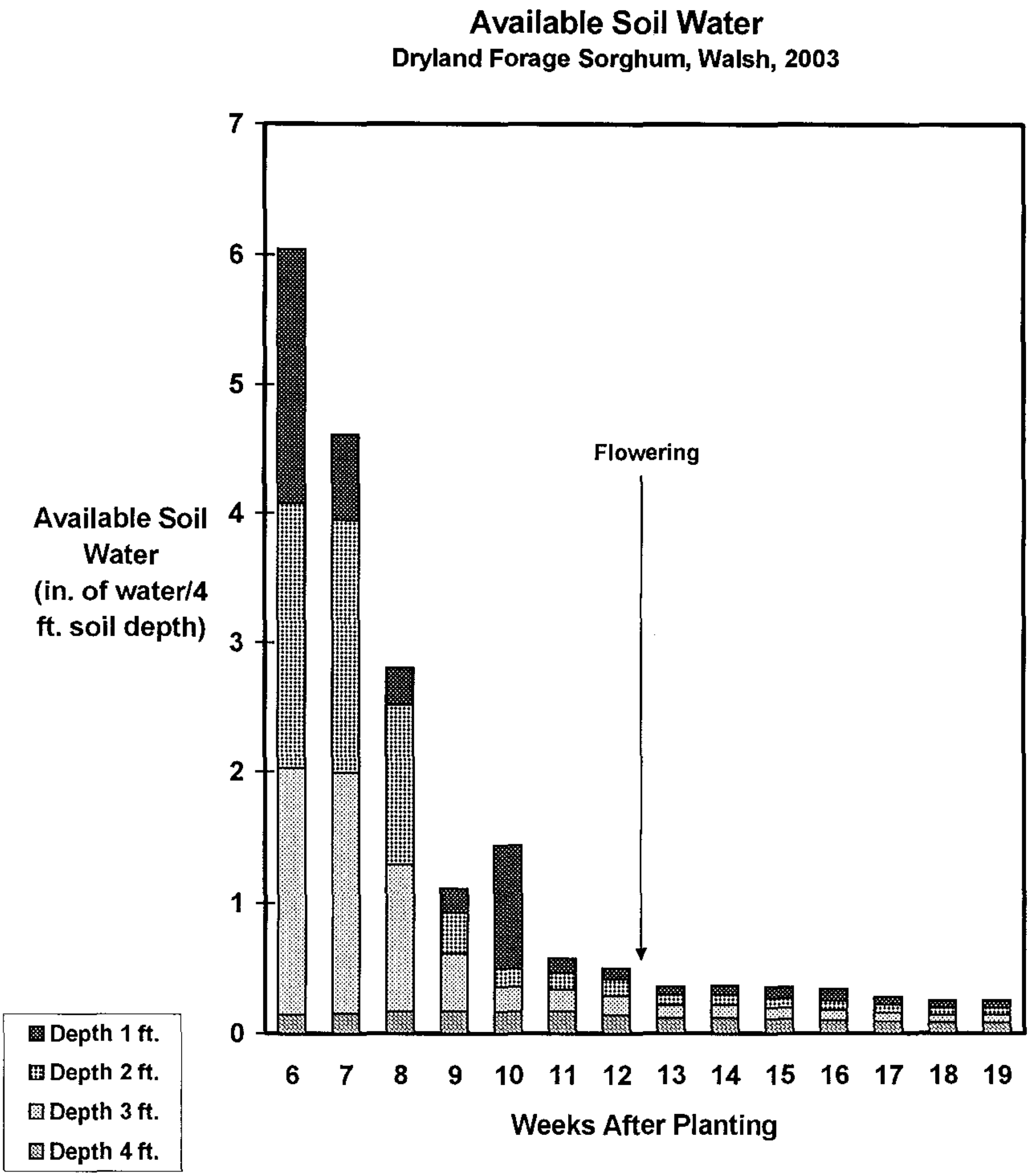


Fig. 5. Available soil water in dryland forage sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 12.63 in. Any increase in available soil water between weeks is from rain.

Table .--Dryland Forage Sorghum Hybrid Performance Test at Walsh, 2003. \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	%
AERC	AERC SSH 51	FS	9	Veg	16.3	40	Veg	13	0	6.2	131
BUFFALO BRAND	Canex BMR 340	FS	9	83	24.4	44	MT	23	0	6.0	127
SORGHUM PARTNERS	SS 405	FS	10	Veg	20.9	48	Veg	15	0	6.0	127
BUFFALO BRAND	Canex BMR 310	FS	9	87	19.0	45	MT	15	0	5.5	118
BUFFALO BRAND	Canex	FS	11	88	23.2	51	MT	22	0	5.5	117
BUFFALO BRAND	Canex BMR 248	FS	9	86	20.9	53	MT	20	0	5.1	109
(Check)	NB 305F	FS	12	95	20.1	50	MT	20	1	5.0	106
AERC	AERC SSH 35	FS	9	109	20.1	43	SD	20	1	4.9	104
BUFFALO BRAND	Canex BMR 208	FS	9	89	17.4	47	MT	19	0	4.8	101
BUFFALO BRAND	Canex II	FS	10	89	24.4	37	MT	22	2	4.3	90
SORGHUM PARTNERS	NK 300	FS	9	89	28.3	32	MT	11	0	4.2	89
RICHARDSON SEEDS	Dairy Master BMR	FS	10	93	21.7	58	MT	17	0	3.9	82
SORGHUM PARTNERS	1990	FS	9	Veg	24.8	38	Veg	15	0	3.3	70
BUFFALO BRAND	Buffalo Brand	SS	9	83	26.3	61	MT	22	1	5.6	119
BUFFALO BRAND	Grazex II W	SS	10	79	22.5	62	MT	15	0	4.6	97
SORGHUM PARTNERS	Sordan Headless	SS	10	Veg	25.6	42	Veg	14	0	4.3	91
SORGHUM PARTNERS	Trudan 8	SS	10	77	19.8	56	MT	15	0	4.2	89
BUFFALO BRAND	Grazex II	SS	10	79	26.7	51	MT	19	0	4.1	88
DRUSSEL SEED	DSS Bonus-R BMR	SS	9	Veg	21.3	44	Veg	11	0	4.1	86
SORGHUM PARTNERS	Sordan 79	SS	9	83	27.9	50	MT	20	1	3.9	83
BUFFALO BRAND	Grazex BMR 727	SS	9	80	21.7	55	MT	9	0	3.9	82
TRIUMPH	TR 1866 Bt	Corn	8	Veg	18.6	50	Veg	15	0	3.1	65
Sorghum Average		FS	10	86	22.5	48	MT	17	0	4.7	
LSD 0.20										1.37	

\1 Planted: May 23; Harvested: October 8.

\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 .--Summary: Dryland Forage Sorghum Hybrid Performance Tests at Walsh, 2001-2003.

Brand	Hybrid	Forage Yield 2001	2002	2003	2-Year Avg	3-Year Avg	Yield as % of Test Average 2001	2002	2003	2-Year Avg	3-Year Avg
		--Tons/A--					--%--				
BUFFALO BRAND	Canex	10.8	13.5	5.5	9.5	9.9	122	124	117	121	121
BUFFALO BRAND	Canex II	10.9	11.7	4.3	8.0	9.0	124	107	90	99	107
BUFFALO BRAND	Canex BMR 208	8.1	9.5	4.8	7.2	7.5	92	87	101	94	93
BUFFALO BRAND	Canex BMR 310	7.3	8.8	5.5	7.2	7.2	83	81	118	100	94
BUFFALO BRAND	Buffalo Brand	8.4	12.0	5.6	8.8	8.7	96	110	119	115	108
BUFFALO BRAND	Grazex II	8.6	10.5	4.1	7.3	7.7	97	96	88	92	94
BUFFALO BRAND	Grazex II W	6.0	9.7	4.6	7.2	6.8	69	89	97	93	85
BUFFALO BRAND	Grazex BMR 727	11.2	8.5	3.9	6.2	7.9	128	78	82	80	96
BUFFALO BRAND	Grazex BMR 720	8.4	7.4	--	7.9	--	95	68	--	82	--
GOLDEN HARVEST	Re-Gro H-22B	8.4	12.0	--	10.2	--	96	110	--	103	--
GOLDEN HARVEST	Re-Gro H-33	9.0	10.2	--	9.6	--	102	93	--	98	--
SORGHUM PARTNERS	NK 300	9.6	11.9	4.2	8.1	8.6	109	109	89	99	102
SORGHUM PARTNERS	NK HiKane II	9.7	11.5	--	10.6	--	111	105	--	108	--
SORGHUM PARTNERS	SS 405	--	16.0	6.0	11.0	--	--	147	127	137	--
SORGHUM PARTNERS	1990	--	12.9	3.3	8.1	--	--	118	70	94	--
SORGHUM PARTNERS	Sordan Headless	--	12.5	4.3	8.4	--	--	115	91	103	--
SORGHUM PARTNERS	Sordan 79	--	12.2	3.9	8.1	--	--	112	83	98	--
SORGHUM PARTNERS	Trudan 8	--	11.8	4.2	8.0	--	--	108	89	99	--
(Check)	NB 305F	10.2	12.8	5.0	8.9	9.3	116	117	106	112	113
(Check)	Corn	5.9	5.7	3.1	4.4	4.9	69	52	65	59	62
Average		8.8	10.9	4.7	7.8	8.1					

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

Table .--Dryland Forage Sorghum Hybrid Dry Matter Analysis at Walsh, 2003.

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-----		
AERC	AERC SSH 51	FS	Veg	45	8.3	29.5	48.0	84.9	68.2	175	0.73	0.45	0.70
SORGHUM PARTNERS	1990	FS	Veg	40	7.6	30.5	46.8	84.6	67.3	174	0.71	0.44	0.69
(Check)	NB 305F	FS	86	47	10.8	29.8	51.8	83.9	69.0	167	0.72	0.45	0.71
BUFFALO BRAND	Canex BMR 340	FS	79	40	14.5	27.2	50.2	83.4	66.9	163	0.76	0.49	0.69
BUFFALO BRAND	Canex BMR 310	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 BMR 248	FS	79	45	14.0	28.0	52.3	81.6	65.6	152	0.75	0.48	0.68
RICHARDSON SEEDS	Dairy Master BMR	FS	86	45	11.3	30.1	53.0	81.8	65.8	152	0.72	0.44	0.68
BUFFALO BRAND	Canex	FS	81	47	10.3	31.1	53.4	81.5	66.1	151	0.70	0.43	0.68
AERC	AERC SS 35	FS	101	37	11.6	28.4	52.0	80.7	65.5	149	0.75	0.47	0.67
BUFFALO BRAND	Canex II	FS	82	37	12.0	30.2	53.9	79.0	64.4	140	0.72	0.44	0.66
SORGHUM PARTNERS	NK 300	FS	83	26	12.6	29.1	53.4	79.3	64.0	140	0.73	0.46	0.66
SORGHUM PARTNERS	Trudan 8	SS	69	36	13.1	30.3	51.5	82.6	67.5	160	0.71	0.44	0.70
SORGHUM PARTNERS	Sordan Headless	SS	Veg	40	9.5	29.5	50.2	82.5	66.4	159	0.73	0.45	0.69
DRUSSEL SEED	DSS Bonus-R BMR	SS	Veg	47	10.4	31.0	51.9	81.2	65.9	152	0.70	0.43	0.68
BUFFALO BRAND	Grazex II W	SS	71	51	13.9	29.6	52.2	81.1	65.7	150	0.73	0.45	0.68
BUFFALO BRAND	Buffalo Brand	SS	77	45	11.8	30.8	53.6	80.0	66.0	147	0.71	0.43	0.68
BUFFALO BRAND	Grazex II	SS	71	46	11.7	32.2	54.6	80.8	65.7	147	0.68	0.41	0.68
SORGHUM PARTNERS	Sordan 79	SS	77	41	13.1	29.2	51.9	80.4	64.8	147	0.73	0.46	0.67
BUFFALO BRAND	Grazex BMR 727	SS	73	42	12.8	30.7	54.9	80.3	64.7	143	0.71	0.44	0.67
TRIUMPH	TR 1866 Bt	Corn	66	57	13.3	33.7	55.3	81.8	65.5	148	0.66	0.39	0.67
Sorghum Average		FS	80	42	11.7	29.8	52.1	81.7	66.1	154	0.72	0.45	0.68

\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 Test at Walsh, 2003

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

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

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 113,250 Seed/A. PLANTED: May 22. HARVESTED: October 9 and 10.

EMERGENCE DATE: 10 days after planting. SOIL TEMP: 63 F.

IRRIGATION: Three furrow irrigations: July 2, July 23, and August 7, total applied 14 A-in./A.

PEST CONTROL: Preemergence Herbicides: None. Post Emergence Herbicides: Clarity 4 Oz/A, Buctril 16 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--------		
May	0.55	175	2	2	9
June	6.89	626	14	3	39
July	1.62	963	28	13	70
August	2.72	829	24	3	101
September	0.77	495	3	0	131
October	0.08	126	0	0	141
Total	12.63	3214	71	23	141

\1 Growing season from May 22 (planting) to October 9 & 10 (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 good soil moisture. Weed control was fair. Near normal precipitation for the growing season with a wet June and dry July and September months. No greenbug infestation. Forage yields were very good.

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

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	---------------ppm---------------				
0-8"	7.7	0.6	2.3	14	2.0	395	0.6	5.2
8"-24"				5				
Comment	Alka	VLo	VHi	Mod	VLo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	-------------------Lb/A------------------			
Recommended	75	20	0	0
Applied	125	20	0.3	0

Yield Goal: 18 Ton/A.
Actual Yield: 19.4 Ton/A @ 70% MC.

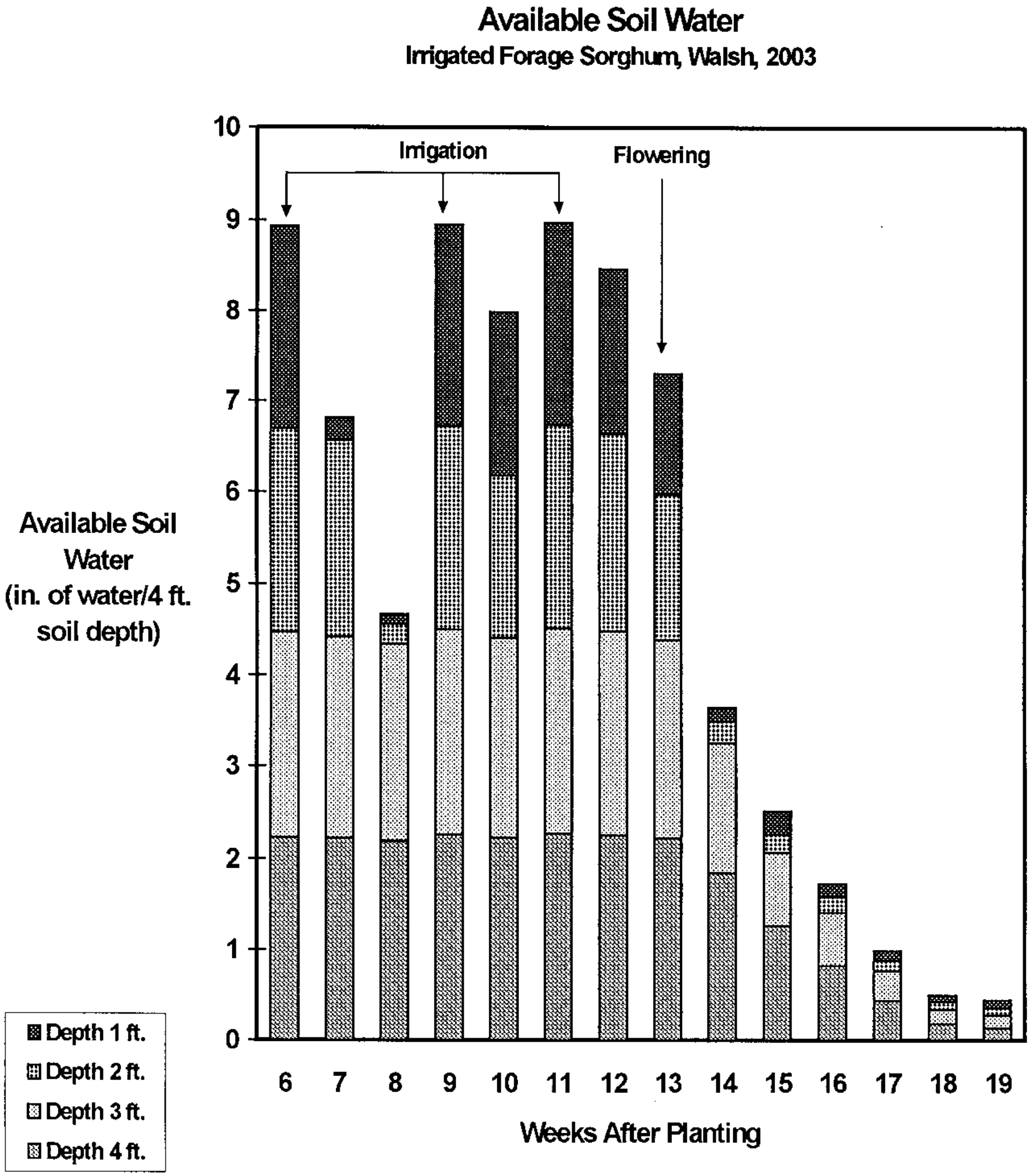


Fig. 6. Available soil water in irrigated forage sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 12.63 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .--Irrigated Forage Sorghum Hybrid Performance Test at Walsh, 2003. \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	%
NC+	NC+ Nutri-Ton II	FS	10	107	39.9	104	LM	11	12	25.6	132
DRUSSEL SEED	DSS Dividend BMR	FS	9	96	43.4	102	HD	10	18	24.1	124
DEKALB	FS-5	FS	11	95	36.8	106	HD	11	0	24.0	123
DEKALB	FS-25E	FS	10	115	45.7	112	EM	16	0	23.6	121
RICHARDSON SEEDS	Dairy Master BMR	FS	9	87	34.9	108	MT	11	3	23.0	118
NC+	NC+ Nutri-Cane II	FS	11	91	35.6	102	HD	17	0	22.8	117
SORGHUM PARTNERS	NK 300	FS	9	86	32.1	80	MT	4	0	21.9	112
(Check)	NB 305F	FS	12	91	32.5	94	HD	11	0	21.8	112
SORGHUM PARTNERS	SS 405	FS	10	102	38.3	137	LM	15	0	20.6	106
SORGHUM PARTNERS	1990	FS	11	Veg	31.8	120	Veg	13	0	20.2	103
AERC	AERC SSH 35	FS	9	93	25.6	89	HD	14	1	19.8	102
BUFFALO BRAND	Canex	FS	11	85	31.4	99	MT	17	0	19.8	102
BUFFALO BRAND	Canex BMR 248	FS	9	85	34.9	94	MT	15	2	19.6	100
BUFFALO BRAND	Canex BMR 340	FS	9	85	36.8	92	MT	18	0	18.8	97
BUFFALO BRAND	Canex II	FS	10	86	31.0	106	MT	13	0	18.1	93
BUFFALO BRAND	Canex BMR 310	FS	9	83	30.2	96	MT	12	3	18.0	93
AERC	AERC SSH 51	FS	10	104	29.0	142	LM	14	0	17.9	92
DEKALB	DKS 59-09	FS	9	88	45.3	80	MT	6	37	17.4	89
BUFFALO BRAND	Canex BMR 208	FS	9	86	29.4	93	MT	16	0	16.6	85
BUFFALO BRAND	Grazex BMR 727	SS	9	75	38.7	106	MT	8	20	20.8	107
SORGHUM PARTNERS	Sordan Headless	SS	10	131	34.1	114	PM	12	0	19.9	102
SORGHUM PARTNERS	Trudan 8	SS	9	73	33.7	111	MT	11	20	19.0	98
CAL/WEST SEEDS	CW 1-61-9	SS	11	84	27.9	98	MT	13	1	18.3	94
BUFFALO BRAND	Buffalo Brand	SS	10	79	36.4	124	MT	12	0	18.2	93
BUFFALO BRAND	Grazex II W	SS	10	76	37.6	119	MT	13	3	17.8	91
BUFFALO BRAND	Grazex II	SS	10	74	35.2	114	MT	13	7	17.5	90
CAL/WEST SEEDS	CW 1-61-1	SS	10	85	38.3	98	MT	9	1	16.9	87
SORGHUM PARTNERS	Sordan 79	SS	9	77	46.9	120	MT	10	25	16.7	86
CAL/WEST SEEDS	CW 1-61-10	SS	10	83	28.3	111	MT	9	0	16.6	85
CAL/WEST SEEDS	CW 1-61-4	SS	10	85	27.1	99	MT	7	0	16.3	84
CAL/WEST SEEDS	CW 1-63-1	SS	10	83	36.8	94	MT	15	2	16.1	83
CAL/WEST SEEDS	CW 1-63-4	SS	9	85	29.0	103	MT	8	1	15.7	80
TRIUMPH	TR 1866 Bt	Corn	8	78	25.9	102	HD	7	0	19.3	99
Sorghum Average		FS	10	86	34.8	105	HD	12	5	19.5	
LSD 0.20										3.08	

\1 Planted May 22; Harvested: October 9 and 10.

\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 .--Summary: Irrigated Forage Sorghum Hybrid Performance Tests at Walsh, 2001-2003.

Brand	Hybrid	Forage Yield 2001	2002	2003	2-Year Avg	3-Year Avg	Yield as % of Test Average 2001	2002	2003	2-Year Avg	3-Year Avg
		--Ton/A--					--%--				
BUFFALO BRAND	Canex	22.5	19.9	19.8	19.9	20.7	114	111	102	107	109
BUFFALO BRAND	Canex II	22.1	19.0	18.1	18.6	19.7	112	106	93	100	104
BUFFALO BRAND	Buffalo Brand	16.5	17.8	18.2	18.0	17.5	84	99	93	96	92
BUFFALO BRAND	Grazex II	19.3	15.7	17.5	16.6	17.5	98	88	90	89	92
BUFFALO BRAND	Grazex II W	17.1	13.5	17.8	15.7	16.1	87	76	91	84	85
BUFFALO BRAND	Canex BMR 310	20.5	17.9	18.0	18.0	18.8	104	100	93	97	99
BUFFALO BRAND	Canex BMR 208	21.5	19.8	16.6	18.2	19.3	109	111	85	98	102
BUFFALO BRAND	Grazex BMR 727	18.1	17.9	20.8	19.4	18.9	92	100	107	104	100
BUFFALO BRAND	Grazex BMR 720	17.0	13.5	--	15.3	--	86	76	--	81	--
CAL/WEST SEEDS	CW 1-61-1	--	20.1	16.9	18.5	--	--	112	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	--	--	95	85	90	--
CAL/WEST SEEDS	CW 1-63-1	--	18.0	16.1	17.1	--	--	100	83	92	--
GOLDEN HARVEST	Si-Gro H-45	20.3	21.1	--	20.7	--	103	118	--	111	--
GOLDEN HARVEST	Si-Gro H-47	19.1	19.0	--	19.1	--	97	106	--	102	--
NC+	NC+ Nutri-Cane II	--	20.7	22.8	21.8	--	--	116	117	117	--
NC+	NC+ Nutri-Ton II	--	19.3	25.6	22.5	--	--	108	132	120	--
SORGHUM PARTNERS	NK 300	24.0	20.5	21.9	21.2	22.1	122	115	112	114	116
SORGHUM PARTNERS	HiKane II	20.2	18.6	--	19.4	--	102	104	--	103	--
SORGHUM PARTNERS	Sordan Headless	--	20.6	19.9	20.3	--	--	115	102	109	--
SORGHUM PARTNERS	SS 405	--	20.2	20.6	20.4	--	--	113	106	110	--
SORGHUM PARTNERS	1990	--	18.6	20.2	19.4	--	--	104	103	104	--
SORGHUM PARTNERS	Sordan 79	--	16.6	16.7	16.7	--	--	93	86	90	--
SORGHUM PARTNERS	Trudan 8	--	14.5	19.0	16.8	--	--	81	98	90	--
RICHARDSON SEEDS	Dairy Master BMR	21.7	20.3	23.0	21.7	21.7	110	113	118	116	114
RICHARDSON SEEDS	Sweeter N Honey BMR	20.8	20.0	--	20.4	--	105	112	--	109	--
RICHARDSON SEEDS	Honey Graze BMR	19.5	15.9	--	17.7	--	99	89	--	94	--
(Check)	NB 305F	17.8	20.0	21.8	20.9	19.9	90	112	112	112	105
(Check)	Corn	22.4	13.9	19.3	16.6	18.5	114	78	99	89	97
Average		19.7	17.9	19.5	18.7	19.0					

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

Table .--Irrigated Forage Sorghum Hybrid Dry Matter Analysis at Walsh, 2003.

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-----		
BUFFALO BRAND	Canex BMR 208	FS	79	75	12.0	34.8	58.1	81.7	63.4	140	0.64	0.37	0.65
BUFFALO BRAND	Canex BMR 248	FS	78	78	13.5	34.2	56.2	80.4	62.9	138	0.65	0.38	0.65
RICHARDSON SEEDS	Dairy Master BMR	FS	80	68	11.6	35.3	59.1	81.1	63.5	138	0.63	0.37	0.65
BUFFALO BRAND	Canex BMR 340	FS	78	75	10.4	35.4	60.5	80.1	64.8	137	0.63	0.37	0.67
BUFFALO BRAND	Canex II	FS	79	81	11.7	36.5	59.0	79.9	63.4	135	0.61	0.35	0.65
AERC	AERC SSH 35	FS	85	78	13.8	35.5	57.8	80.7	61.0	133	0.63	0.36	0.62
BUFFALO BRAND	Canex	FS	78	77	10.2	36.8	59.4	79.0	62.9	131	0.60	0.34	0.65
NC+	NC+ Nutri-Ton II	FS	103	82	10.4	37.5	59.3	78.9	62.3	130	0.59	0.33	0.64
(Check)	NB 305F	FS	82	69	12.8	35.8	58.9	79.4	61.4	129	0.62	0.36	0.63
SORGHUM PARTNERS	SS 405	FS	93	115	13.0	35.6	57.9	79.2	61.1	129	0.63	0.36	0.63
DEKALB	FS-25E	FS	104	97	10.2	37.3	61.2	77.3	62.3	125	0.60	0.34	0.64
BUFFALO BRAND	Canex BMR 310	FS	76	74	11.5	34.8	61.2	77.9	61.8	125	0.64	0.38	0.63
DEKALB	DKS 59-09	FS	80	59	9.8	39.0	62.1	78.9	61.2	125	0.57	0.31	0.63
DRUSSEL SEED	DSS Dividend BMR	FS	86	86	12.2	37.4	60.5	77.8	59.9	121	0.59	0.33	0.61
SORGHUM PARTNERS	1990	FS	Veg	119	9.0	39.8	62.1	77.9	60.5	121	0.55	0.30	0.62
NC+	NC+ Nutr-Cane II	FS	81	79	9.8	39.5	64.0	75.8	60.0	115	0.56	0.30	0.61
SORGHUM PARTNERS	NK 300	FS	78	46	10.1	10.9	64.3	76.0	59.2	113	0.53	0.28	0.60
DEKALB	FS-5	FS	88	82	11.9	37.9	61.8	74.3	57.1	107	0.59	0.33	0.58
AERC	AERC SSH 51	FS	95	99	10.7	36.8	62.1	74.3	57.2	107	0.60	0.34	0.58
BUFFALO BRAND	Grazex BMR 727	SS	64	42	12.8	32.2	53.8	83.6	67.9	161	0.68	0.41	0.70
SORGHUM PARTNERS	Trudan 8	SS	62	45	11.7	34.6	56.4	82.6	67.2	153	0.64	0.38	0.69
SORGHUM PARTNERS	Sordan 79	SS	65	46	12.5	34.2	54.4	82.5	66.0	152	0.65	0.38	0.68
BUFFALO BRAND	Grazex II W	SS	65	44	12.8	35.0	56.5	81.2	64.9	144	0.64	0.37	0.67
BUFFALO BRAND	Grazex II	SS	63	47	11.5	35.7	58.3	80.3	65.5	141	0.63	0.36	0.67
BUFFALO BRAND	Buffalo Brand	SS	66	46	13.6	33.5	55.9	79.0	62.9	135	0.66	0.39	0.65
CAL/WEST SEEDS	CW 1-61-9	SS	75	74	11.1	39.2	61.1	80.7	62.9	134	0.56	0.31	0.65
CAL/WEST SEEDS	CW 1-63-1	SS	74	73	11.2	39.1	62.5	79.9	61.9	129	0.56	0.31	0.63
SORGHUM PARTNERS	Sordan Headless	SS	120	118	9.9	37.1	57.9	77.5	62.1	127	0.60	0.34	0.64
CAL/WEST SEEDS	CW 1-61-10	SS	75	78	10.7	39.3	63.8	78.0	62.1	124	0.56	0.30	0.64
CAL/WEST SEEDS	CW 1-61-4	SS	76	73	10.6	40.1	63.7	77.9	60.3	120	0.55	0.29	0.62
CAL/WEST SEEDS	CW 1-61-1	SS	76	77	10.3	38.8	63.7	76.4	60.4	117	0.57	0.31	0.62
CAL/WEST SEEDS	CW 1-63-4	SS	76	80	11.9	39.6	63.9	75.9	59.7	114	0.56	0.30	0.61
TRIUMPH	TR 1866 Bt	Corn	73	92	13.6	37.1	56.4	81.3	64.0	142	0.60	0.34	0.66
Sorghum Average		FS	80	74	11.4	35.9	59.9	78.9	62.2	130	0.60	0.34	0.64

\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..

Limited Sprinkler Irrigation on Corn and Grain Sorghum, Walsh 2003

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 18 grain sorghum hybrids under limited sprinkler irrigation. We planted the corn study on April 30 at 28,000 Seeds/A, and the grain sorghum study on June 11 at 80,000 Seeds/A. We fertilized both studies with 150 Lb N/A, 20 Lb P_2O_5/A, and 0.25 Lb Zn/A. We applied 12.5 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.

RESULTS: Yields and test weights for both corn and grain sorghum were good; however, the latest maturing hybrids in both studies were the lowest yielding hybrids tested. More than 30 Bu/A separated the highest and lowest yielding hybrids for both corn and grain sorghum studies.

DISCUSSION: The low yields for the latest maturing hybrids in both studies suggest that timing of irrigation was too early for these late maturing hybrids to fully utilize. The low yield for the earliest maturing hybrid in the grain sorghum study indicates that irrigation began too late for the earliest maturing hybrid. Reviewing the available soil moisture graph for limited irrigated grain sorghum illustrates the cause for the low grain sorghum yield for the early maturing hybrid. We did not irrigate through the sprinkler until flowering, which is the normal timing for limited furrow irrigation where the soil profile is recharged with a single irrigation, but is too late for sprinkler irrigation where only the top foot or so is filled per irrigation. The irrigation delay lowered the yield potential of the early maturing hybrid.

Water use for limited sprinkler irrigated corn and grain sorghum can be indirectly constructed from dryland yields and irrigated yields. Nearby dryland corn study with all the same hybrids as the irrigated study averaged 13 Bu/A, and a dryland grain sorghum study averaged 26 Bu/A. If we use the dryland yield averages as the yields resulting from stored and in-season precipitation, we find that the water use efficiency of the limited sprinkler irrigation is 9.2 Bu/in. for corn and 8.8 Bu/in. for grain sorghum. These water use efficiencies are close to the amounts predicted by KSU researchers, 12.6 Bu/in. for corn and 9.1 Bu/in. for grain sorghum.

Limited Sprinkler Irrigation Corn Study at Walsh, 2003

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: The highest yielding hybrid, Pioneer 33B51, produced 145 Bu/A. The lowest yielding hybrid, Triumph 1866 Bt, produced only 105 Bu/A. The yield of the nonresistant corn borer hybrid, Mycogen 2P682, was average, indicating that corn borer infestation was not the most limiting yield factor.

PLOT: Four rows with 30" row spacing, at least 600' long. SEEDING DENSITY: 28,000 Seeds/A. PLANTED: April 30. HARVESTED: October 20.

IRRIGATION: Ten sprinkler rotations applied 12.5 acre-in/A of total water.

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

FIELD HISTORY: Last Crop: Wheat. 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-------		
April	0.00	18	0	0	1
May	2.29	472	2	2	32
June	6.89	626	14	3	62
July	1.62	963	28	13	93
August	2.72	829	24	3	124
September	0.77	495	3	0	154
October	0.08	273	2	0	174
Total	14.37	3676	73	21	174

\1 Growing season from April 30 (planting) to October 20 (harvest).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in good soil moisture. Weed control was fair. Near normal precipitation for the growing season, June was wet and July and September were dry. There was widely varying responses to sprinkler applied water. Grain yields were 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	0.7	2.8	29	1.6	400	0.8	7.1
8"-24"				26				
Comment	Alka	VLo	VHi	VHi	VLo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization for Sprinkler Site.

Fertilizer	N	P_2O_5	Zn	Fe
	------------------Lb/A------------------			
Recommended	0	40	2.0	0
Applied	150	20	0.3	0

Yield Goal: 125 Bu/A.
Actual Yield: 127 Bu/A.

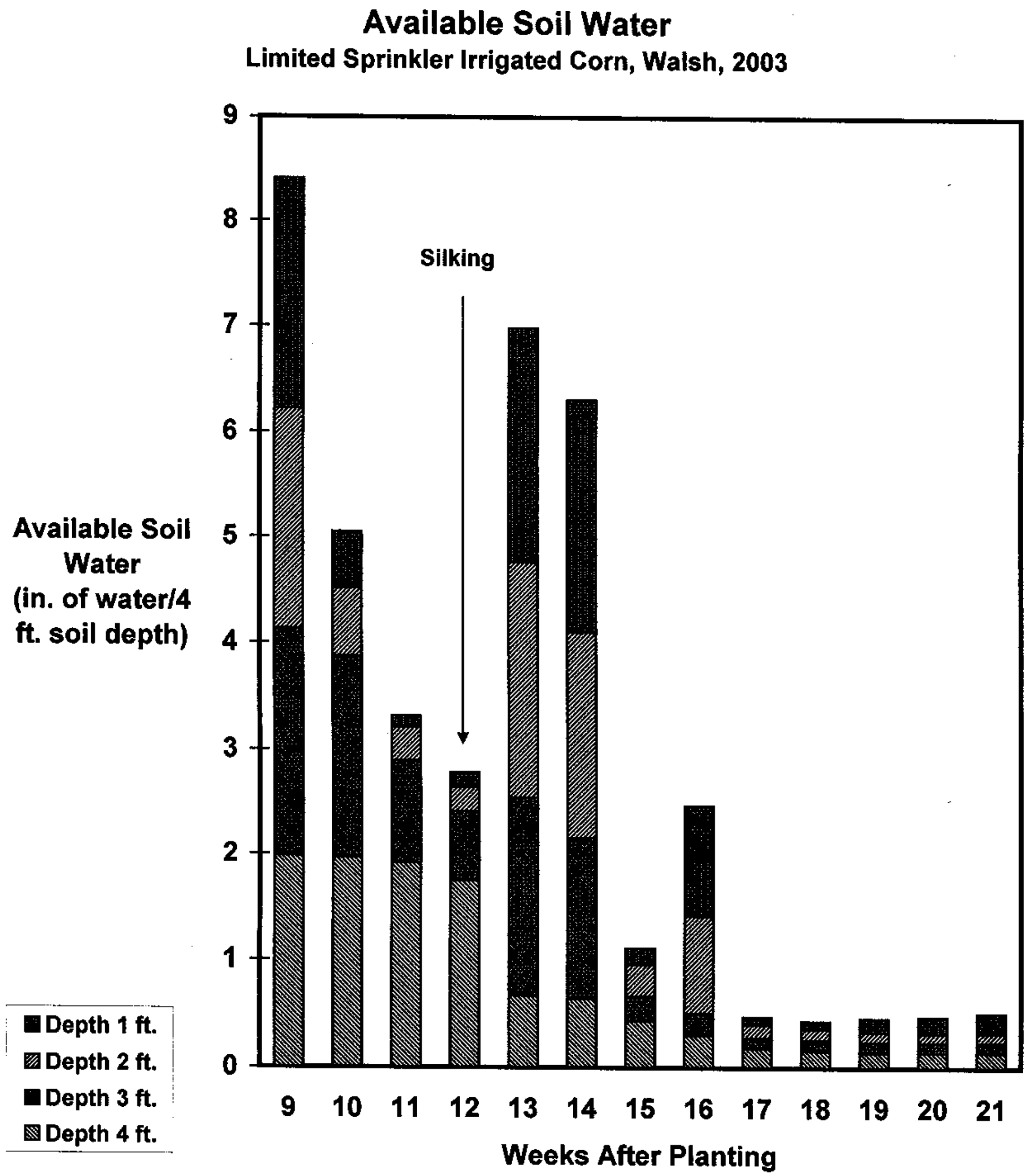


Fig. . Available soil water in limited sprinkler irrigation corn at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 14.37 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .Limited Sprinkler Irrigation Corn, Plainsman Research Center, Walsh, 2003.

Firm	Hybrid	50% Silking Date	Plant Density	Seed Moisture	Test Weight	Grain Yield
			Plants/A (X 1000)	%	Lb/Bu	Bu/A
PIONEER	33B51 (Bt)	22-Jul	24.8	14.9	59	145
GARST	8383 YG1	23-Jul	23.8	14.8	59	138
PIONEER	34N44 (Bt)	16-Jul	24.0	13.3	60	138
MYCOGEN	7821 Bt	23-Jul	27.8	14.5	59	135
GOLDEN HARVEST	H-9485 Bt	21-Jul	25.6	13.5	59	133
TRIUMPH	1120 Bt/RR	20-Jul	24.6	14.6	59	128
MYCOGEN	2R773 (Bt)	21-Jul	24.4	13.2	58	127
MYCOGEN	2P682	19-Jul	25.8	12.8	57	127
GOLDEN HARVEST	H-9430 Bt	23-Jul	25.2	15.4	60	126
FONTANELLE	HC 7638 YG-G	20-Jul	26.2	13.0	57	126
NK	N68-K7 (Bt)	20-Jul	25.2	13.8	59	125
ASGROW	RX 730 RR/YG	19-Jul	25.4	14.3	58	123
NK	N67-T4 (Bt)	19-Jul	25.8	14.9	58	122
ATLAS	2H722 (Bt)	21-Jul	25.0	13.6	58	121
GARST	8510 YG1/RR	20-Jul	24.4	14.1	58	115
TRIUMPH	1866 Bt	25-Jul	25.0	13.1	58	105
Average		20-Jul	25.2	14.0	59	127
LSD 0.20						11.1

Planted: April 30; Harvested: October 20.
Grain Yield corrected to 15.5% moisture content.
Ten sprinkler rotations applied a total of 12.5 acre-in./A of water.

Limited Sprinkler Irrigation Grain Sorghum Study at Walsh, 2003

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, Triumph TR 459, produced 104 Bu/A. The lowest yielding hybrid, Pioneer 84G62, produced only 72 Bu/A.

PLOT: Four rows with 30" row spacing, at least 600' long. SEEDING DENSITY: 80,000 Seeds/A. PLANTED: June 11. HARVESTED: November 10.

IRRIGATION: Six 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: None. CULTIVATION: Once. INSECTICIDE: None.

FIELD HISTORY: Last Crop: Wheat. 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-------		
June	2.91	474	13	3	19
July	1.62	963	28	13	50
August	2.72	829	24	3	81
September	0.77	495	3	0	111
October	0.08	359	2	0	137
Total	8.10	3120	70	19	137

\1 Growing season from June 11 (planting) to October 26 (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. Near normal precipitation for the growing season with a wet June and dry July and September months. 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	0.7	2.8	29	1.6	400	0.8	7.1
8"-24"				26				
Comment	Alka	Vlo	VHi	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	2	0
Applied	150	20	0.3	0

Yield Goal: 100 Bu/A.
Actual Yield: 92 Bu/A.

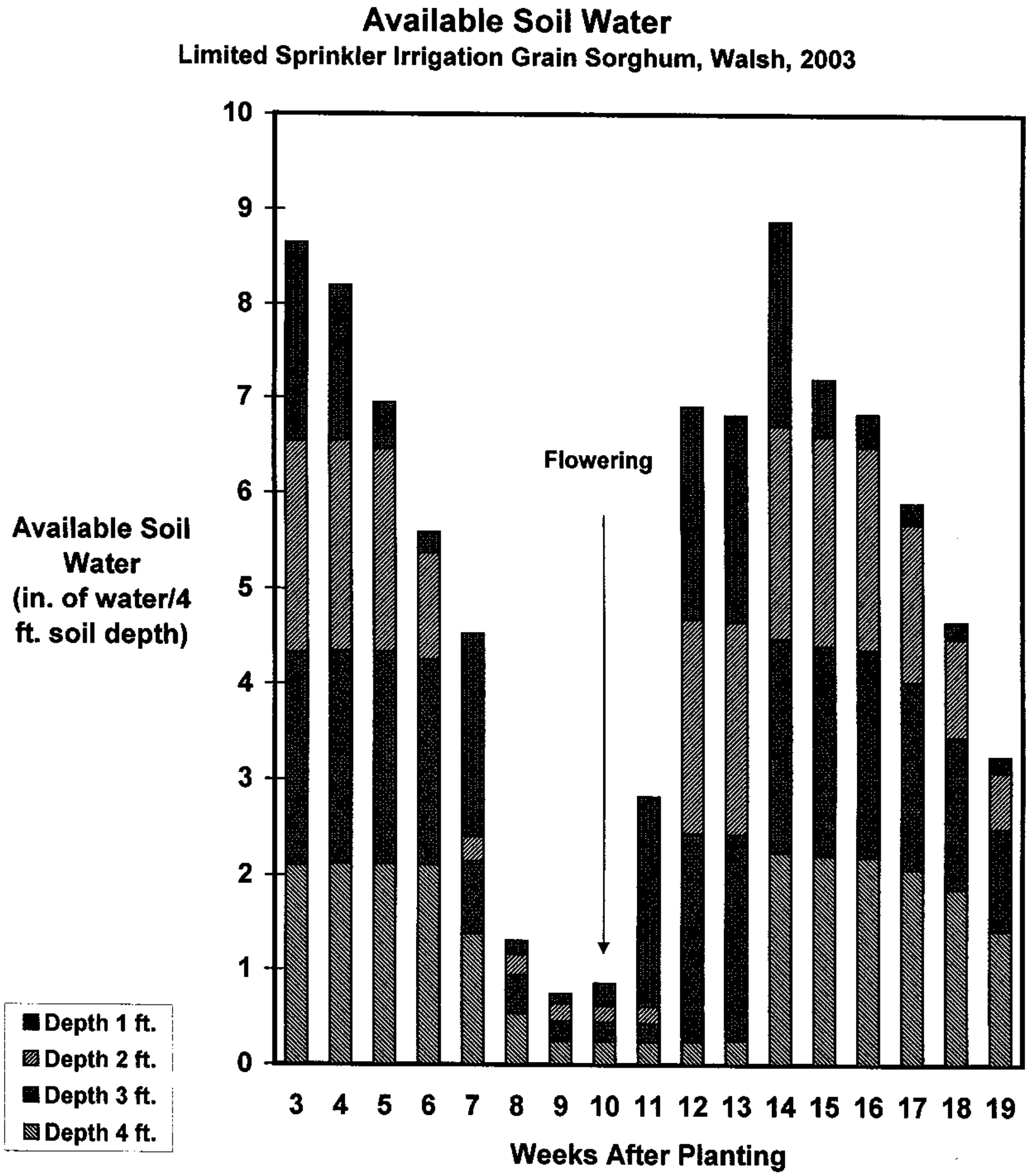


Fig. . Available soil water in limited sprinkler irrigation grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 8.10 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .Limited Sprinkler Irrigation Grain Sorghum, Plainsman Research Center, Walsh, 2003.

Brand	Hybrid	Plant Density	50% Flowering Date	50% Maturity Date	Plant Height	Seed Moisture Content	Test Weight	Grain Yield
		Plants/A (1000X)			In	%	Lb/Bu	Bu/A
TRIUMPH	TR 459	54.5	8/15	10/5	40	15.1	59	104
MYCOGEN	627	46.5	8/15	10/2	43	13.8	59	101
GARST	5750	39.3	8/14	10/1	41	12.1	60	98
GOLDEN HARVEST	H-390W	50.9	8/17	10/11	42	14.6	58	98
PIONEER	8500	56.5	8/15	10/2	43	13.7	60	96
FONTANELLLE	X-532	54.5	8/16	10/2	41	14.0	60	96
MYCOGEN	1482	50.1	8/13	9/28	39	13.7	59	96
PIONEER	86G71	42.5	8/11	9/29	42	14.1	61	95
MYCOGEN	M3838	48.5	8/18	10/10	41	14.6	58	94
TRIUMPH	TR 438	42.1	8/11	9/22	41	14.2	59	94
FONTANELLLE	G-3245	48.1	8/12	9/21	35	14.0	59	93
ASGROW	Seneca	51.7	8/16	10/3	43	14.0	60	92
NK	KS 585	48.9	8/18	10/5	42	14.6	59	90
GARST	9135	55.7	8/10	9/21	41	14.3	59	89
GOLDEN HARVEST	H-430Y	43.7	8/19	10/17	43	15.9	58	84
NK	KS 310	51.3	8/11	9/29	38	14.5	59	84
PIONEER	87G57	42.5	8/8	9/18	42	14.2	58	82
PIONEER	84G62	52.3	8/21	10/19	42	16.6	57	72
Average		48.9	8/14		41	14.3	59	92
LSD 0.20								5.7

Planted: June 11; Harvested: November 10.
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.

Corn Borer Resistant and Nonresistant Hybrid Comparisons, Walsh, 2003

Kevin Larson and Dennis Thompson

PURPOSE: To evaluate corn borer resistant hybrids (Bt gene insertion) and nonresistant hybrids under dryland conditions without applied insecticides.

RESULTS: Only the nonresistant corn borer hybrids displayed first generation shot hole damage with 14% of the plants damaged. Second generation corn borer infestation was severe, averaging 89% damaged stocks in the nonresistant hybrids. The two nonresistant hybrids produced 12 Bu/A, which was the study average. Yields were low because of late-season moisture stress.

DISCUSSION: All 16 Bt hybrids tested showed excellent resistance to corn borer, even though no insecticides were applied and corn borer infestation was severe.

The only hybrid that produced significantly more than the nonresistant hybrids was Pioneer 34N44 with a test high yield of 20 Bu/A ($P > 0.20$). For the other 15 Bt hybrids, there was no significant yield difference between them and the nonresistant hybrids. We believe the reason there was no yield advantage using Bt hybrids was to due to the hot, dry weather greatly reducing yields. The primary yield-limiting factor was hot, dry weather and not corn borer infestation.

Even though there may not be a yield advantage with Bt hybrids under hot, dry conditions, we recommend that Bt hybrids be used for all dryland plantings in our area. The lower seeding rate, and thus lower seeding cost, for dryland production make corn borer Bt hybrids profitable choices. Our dryland seeding rate was 16,000 seeds/A that translates to an additional $4 to $6/A for Bt hybrid seed. This extra seed cost would be far less than the cost of a single corn borer controlling application. The relatively low seeding cost and efficacy of the corn borer resistant Bt hybrids makes dryland corn a viable crop for Southeastern Colorado under adequate moisture conditions. However, if the weather conditions continue to remain hot and dry, dryland corn should be replaced by grain sorghum because grain sorghum tolerates hot and dry conditions better than corn.

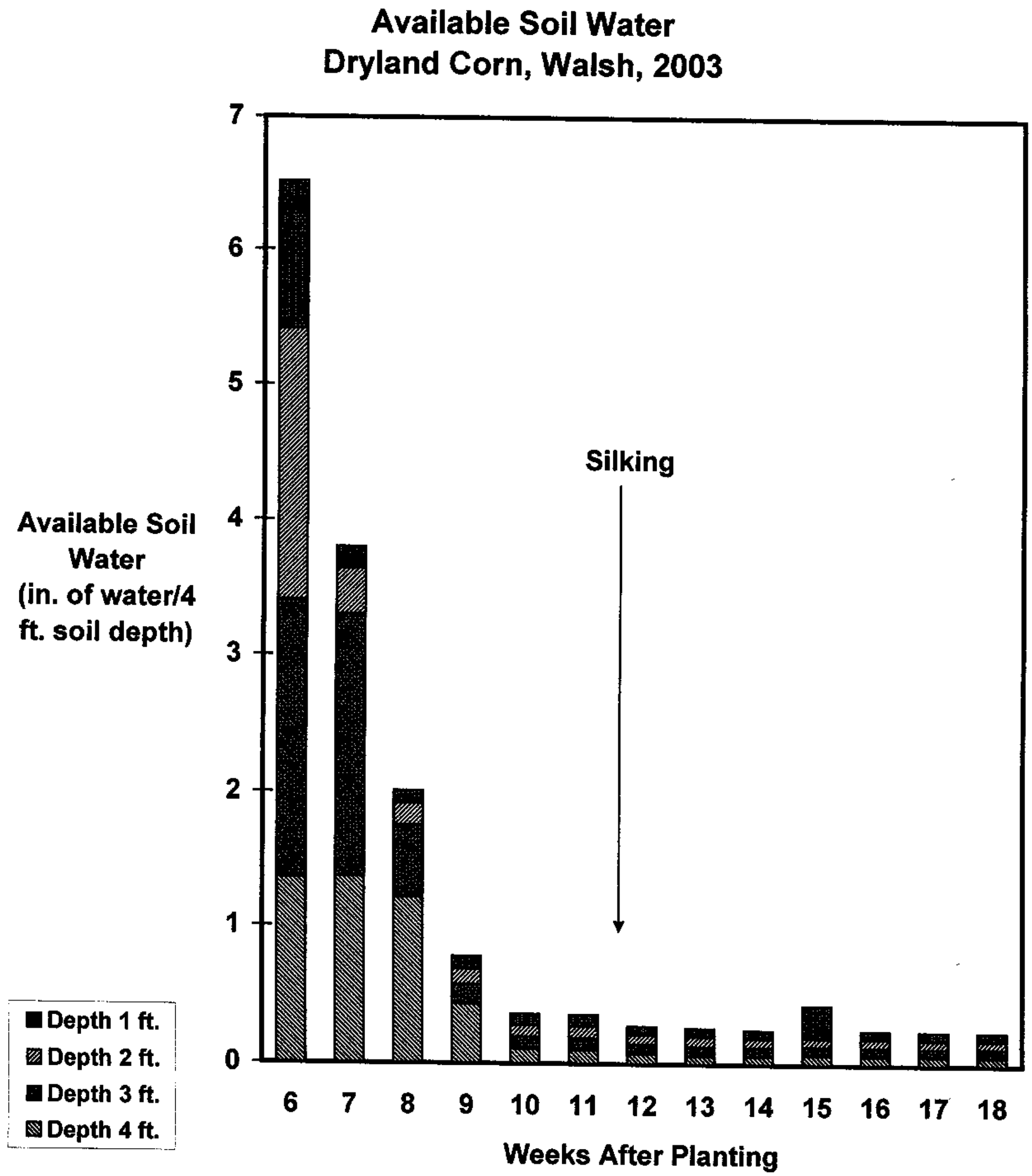


Fig. . Available soil water in dryland corn at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 12.63 in. Any increase in available soil water between weeks is from rain.

Table .Dryland Corn, Plainsman Research Center, 2003.

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)	--------% Plants--------			Lb/Bu	Bu/A
PIONEER	34N44 (Bt)	7-Aug	12.0	0	3	0	59	20
FONTANELLE	HC 7638 YG-G	12-Aug	15.7	0	0	0	60	19
NK	N67-T4 (Bt)	10-Aug	15.5	0	3	3	60	19
ATLAS	2H722 (Bt)	10-Aug	14.5	0	0	0	59	17
MYCOGEN	7821 Bt	12-Aug	12.8	0	0	0	60	15
DEKALB	DK 105 Bt/RR	3-Aug	12.0	0	0	0	58	14
PIONEER	33B51 (Bt)	12-Aug	14.9	0	0	0	59	13
TRIUMPH	TR 2010	13-Aug	15.1	13	90	40	60	12
MYCOGEN	2R773 (Bt)	11-Aug	13.9	0	0	0	60	12
ASGROW	RX 730 RR/YG	12-Aug	13.6	0	0	0	59	12
NK	N68-K7 (Bt)	12-Aug	13.7	0	3	3	59	12
MYCOGEN	2P682	9-Aug	13.0	15	88	38	58	12
TRIUMPH	1120 Bt/RR	10-Aug	13.4	0	0	0	58	11
TRIUMPH	1866 Bt	15-Aug	14.3	0	0	0	59	11
GARST	8510 YG1/RR	11-Aug	13.6	0	0	0	59	8
GARST	8383 YG1	12-Aug	13.2	0	0	0	59	7
GOLDEN HARVEST	H-9430 Bt	13-Aug	13.0	0	0	0	60	6
GOLDEN HARVEST	H-9485 Bt	12-Aug	14.9	0	0	0	60	6
Average		10-Aug	13.8	2	10	5	59	12
LSD 0.20				1.1	3.8	4.6		7.5

Planted: May 22; Harvested: October 24.
Grain Yield corrected to 15.5% moisture content.

Low and Moderate Plant Densities on Subsurface Drip Irrigated Corn Hybrids

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). We designed this study to compare full verses limited subsurface drip irrigation on corn hybrids; however, the controller lost power and our irrigation protocol was not followed. Without irrigation differences, the study became a comparison of low to moderate plant densities.

Materials and Methods

We planted four corn hybrids, Pioneer 33B51, NK N67-T4, Garst 8383 Bt, and Mycogen 7821 Bt, on May 15 at low to moderate seeding densities, 24,000 and 30,000 Seeds/A, under subsurface drip irrigation. The subsurface drip lines are 60 inches apart with emitters every foot and buried 12 in. to 14 in. deep. Our 25 gpm well supplies each zone with 0.12 in. per day when equally distributed to all zones. Our original intent was to fully irrigate the higher planting rate (18 in./A) and apply one-third less irrigation to the lower planting rate (12 in./A). However, our irrigation controller kept malfunctioning and both planting rates received about the same amount of irrigation, 15.3 in./A. The soil test recommendation for 160 Bu/A crop was 90 Lb N/A and 20 Lb P_2O_5/A. We seedrow applied 20 Lb P_2O_5/A and 0.25 Lb Zn/A at planting and injected 100 Lb N/A 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 Banvel 5 Oz/A and Saber 10 Oz/A for postemergence broadleaf weed control. We cultivated once. We harvested the 10 ft. by 600 ft. plots on October 22 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 yields of three of the four corn hybrids: Garst 8383 Bt, NK N67-T4, and Mycogen 7821 Bt, increased from 7 to 13 Bu/A with higher plant densities. The yield of Pioneer 33B51 increased only 1 Bu/A with higher plant density. The explanation for the lack of response for Pioneer 33B51 does not appear to be related to maturation. The corn hybrids silked within three days of one another and their silking date were the same for both low and moderate plant densities. The Pioneer hybrid was also near the study average for grain moisture and test weight. From the parameters that we measured, there does not appear to be an explanation for the non-response of Pioneer 33B51 to increased plant density.

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 .Corn Hybrids with Low to Moderate Plant Density under Subsurface Drip Irrigation, Walsh, 2003.

Firm	Hybrid	Plant Density	Silking Date	Grain Moisture	Test Weight	Grain Yield
		Plants/A (X1000)		%	Lb/Bu	Bu/A
Mycogen	7821 Bt	21	7-Aug	22.2	58	140
NK	N67-T4	21	4-Aug	17.9	59	141
Garst	8383 Bt	21	7-Aug	21.8	58	132
Pioneer	33B51	21	5-Aug	20.0	59	135
Low Density Average			5-Aug	20.5	59	137
Mycogen	7821 Bt	26	7-Aug	23.5	59	150
NK	N67-T4	26	4-Aug	18.0	59	148
Garst	8383 Bt	26	7-Aug	21.9	58	145
Pioneer	33B51	26	5-Aug	21.1	58	136
Moderate Density Average			5-Aug	21.1	59	145

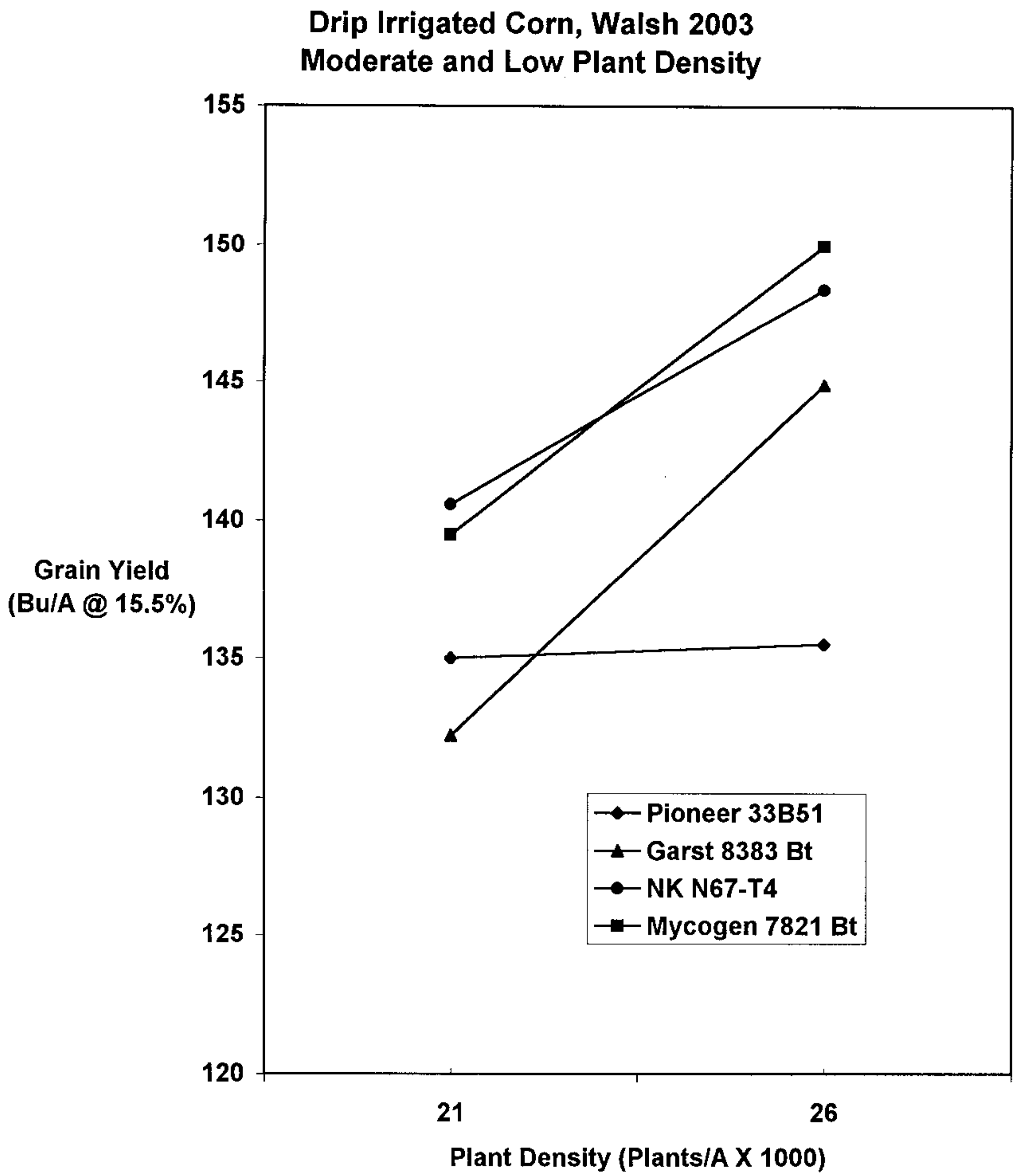


Fig. . Grain yield from seeding rate comparison of corn hybrids with subsurface drip irrigation. The two plant densities were 26,000 and 21,000 Plants/A. The four corn hybrids were: Mycogen 7821 Bt, Pioneer 33B51, Garst 8383 Bt, and NK N67-T4.

Limited Sprinkler Irrigated Grain Sorghum Comparison between Nozzles Five Feet Aboveground, Lay Flat Drags, and Nozzles Two Feet Aboveground with Five Feet Spacing between Nozzle Drops

COOPERATORS: Tim A. Macklin, Agronomist, Southeastern Colorado, Cooperative Extension, and Randy Shaw, Farmer, Springfield, Colorado.

RESULTS: The lower drops, two feet above the ground produced the highest yield, 101 bu./A. The lay-flat drags produced the second highest yields of 96 bu./A and the highest drops at five feet above the ground produced the lowest yield of 90 bu./A. Available soil water was much lower throughout the growing season for the 5 ft. aboveground nozzle treatments compared to the lower nozzle treatments.

PLOTS: Pioneer 87G57 at 48,000 seeds/A.
Planted: June 1, 2003. Harvest: November 9, 2003

IRRIGATION: Limited sprinkler irrigated with 5acre-in/A of total applied water.

PEST CONTROL: Herbicide: Roundup, 24 oz./A and Atrazine, 0.75 lb/A.
Insecticide: None

PREVIOUS CROP: Wheat.

FIELD PREPERATION: No-till into wheat stubble.

FERTILIZATION: 25 lb N/A as 32-0-0 and 12 lb P2O5/A as 10-34-0 was preplant applied, and about 50 lb N/A was injected through the sprinkler during the growing season.

COMMENTS: The drop nozzles were spaced 5 ft. apart. For the nozzle treatments, the drops were taped 5 ft. aboveground for the high nozzle treatment, for the lay flat drag nozzle treatment, the open-ended lay flat drags were attached so that approximately 3 ft. of each drag was in contact with the ground, and the low nozzle treatment was unchanged with nozzle height 2 ft. aboveground. Plant lodging was dependent on nozzle height. The low nozzle drops (2 ft. aboveground) and the lay flat drags had much lower plant lodging than the high nozzle drops (5 ft. aboveground).

OBSERVATIONS: Made prior to harvest on October 10.
Viewing all treatments, there is a distinct visual difference between nozzle treatments in plant size, grain fill and dryness of plants.

The five foot drops show a distinctive drying and browning of the plants.

On the five foot drop plots plants are smaller, leaves are narrower and the plants are dryer showing lower leaf senescence (dry and brown) to blue green in color. The average plant height is three feet. The probe would only go in six inches in most places and the deepest probe around the wheat stubble and sorghum plants was five feet and extremely hard to push.

On the drag plots the plants were larger with wider leaves and still green color with larger heads. The average plant height was three feet, seven inches. The probe would go in an average of five feet with little resistance.

On the 2 ft. plots the plants were similar to the drag plots with larger plants, larger leaves and good green color with larger heads. The average plant height was three feet, nine inches tall. The probe would go in an average of five feet with very little resistance.

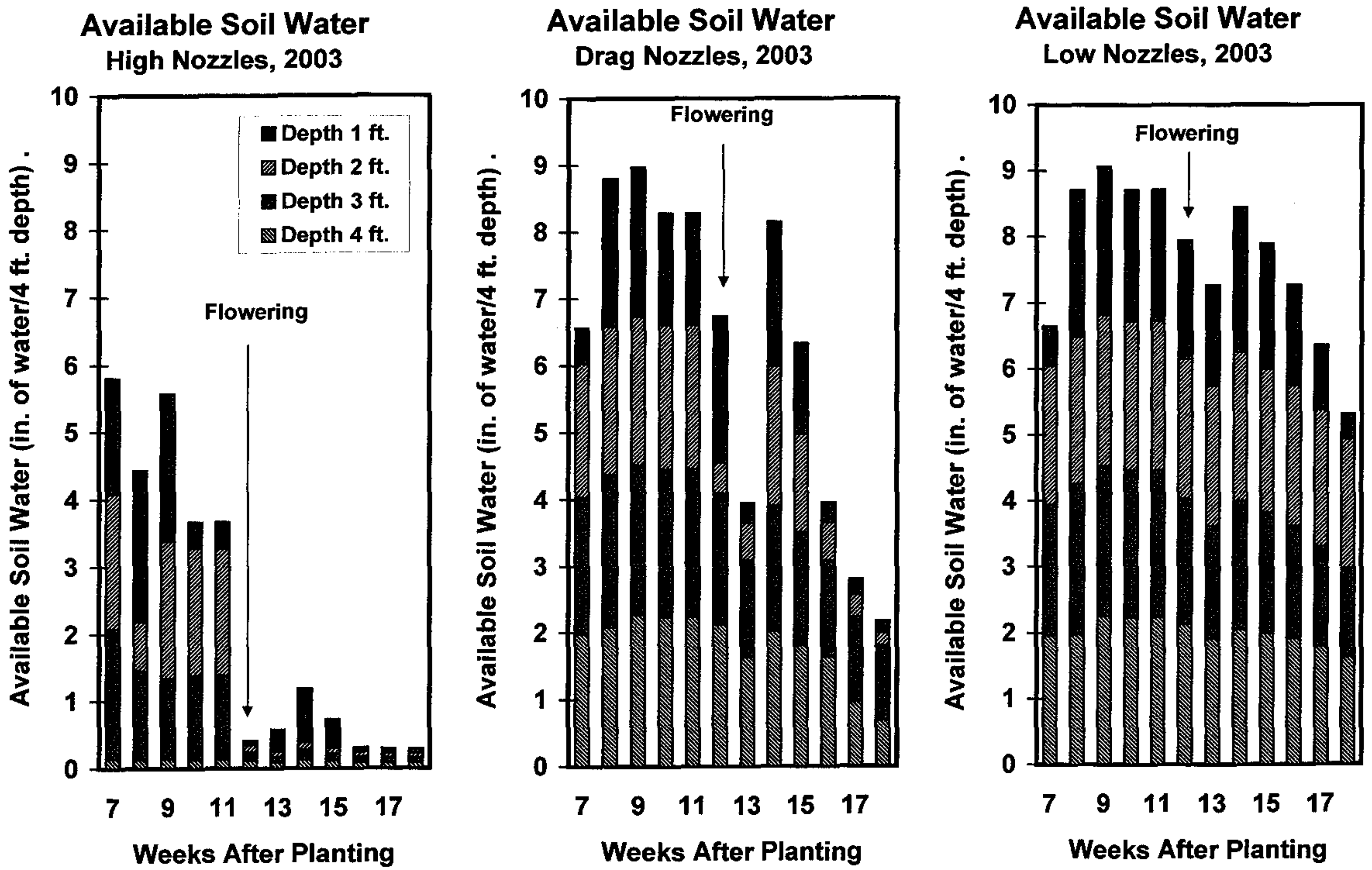


Fig. . Available soil water in limited sprinkler irrigation grain sorghum at Two Buttes. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Any increase in available soil water between weeks not attributed to applied irrigation is from rain. Nozzles heights were: Low, 2 ft off ground; High, 5 ft off ground; Drag, lay flat on ground. Drop nozzles were spaced 5 ft. apart.

Table . Limited Sprinkler Irrigation Nozzle Height Comparison in Grain Sorghum at Two Buttes.

Nozzle Treatment	Test Weight	Grain Yield
	Lb/Bu	Bu/A
Low (2 ft. above ground)	61	101
Drag (lay flat on ground)	60	96
High (5 ft. above ground)	60	90
Average	60	96
Orthogonal Contrast: Low vs. High different at 0.10 level.		0.10

Nozzle drops were 5 ft. apart.
Grain yields were adjusted to 14% seed moisture.

Nozzle Height Comparison of Sprinkler Irrigated Corn with Widely Spaced Drop Nozzles

COOPERATORS: Tim A. Macklin, Agronomist, Southeastern Colorado, Cooperative Extension, and Robert Wood, Farmer, Springfield, Colorado.

PURPOSE: To compare nozzle application heights, high (7 ft. aboveground) and low (3 ft. aboveground), for sprinkler irrigated corn production with 10 ft. spacing between drop nozzles.

RESULTS: With drop nozzles spaced 10 ft. apart, the high nozzle drops (7 ft. above ground) produced significantly more grain yield than the low nozzles drops (3 ft. above ground). Available soil moisture was much higher throughout the season with high drops than with low drops.

PLOT (HARVEST): 10 ft. X 100 ft. SEEDING DENSITY: 36,000 seeds/A; HYBRID: NK N67-T4. PLANTED: May 1, 2003. HARVESTED: October 23, 2003.

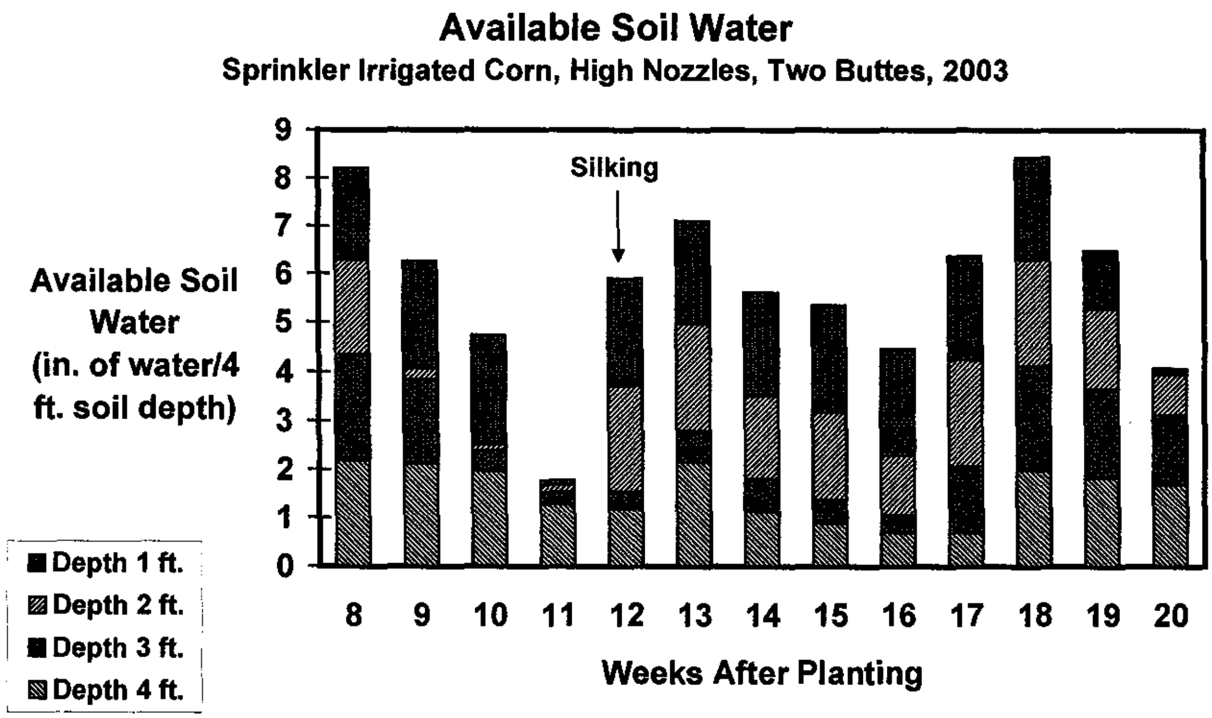
FERTILIZATION: Total N, 205 lb/A (131 lb N/A as NH3 and 74 lb N/A as 32-0-0); 20 lb P2O5/A; 0.75 lb Zn/A.

FIELD PREPARATION: Disc and mulch finish (twice). PREVIOUS CROP: Continuous corn.

IRRIGATION: 83 irrigation days with 25 acre-in./A of total water applied.

PEST CONTROL: Weed Control: Steadfast 0.75 oz/A, Clarity 3 oz/A, Atrazine 0.75 lb/A, Callisto 2 oz/A, COC 1 qt/A, and 28-0-0 2 gal/A. Insect Control: Cruiser seed treatment; Comite 2.25 qt/A, Bond 0.64 oz/A.

COMMENTS: Before the irrigation season, drop nozzle treatments were made by raising the nozzles for the high drop nozzle treatments (7 ft. aboveground) and leaving the nozzles at their current height for the low drop nozzle treatments (3 ft. aboveground). The drop nozzles were spaced 10 ft. apart for this study. Before harvest, plant height was measured and the high nozzle treatment was almost 1 ft. higher than the low nozzle treatment on the outside rows of the drops. Because of the wide (10 ft.) spacing of the drops, the high nozzle treatments distributed their water more uniformly across all corn rows; whereas, the water from the low nozzle treatments was blocked by the corn plants surrounding the drops, preventing water from reaching the outside corn rows.



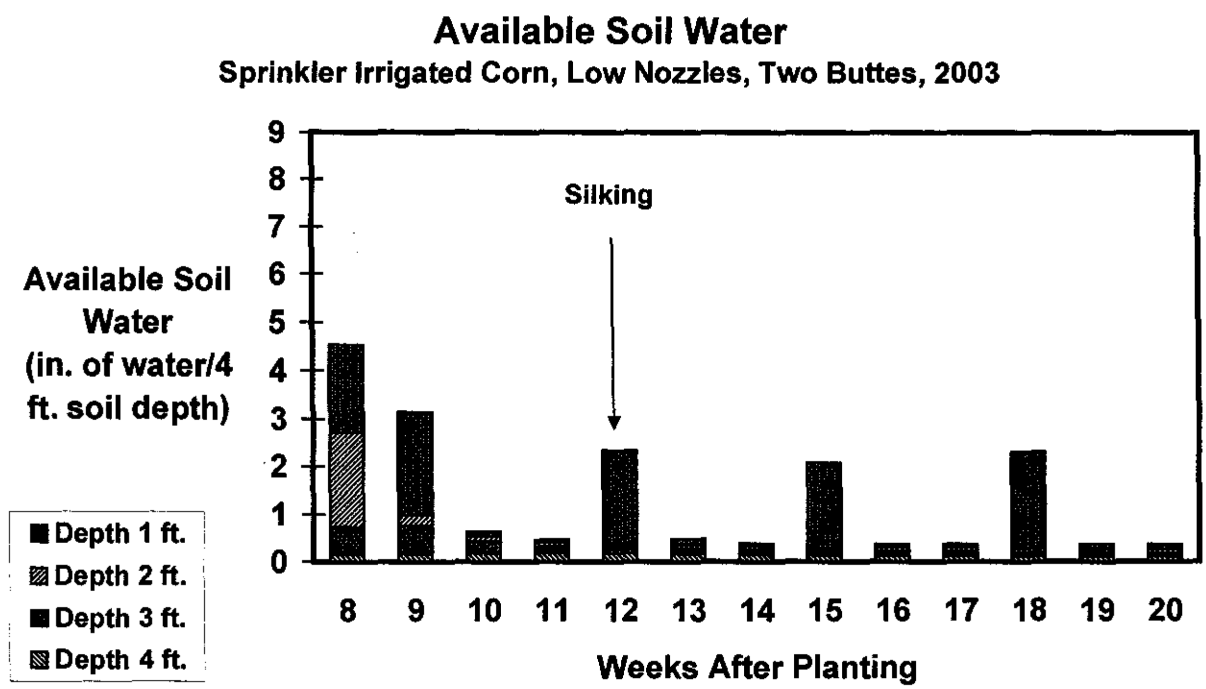


Fig. . Available soil water in sprinkler irrigated corn at Two Buttes. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 14.37 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .Sprinkler Irrigation Nozzle Height
Comparison in Corn at Two Buttes.

Nozzle Treatment	Test Weight	Grain Yield
	Lb/Bu	Bu/A
High (7 ft. above ground)	60	186
Low (3 ft. above ground)	60	130
Average	60	158
Orthogonal Contrast: High vs. Low different at 0.05 level.		*

Nozzle drops were 10 ft. apart.
Grain yields were adjusted to 15.5% seed moisture.

Long Drop Nozzle and Lay Flat Drag Comparison on Sprinkler Irrigated Corn

COOPERATORS: Tim Macklin, Cropping Systems Specialist, Southeastern Colorado, Cooperative Extension, and Randy Shaw, Farmer, Two Butts, Colorado.

PURPOSE: Yield comparison between low drop nozzles, two feet aboveground, and open-ended, lay-flat drags with three feet dragging the ground, all drops are on five feet spacing in sprinkler irrigated corn.

RESULTS: This was a non-replicated demonstration test. The drops produced the highest yield, 219 bu/A, and the drags yielded 206 bu./A.

PLOT: Strip till into corn stalks

HYBRID: Pioneer 33B51. SEEDING DENSITY: 32,000 seeds/A. Planted: April 28; Harvested: October 10.

PEST CONTROL: Herbicides: Preplant Roundup for burn down, Distinct and Atrazine
Insecticide: Pencap applied in strips for corn root worm beetles.

FIELD HISTORY: Last crop corn.

FIELD PREPARATION: Strip till.

COMMENTS: Noticed that the drags tended to pulsate water application. The drags would fill with water and release the water periodically, creating wet and dry areas. This flow of water from the drags would frequently run and disperse into soil cracks; whereas, the low drop nozzles sealed the soil surface and closed the cracks. The low drop nozzles produced higher yield than the drags. One reason for the lower yield from drags may be because the crop was planted straight across the field and the water pulse from the drags caused wet and dry areas. This suggests that if the crop had been planted circularly following the center pivot the drags would have followed the crop rows and mimicked surge irrigation. Drags reduced wheel track ruts by limiting water flow into them, making drags a good choice for drops near wheel tracks.

Table .Sprinkler Irrigation Nozzle Enclosure Comparison in Corn at Two Buttes.

Nozzle Treatment	Test Weight	Grain Yield
	Lb/Bu	Bu/A
Low (2 ft. above ground)	60	218
Drag (lay flat on ground)	59	207
Average	60	213

Nozzle drops were 5 ft. apart.
Grain yields were adjusted to 15.5% seed moisture.

Sorghum Hydrogel, PAM Limited Irrigation Test
Tim A. Macklin

Introduction
This year producers were bombarded with new variations of soil amendments, seed treatments and fertilizer additives. Many producers were interested in these concepts but would like to see local research behind some of these products. PAM a linear-linked polymer had been tested with full irrigation and crops under ideal conditions showing little to no increase in yield. The company had a new Hydrogel with zlite a cross-linked polymer that moves water latterly across the soil. With on-farm testing producers evaluated limited irrigated grain sorghum.

Comparisons of interest were:

- PAM and Hydrogel with zlite
- PAM only
- Hydrogel only
- Check

Hydrogel with zlite was applied at planting through an air seeder at a rate of three pounds per acre with the seed at five pounds per acre. Irrigations water was applied late in the growing season due to other crop use. Six inches of water was surge applied and PAM was added at that time. Beds were on five foot spacing with half mile runs, five beds with hydrogel and five without alternating across two forty acre test sites. Observations show that the beds with hydorgel at the center of the bed were able to run a probe five feet deep; where as the check could only probe eight inches deep at the center of the bed given the same amount of water and time at the end of the first run of water.

Results
Grain yield showed no significant difference between treatments due to the late irrigations and lack of time to finish grain production. Grain yield ranged form 1.9bu/A to 2.7bu/A. in the first test. The second test averaged grain yields of 9 bu/A with hydrogel and 10 bu/A without hydrogel. However, looking at soil erosion there was a significant difference between Hydrogel and Pam, PAM alone with no soil erosion respectively and the check showing 2.20 Ton/A/Day soil erosion. Looking at forage production using both PAM and Hydrogel the yield was 8 Ton/A compared to the check with 5 Ton/A showing a significant difference in the first test. The second test show a 9 Ton/A yield with hydrogel compared to the check at 5 Ton/A showing a significant difference in forage yield. The question is whether we would have seen these same relative differences in the sorghum yields had it produce a reasonable amount of grain?

Table . Effects of Hydrogel and PAM on Limited Furrow Irrigation on Grain Sorghum at Springfield.

Treatment	Soil Erosion	Forage Yield
	Ton/A/Day	Ton/A
No Hydrogel, No PAM Check	2.20	4.99
Hydrogel	0.91	5.17
PAM	0.00	5.18
Hydrogel and PAM	0.00	7.53
Average	0.78	5.72
Orthogonal Contrast: Hydrogel and PAM different at 0.05 level than other treatments.		*

Table . Effects of Hydrogel on Limited Furrow Irrigation on Grain Sorghum at Two Buttes.

Treatment	Grain Yield	Forage Yield
	Bu/A	Ton/A
No Hydrogel	10	5.72
Hydrogel	9	9.17
Average	10	7.45
Orthogonal Contrast: Hydrogel versus no hydrogel different at 0.10 level.		0.10

Grain Sorghum Maturity Comparison Study at Holly, 2003

COOPERATORS: Tim Macklin, Cropping Systems Specialist, Southeastern Colorado, Cooperative Extension, and David Willhite, Farmer, Holly Colorado.

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

RESULTS: The early hybrid Pioneer 87G57 was second in yield, 23.66 bu/A. to the medium-early (medium range) grain sorghum hybrid, Pioneer 85Y34, produced the highest yield, 23.75 bu/A. Also in this group was KS 310, 14bu/A. Mycogen 627 and Mycogen 3838 with 13bu/A each. The medium to medium late maturity KS 585 at 5bu/A and 84G62 at 4bu/A hybrids produced the lowest yields.

PLOT: Sixteen rows with 30 in. row spacing, 2500 ft. long, encompassing a terrace.
SEEDING DENSITY: 18,000 seeds/A (1.3# /A.) PLANTED May 30. HARVESTED: June 21.

PEST CONTROL: Pre-emergence Herbicides: Roundup, 24 oz/A and 2,4-D; and 15 inch band applied Lasso, 1 qt/A and Atrazine, 0.75 lb./A on Concept-treated seed.

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

FERTILIZATION: Applied starter fertilizer at planting 4.03 gallons/A of 28-0-0 (13 lbs. of N). Cultivated once and applied 30lbs of N.

Field Notes: 7/14/04 Pioneer 84G62 at the 7 leaf stage, Mycogen 627is at the 7 leaf stage, Mycogen 3838 is at the 8 leaf stage and large plants, Pioneer 85Y34 is a the 8 leaf stage and looks the poorest of the plots, Pioneer 87G57 is at the 8 leaf stage, KS 310 is at the 8 leaf stage and has big plants tillering out two stalks, KS585 is at the 9 leaf stage and tillering out to 4 stalks.

Field Notes: 7/25/03 Pioneer 84G62 at the 7-leaf stage and tillering 2-3 stalks some leaf stress due to dry conditions and plants are very short. Mycogen 627 is at the 9-leaf stage and tillering 2-3 tillers, showing less stress and plants are more upright. Mycogen 3838 at the 9 leaves stage and has 2 tillers showing less leaf roll and upright plants. Pioneer 85Y34 at the 8-leaf stage with 2-3 tillers and not as upright as other hybrids. Pioneer 87G57 is at the 8 leaf stage tillering 2-3 and 50% headed of that 25% flowering with pollen, leaves showing little to no leaf roll. NK KS310 8 leaf stage and tillering 2-3 big healthy looking plants showing no heat stress. NK KS585 tillering 3, big healthy plants. Finding greenbug in some of the plants in this variety.

This field is very weed free and looks very good, cultivated around 7/14/03.

Field Notes: 7/28/03 Pioneer 84G62 not heading, Mycogen 627 not heading, Mycogen 3838 not heading, Pioneer 85Y34 is 50% headed and of that 5% flowering, Pioneer 87G57 is 60% headed and of that 50% flowering, NK KS 310 is 50% headed and of that 60% flowering, NK KS 585 is not headed.

Field Notes: 8/1/03 Pioneer 84G62 is not headed, Mycogen 627 is not headed, Mycogen 3838 is not headed, Pioneer 85Y34 is 60% headed and 50% flowering, Pioneer87G57 is 75% headed and 100% of that is flowering, NK KS 310 is 85% headed and of that 60% flowering, and NK KS 585 is not headed.

Field Notes: 8/6/03 Pioneer 84G62 is not headed, darkest green in color, plants 8 leaf stage two tillers per plant and short in height; Mycogen 627 is not headed, dark green in color with two to three tillers per plant and short in height; Mycogen 3838 is 50% headed with 50% of those headed flowering. Pioneer 85Y34 is 95% headed and of those headed 100% flowering, 10% of the pollen is red or brown. Pioneer 87G57 is 100% headed and 80% of the pollen on berries are red and 20% of pollen on berries are white; NK KS310 is 80% headed with 75% of the pollen on the berries red and 25% of the pollen on the berries white; NK KS 585 0% headed.

Field Notes: 8/28/03 Pioneer 84G62 is 30% headed, Mycogen 627 is 80% headed with 20% bloom, Mycogen 3838 is 50% headed showing poor pollination and blue green in color with a lot of leaf roll. Pioneer 85Y34 100% headed, 50% color turning and looks good, Pioneer 87G57 is 100% headed and 90% turning color, KS310 is 100% headed and 80% turning color, leaf is turning brown and plants are looking very dry and browning, KS 585 not heading yet and is blue green in color.

Field Notes: 9/12/03 Pioneer 84G62 is 20% green heads 10% bloom and 70% no heads showing. Plant head height is 25 inches; plants are very green with little to no lower leaf senescence. Mycogen 627 is 25% of the heads are turning color with no black dot showing. Plant head height is 25 inches; plants are very green with little to no lower leaf senescence. Mycogen 3838 is 75% headed and turned color with 10% showing black dot with 25% green and no pollen. Head height is 27 inches; plants are very green with larger plants and leaves than the 85Y34. Pioneer 85Y34 100 % headed and turned color with 10% at the black dot stage. Plant head height is 29 inches; plants look good with the top 5 leaves green and lower leaves senescent. Pioneer 87G57 is 90% headed with 10% black dot and 10% of the heads were tied up in the flag leaf. Plant head height is 27 inches; plants look good with top 5 leaves green and lower leaves senescent. KS310 is 100% headed and turned color with no black dot showing yet. Heads are not elongated and 95% of the heads have the lower 10% of the head tied up in the flag leaf. The upper three leaves are green with the remainder of the plant brown and senescent. Head height is 25 inches. KS 585 is only 5% headed and 95% of the heads remain in the boot. The plants are green and healthy with a lot of leaf present.

Field Notes: 10/10/03 Pioneer 84G62 No mature heads, 25% of the heads are tied up in the flag leaf and tried to flower with 75% of the plants showing no heads at all. Mycogen

627 80% of the plants is headed and of them 25% of the heads are mature and turned color at the black dot stage and 20% having green heads. Mycogen 3838 is 75 % headed with half matured with high moisture and the other half still having green heads or just flowered. Pioneer 85Y34 100% headed and turned color and at the black dot stage and very dry. The heads are very large and well extended. Pioneer 87G57 is 95% headed, mature and very dry. Some seed shattering with heads averaging eight inches in length. Heads are not extended as well as the 85Y34. KS310 is 50% headed and flowered with 20% of these turning color; leaving 50% of the heads still tied up in the flag leaf. NK585 is only 20% headed and > 1% of this turning color. 80% of the plants show no heads at all.

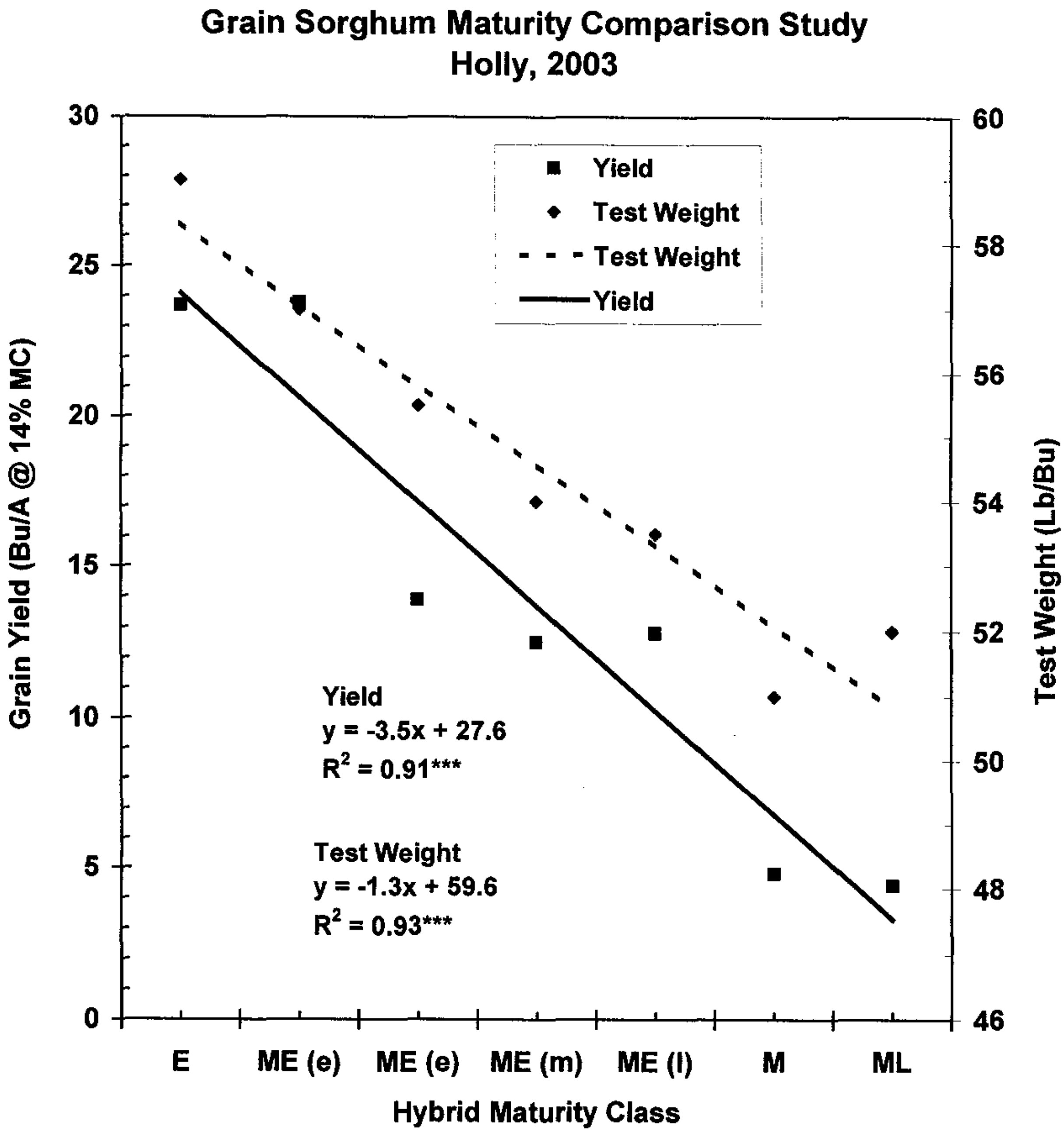


Fig. . Dryland grain sorghum maturity group yield comparison at Holly. Maturity groups and hybrids used were: E, early (PIONEER 87G57); ME (e), medium early (early range) (PIONEER 85Y34 and NK KS 310); ME (m), medium-early (medium range) (MYCOGEN 627); ME (l), medium-early (late range) (MYCOGEN 3838); M, medium (NK KS 585); ML, medium late (PIONEER 84G62). All hybrids were planted at 18,000 Seeds/A.

Southeast Area 2002/2003 Collaborative On-Farm Tests (COFT)

Tim A. Macklin

Introduction

This year, over half (57%) of Colorado's wheat acreage was planted to winter wheat varieties that have been tested in the COFT program. The (COFT) program is in its' sixth year of testing in SE Colorado. With on-farm testing, wheat producers evaluate new varieties on their own farms prior to release of these new varieties to the general public. On-farm testing directly involves agents and producers in the variety development process, thereby speeding adoption of superior, new varieties throughout the area. COFT growers sometimes see some variety characteristic that was not recognized prior to COFT testing. The whole-wheat community benefits from reliable and unbiased COFT results. Comparisons of interest were:

- Compare Russian wheat aphid resistant, Ankor, with non-resistant parent, Akron.
- Compare high yielding KSU hard white wheat, Trego, with CSU sister line selection, Avalanche.
- Ascertain relative performance and wide spread adaptability of high yielding CLEARFIELD* wheat variety, Above.
- Ascertain relative performance and wide spread adaptability of high yielding Cargill-Goertzen hard red winter wheat variety, Enhancer.
- An unforeseen additional in season objective of the 2003 COFT tests was to analyze Wheat Head Armyworm damage. Two pound grain samples of each variety were collected at all COFT tests in the SE Area and from those samples three sets of 100 kernels were counted for percent of damage and averaged.

Results

Each test suffered from one or more of the causes for reduced wheat yields in 2003: poor/uneven stand establishment, Russian wheat aphid infestations, fall or spring drought, Wheat Head Armyworm infestation, and hail. Spring drought and hail were the most important factors affecting yields in 2003. Conclusions should not be drawn from a single on-farm test. There were statistically significant differences in yield among varieties in the SE Area and in the overall average yields, although the yield differences were not great.

- Ankor, the RWA-resistant derivative from HRW Akron, performed better than Akron overall yield comparisons.
- Avalanche performed better, by comparison to Trego, in COFT tests than in the small plot trials. The 2003 results indicate that Avalanche performed better than Trego south of highway 50 in and around the Two Buttes Area.
- Above (HRW), the CLEARFIELD* wheat variety, performed well and was one of the best overall performers. Above can be planted for yield performance alone but certified seed must be purchased annually and cannot be kept for seed in another year.
- Enhancer (HRW), a 1998 release from Cargill-Goertzen, was a top performer in the Pritchett area and thrashed extremely well.
- Indications are that Wheat Head Armyworm kernel damage could be different by variety, however this could be due to the growth stage of the plant when the adult moths were laying their eggs. In most cases damage was not high enough to justify any type of treatment. However, in some fields, if growers would have caught the problem early on significant saving might have occurred if the fields would have been treated.

For additional information on all COFT sites and results go to the wheat program web page at http://www.colostate.edu/Depts/SoilCrop/extension/Newsletters/2003/Wheat/coft.html

Table .Dryland Wheat Variety Tests from Collaborative-On-Farm-Tests, SE Colorado, 2003.

Variety	Wheat Head Armyworm Damage	Test Weight	Grain Yield
	% Kernel Damage	Lb/Bu	Bu/A
Avalanche	2.6	61.0	32.4
Above	3.4	59.6	31.3
Ankor	3.3	60.6	30.8
Enhancer	5.5	59.6	30.7
Akron	3.5	60.5	30.2
Trego	3.1	60.6	29.5
Average	3.6	60.3	30.8
LSD 0.20		0.42	2.04

Grain yields were adjusted to 13.5% seed moisture.

Randy Shaw 7-2-03 Two Buttes	Moisture	Test Wt.	Wt./lbs	Acres	Yield Bu/A	Yield 13.5%
Avalanche	8.40	62.00	230	0.2	19.17	20.30
Ankor	8.10	60.50	225	0.2	18.75	19.92
Prairie Red	8.30	61.00	215	0.2	17.92	18.99
Above	8.40	58.00	200	0.2	16.20	17.65
Akron	8.00	60.50	195	0.2	16.25	17.28
Enchancer	8.00	59.50	175	0.2	14.58	15.51
Trego	8.30	60.00	160	0.2	13.33	14.13

Bill Hall #2 7-7-03 Pritchett	Moisture	Test Wt.	Wt./lbs	Acres	Yield Bu/A	Yield 13.5%
Enhancer	8.50	62.00	3845.00	2.29	27.98	29.60
Above	8.60	62.00	3730.00	2.29	27.15	28.68
Ankor	9.00	62.50	3625.00	2.29	26.38	27.76
Trego	8.90	62.50	3510.00	2.29	25.55	26.90
Akron	9.10	62.50	3465.00	2.29	25.22	26.50
Avalanche	9.10	62.50	3455.00	2.29	25.15	26.42

John Stulp 7-10-03 Lamar	Moisture	Test Wt.	Wt./lbs	Acres	Yield Bu/A	Yield 13.5%
Above	10.70	60.00	2940.00	1.30	37.69	38.91
Akron	10.40	59.50	2880.00	1.30	36.92	38.25
Avalanche	10.90	61.00	2750.00	1.30	35.26	36.32
Ankor	10.90	60.00	2580.00	1.30	33.08	34.07
Prairie Red (South)	9.20	59.00	2515.00	1.30	32.24	33.85
Trego	12.80	60.00	2550.00	1.30	32.69	32.96
Prairie Red (North)	10.60	59.00	2470.00	1.30	31.67	32.73
Enhancer	10.90	59.00	2095.00	1.30	26.86	27.67

Bill Hall #1 7-10-03 Pritchett	Moisture	Test Wt.	Wt./lbs	Acres	Yield Bu/A	Yield 13.5%
Enhancer	8.70	61.50	1180.00	0.56	35.40	37.07
Above	8.40	61.50	970.00	0.56	29.10	30.57
Trego	9.00	63.00	965.00	0.56	29.24	30.21
Ankor	8.40	62.00	920.00	0.56	27.88	29.00
Avalanche	8.50	61.50	840.00	0.56	25.45	26.45
Akron	8.60	60.50	760.00	0.56	22.80	23.90

David Heck #2 6-23-03 Holly	Moisture	Test Wt.	Wt./lbs	Acres	Yield Bu/A	Yield 13.5%
Above	9.60	58.00	1940.00	1.16	27.83	29.13
Halt	8.80	56.50	1590.00	1.16	22.81	24.09
Stanton	10.00	62.00	1590.00	1.16	22.81	23.77
Avalanche	10.00	60.00	1555.00	1.16	22.31	23.25
Prairie Red	8.90	56.00	1525.00	1.16	21.88	23.08
Enhancer	9.60	57.00	1485.00	1.16	21.30	22.30
Akron	9.40	59.00	1240.00	1.16	17.79	18.66
Trego	10.20	58.00	1200.00	1.16	17.21	17.90
Ankor	9.60	59.00	1180.00	1.16	16.93	17.72
Prowers 99	10.10	59.50	1110.00	1.16	15.92	16.58

Scott Scheimer 7-11-03	Moisture	Test Wt.	Wt./lbs	Acres	Yield Bu/A	Yield 13.5%
Cheyenne Wells						
Akron	8.90	57.50	4555.00	3.80	19.32	21.04
Ankor	11.80	58.00	4695.00	3.80	19.88	21.00
Trego	11.30	56.00	1950.00	1.68	19.34	19.84
Enhancer	12.40	56.00	3490.00	3.26	17.84	18.07
Above	7.60	56.00	945.00	0.97	16.30	17.34
Avalanche	11.00	57.00	1605.00	1.68	15.92	16.38

Bob Wood #2 6-24-03	Moisture	Test Wt.	Wt./lbs	Acres	Yield Bu/A	Yield 13.5%
Two Buttes						
Avalanche	10.60	62.00	2965.00	1.63	30.32	31.33
Trego	10.80	62.00	2825.00	1.63	28.89	29.79
Ankor	10.70	62.00	2800.00	1.63	28.65	29.56
Above	10.50	62.00	2770.00	1.63	28.33	29.31
Prairie Red	10.10	61.00	2750.00	1.63	28.12	29.22
Enhancer	10.70	62.00	2585.00	1.63	26.44	27.29
Akron	10.60	62.00	2270.00	1.63	23.21	23.99

Bob Wood #1 6-26-03	Moisture	Test Wt.	Wt./lbs	Acres	Yield Bu/A	Yield 13.5%
Springfield						
Enhancer	11.50	61.00	4780.00	1.59	50.20	51.26
Avalanche	11.40	63.00	4765.00	1.59	50.05	51.16
Prairie Red	10.80	61.00	4478.00	1.59	47.03	48.40
Akron	11.30	62.00	4355.00	1.59	45.74	46.81
Ankor	11.50	61.00	4165.00	1.59	43.74	44.67
Above	11.10	61.00	4005.00	1.59	42.06	43.15
Trego	11.30	62.50	3760.00	1.59	39.49	40.42

Jim Brock 6-26-03	Moisture	Test Wt.	Wt./lbs	Acres	Yield Bu/A	Yield 13.5%
Pritchett						
Avalanche	12.10	60.00	2830.00	1.11	42.52	43.18
Trego	12.40	60.50	2815.00	1.11	42.29	42.80
Enhancer	13.00	60.00	2800.00	1.11	42.07	42.29
Above	12.40	59.00	2780.00	1.11	41.77	42.27
Ankor	12.50	60.00	2760.00	1.11	41.47	41.92
Akron	12.30	60.50	2695.00	1.11	40.49	41.03

David Heck 6-27-03	Moisture	Test Wt.	Wt./lbs	Acres	Yield Bu/A	Yield 13.5%
Carlton						
Stanton	10.20	61.00	4195.00	1.44	48.52	50.41
Avalanche	10.10	61.00	4080.00	1.44	47.19	49.08
Akron	9.70	60.50	3675.00	1.44	42.50	44.40
Prowers 99	10.30	62.00	3575.00	1.44	41.35	42.91
Ankor	10.50	60.50	3555.00	1.44	41.12	42.57
Trego	9.40	61.00	3320.00	1.44	38.39	40.25
Prairie Red	10.70	59.00	3125.00	1.44	36.14	37.34
Enhancer	8.90	57.50	2965.00	1.44	34.29	36.14
Above	10.30	58.00	3000.00	1.44	34.69	36.01
Halt	10.30	57.50	2720.00	1.44	31.46	32.65

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

Kevin Larson, Dennis Thompson and Calvin Thompson

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

Materials and Methods

We tested four rates of poly ammoniated phosphate (10-34-0) fertilizer banded with the grain sorghum seed on 30 in. row spacing in an alkaline Silty Clay Loam soil. The four rates were 0, 1.25, 2.5, and 5.0 gallons of 10-34-0/A, corresponding to 0, 5, 10, and 20 Lb P_2O_5/A. In addition we added N (32-0-0) to the 6 Lb/N level to the two lowest P rates, making a total of 6 treatments. The fertilizer was applied with a squeeze pump at 5 Gal/A and all fertilizer rates were diluted with water to their appropriate levels. Prior to planting, the soil was sampled at six random locations at 0 to 8 in. (surface) and 8 to 24 in. (subsurface) depths. The soil was sent to Colorado State University Soil Testing Lab for analysis. Their soil test recommendation for a 50 Bu/A yield goal was banding 20 Lb P_2O_5/A; and no N was recommend. The grain sorghum hybrid was MYCOGEN 1482 sown at 40,000 Seed/A on June 17. We harvested the 10 ft. by 500 ft. plots on November 3 with a self-propelled combine with a four-row crop header. Grain yields were corrected to 14% seed moisture content.

Results and Discussion

All seedrow P and N treatments produced higher yields than the no P check (Fig. 10). There was a significant trend toward an optimum seedrow P rate of around 10 Lb P_2O_5/A ($P > 0.10$). This is the second year of our long-term, low-rate seedrow P and N study and thus far the rates less than one-half the recommended rate are producing the highest yields. The first year of this long-term study there was no significant yield difference from any of the fertilizer treatments. Subsequent study results from applying the same rates to the same plots should reveal the long-term affects of low-rate P and N fertilizer treatments.

The efficacy of low P seedrow rates with added N to the 6 Lb/A level obtained from two previous studies indicates that low P rates are effective, at least in the short term (Larson, Schweissing, Thompson, 2000). Our results from these studies found that low seedrow P (10-34-0) rates, as low as one-sixteenth the recommended banded P rate, can be used to produce grain yields as high as those from soil test recommend banded P rates when N is added to the 6 Lb N/A level. However, more P is removed with grain than is added from rates below 20 Lb P_2O_5/A level: a 40 Bu/A sorghum grain crop removes about 18 Lb P_2O_5/A (extrapolated from Leonard and Martin, 1963). Since more P is removed with grain than is added with these low P rates, continuous use of these low P rates may eventually reduce yield levels because the available soil P pool in these low P soils will be depleted.

Literature Cited

Larson, K.J., F.C. Schweissing, D.L. Thompson. 2000. Sorghum hybrid performance tests in Colorado, 1999. Technical Report TR00-1. AES, Dept. of Soil and Crop Sciences, CSU. 47p.

Leonard, W. H. and J. H. Martin. 1963. Cereal Crops. MacMillan Publishing Co., New York, New York. pp. 789-791.

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

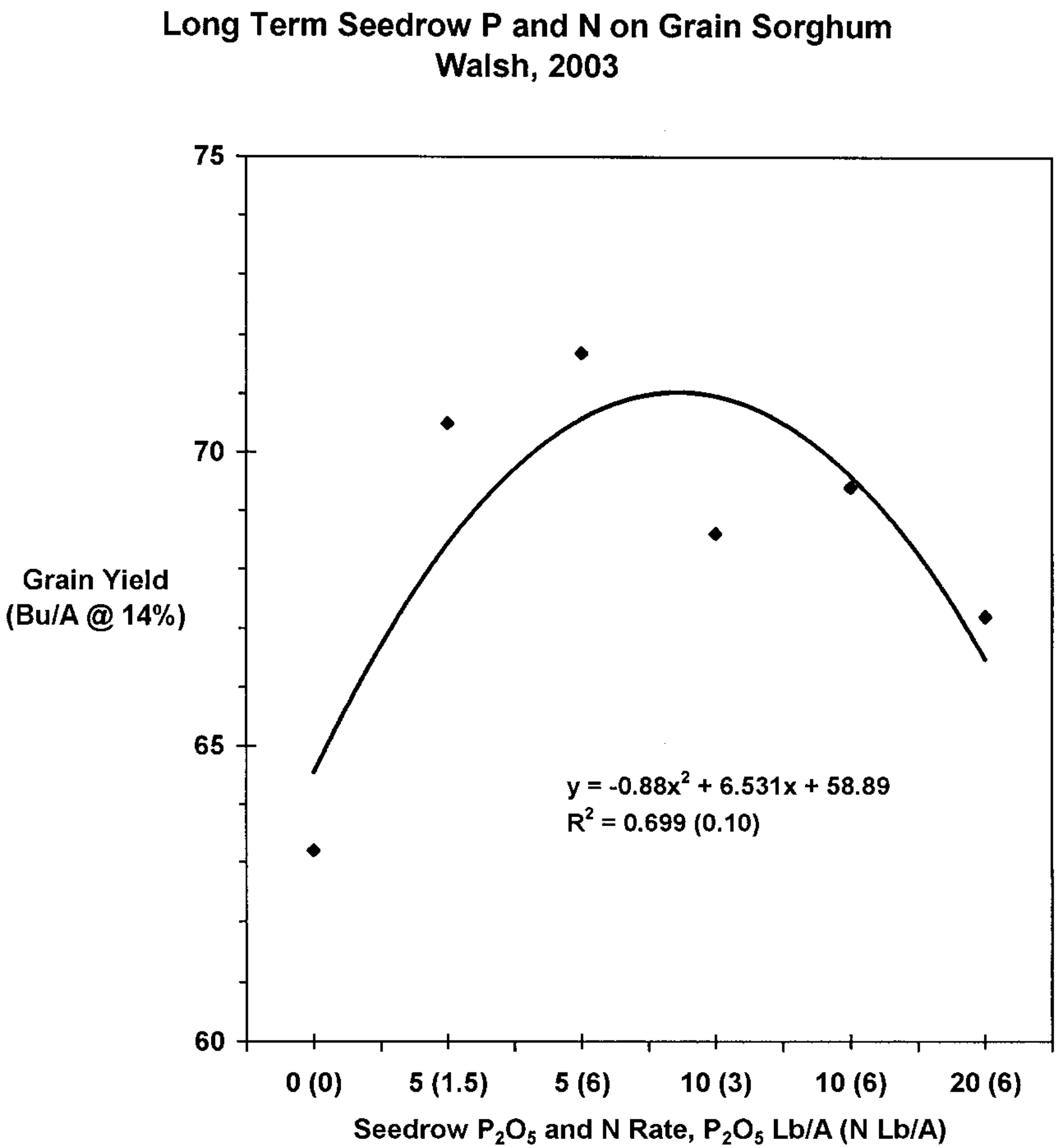


Fig. 10. Second year of long-term seedrow N and P on dryland grain sorghum at Walsh. MYCOGEN 1482 was planted at 40,000 Seeds/A. The N fertilizer was 32-0-0 and the P fertilizer was 10-34-0. All fertilizer treatments applied seedrow at 5 Gal/A.

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 second year of our continuing study to determine the optimum Zn rate for irrigated grain sorghum under high yielding conditions.

Materials and Methods

We used five seedrow applied Zn rates at Vilas: 0, 0.25, 0.5, 0.75 and 1.0 Lb Zn/A as Zn chelate. At Walsh we used six seedrow applied Zn rates: 0, 0.2, 0.4, 0.6, 0.8, and 1.0 Lb Zn/A as Zn chelate. At both sites, we mixed the Zn with 5 Gal 10-34-0/A. The Vilas site was sprinkler irrigated with 14 A-in./A of water. The Walsh site was subsurface drip irrigated with 11.8 A-in./A. The grain sorghum hybrid used at Walsh was MYCOGEN 627 planted on June 16 at 87,100 Seeds/A. The grain sorghum hybrid used at Vilas was PIONEER 84G62 planted on May 30 at 70,000 Seeds/A. The grower applied 80 Lb N/A and 24 Lb P_2O_5/A to the Vilas site. We applied 100 Lb N/A and 20 Lb P_2O_5/A to the Walsh site. An herbicide mixture of Guardsman 2.2 Pt/A and Outlook 5 Oz/A was banded on to control weeds at Vilas. We used a post emergence broad-spectrum weed herbicide mixture of Atrazine 1.0 Lb/A, Clarity 4 Oz/A and COC 1Qt/A for weed control at Walsh. Both sites were cultivated once. The 10 ft. X 650 ft. plots at Walsh and the 22.5 ft. X 2500 ft. plots at Vilas were harvested with self-propelled combines and weighed in a digital weigh cart.

Results and Discussion

This year there was no response to applied Zn on irrigated grain sorghum at either the Vilas or the Walsh sites and yields were very high (152 Bu/A at Vilas and 116 Bu/A at Walsh) (Fig. 8 and Fig. 9). Last year the Vilas site responded to applied Zn with an optimum rate around 0.6 Lb Zn/A and a yield of 98 Bu/A (Larson, Schweissing, Thompson, 2003). With the high yields we achieved this year, we anticipated a response to applied Zn; however, we recorded no response to Zn.

Bill Brooks, the farmer-cooperator at the Vilas site, observed plant maturity acceleration with increasing Zn rates at the Vilas site. These maturation differences became undistinguishable with the later than average freeze date (June 26, 22 F). Bill Brooks suggested that the Zn maturation response he observed might have produced yield responses if this season's first freeze date would have been closer to average (June 12). Brook's plausible explanation for the lack of Zn response suggests that one of the roles of Zn for our area is maturity acceleration.

This is the second year of our multi-year irrigated grain sorghum Zn study. The lack of Zn response we obtained this year suggests that Zn fertilizer may not be required for high grain sorghum production if the growing season is long enough for full maturation.

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.

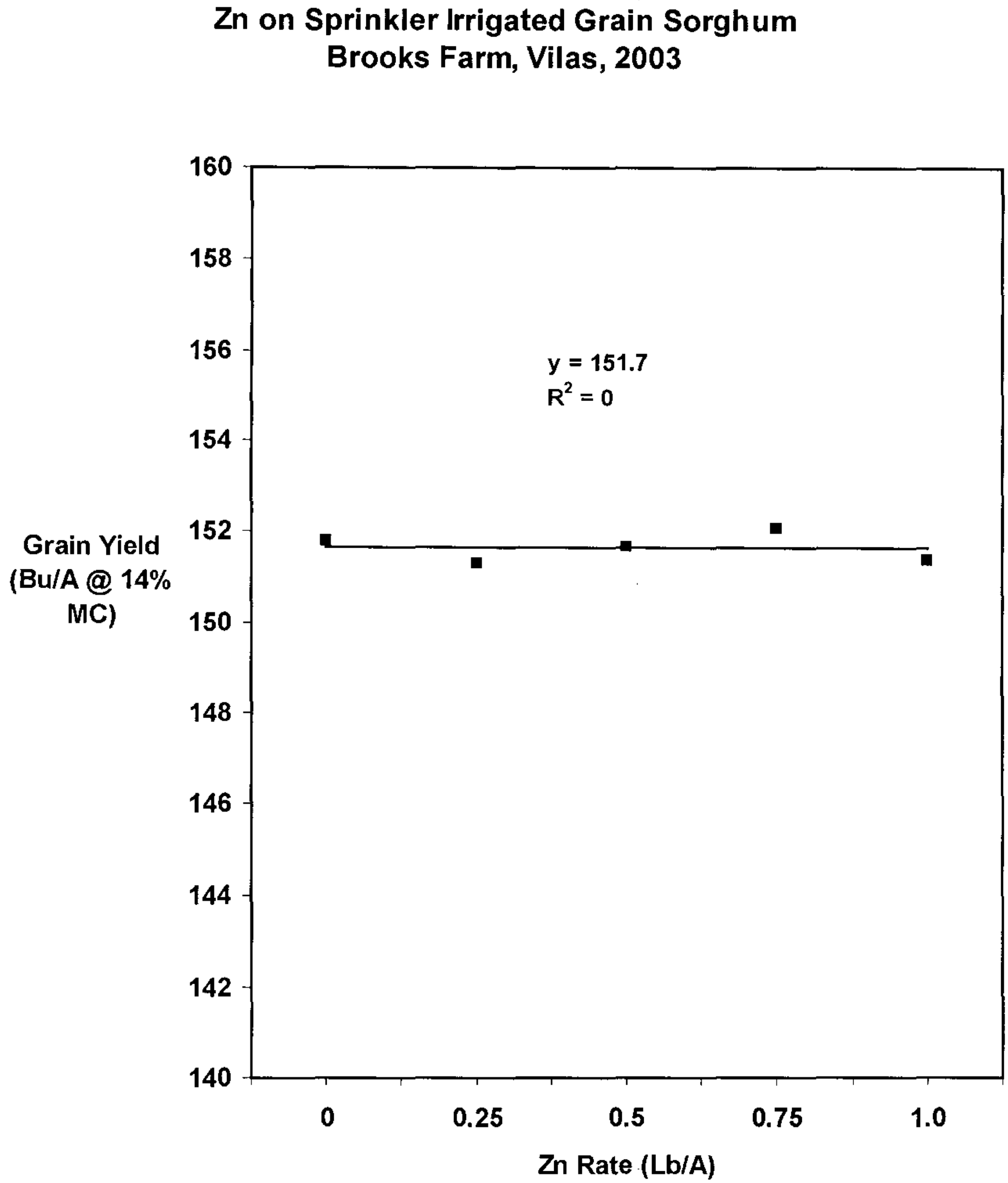


Fig. 8. Seedrow Zn on sprinkler irrigated grain sorghum at Vilas. The Zn rates were 0, 0.25, 0.5, 0.75 and 1.0 Lb Zn/A as Zn chelate. The grain sorghum hybrid was PIONEER 84G62.planted at 70,000 Seeds/A.

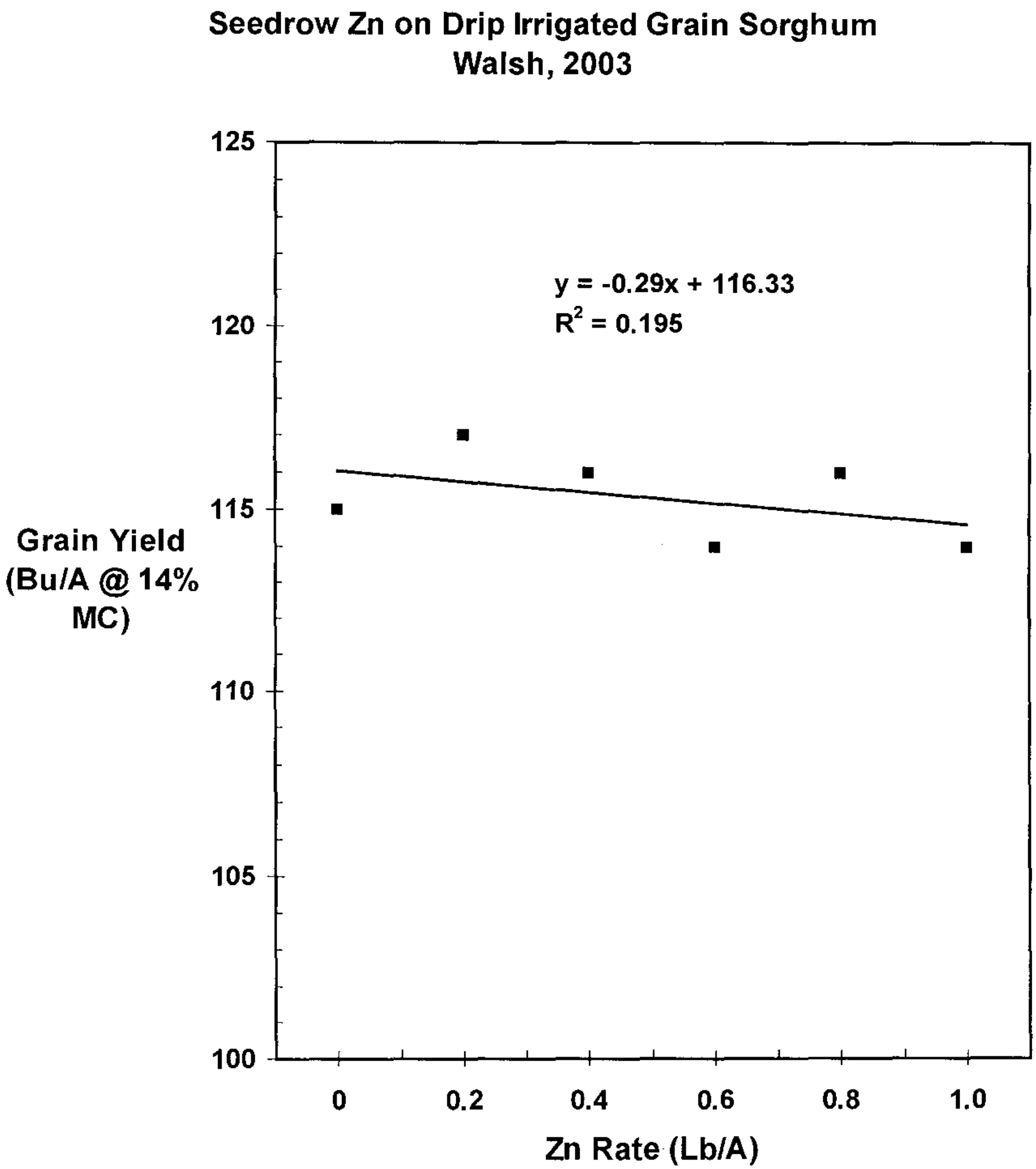


Fig. 9. Seedrow Zn rate on subsurface drip irrigated grain sorghum at Walsh. The Zn rates were 0, 0.2, 0.4, 0.6, 0.8 and 1.0 Lb Zn/A as Zn chelate. The grain sorghum hybrid was MYCOGEN 627 planted at 87,100 Seeds/A.

Broadleaf Weed Control, Crop Injury and Net Return of Commonly Used 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 record chemical costs and grain yields. We tested commonly used herbicide mixtures as well as some newer registered herbicides for broadleaf weed control in grain sorghum. Pigweed and kochia are the most prevalent broadleaf weeds in grain sorghum in Southeastern Colorado.

Materials and Methods

We applied ten post emergent herbicide treatments on 12 in. tall pigweed and kochia in 12 in. high grain sorghum. The herbicide treatments were applied on July 15 at 10 Gal/A with 110° flat fan nozzles spaced 18 in. apart. The site was planted June 12 with MYCOGEN 627 at 38,000 Seeds/A. A late-season cultivation was performed on all treatments to control grassy weeds.

Results and Discussion

All herbicide treatments produced higher yield than the cultivation check (Table 21). All but four herbicide treatments provided positive net incomes compared to the cultivation check. Three of the four herbicide treatments with net incomes less than the cultivation check had the highest herbicide costs, $8 to $19/A higher than the check. The herbicide treatment that produced the highest variable net income was the Atrazine, Clarity, 2,4-D and Crop Oil Concentrate (COC) mixture with $8.98/A. Along with the highest variable net income, the Atrazine, Clarity, 2,4-D and COC treatment also had significantly higher yield than three of the four treatments with negative net incomes ($P > 0.20$). The Paramount, Clarity, 2,4-D, and COC treatment and the Buctril, Atrazine, and Penetrant II treatment had the two lowest net incomes, but surprisingly, they also had some of the highest weed control ratings. We have no explanation for their lower than expected yields.

In order to fully evaluate herbicides it is important to include, not only weed control and crop injury, but also, chemical cost and grain yield. Recording only weed control and crop injury efficacies for evaluation of herbicides produces a skewed, even misleading, economic picture. For example, the efficacy of 2,4-D for grain sorghum production appears questionable if weed control and crop injury are the only criteria. However, 2,4-D produced a moderate grain yield at a very low chemical cost, giving it one of the higher net returns.

Table 21.-Broadleaf Weed Control in Dryland Grain Sorghum at Walsh, 2003.

Herbicide Treatment	Rate	Pigweed Control	Kochia Control	Crop Injury	Test Weight	Grain Yield	Chem. Cost	Var. Net Income
	*/A	%	%	%	Lb/Bu	Bu/A	$/A	$/A
1 Atrazine	0.75 lb	90	85	10	57	48	5.92	8.98
1 Clarity	3 oz							
1 2,4-D	0.28 lb							
1 COC	1 qt							
2 Atrazine	0.75 lb	90	75	10	56	47	4.21	8.39
2 2,4-D	0.38 lb							
2 COC	1 qt							
3 Peak	0.5 oz	83	70	0	58	45	8.25	-0.25
3 Atrazine	0.75 lb							
3 COC	1 qt							
4 Atrazine	0.75 lb	85	85	10	56	45	5.76	2.24
4 Clarity	4 oz							
4 COC	1 qt							
5 Ally	0.0625 oz	80	80	6	56	44	3.50	2.20
5 2,4-D	0.38 lb							
5 Penetrant II	1 qt/100 gal							
6 2,4-D	0.47 lb	80	55	11	57	44	2.44	3.26
6 Penetrant II	1 qt/100 gal							
7 Buctril	20 oz	88	88	0	57	43	12.03	-8.63
7 Atrazine	0.75 lb							
7 Penetrant II	1 qt/100 gal							
8 Clarity	5 oz	83	83	15	55	43	5.22	-1.82
8 2,4-D	0.38 lb							
8 Penetrant II	1 qt/100 gal							
9 Paramount	5.33 oz	88	85	14	56	43	19.38	-15.98
9 Clarity	3 oz							
9 2,4-D	0.28 lb							
9 COC	1qt							
10 Cultivation Check	None	0	0	0	56	40	0.00	0.00
Average		77	71	8	56	44	6.67	-0.16
LSD 0.20		3.1	4.0	1.1		3.8		

Planted: June 12, Cargill 627 at 38,000 Seeds/A; Harvested: November 20.
Variable Net Income: Treatment Yield - Control Yield x $2.30/Bu - Chemical Cost - Application Cost ($3.50/A). All treatments were cultivated

Tillage System Comparisons for Dryland Grain Sorghum Production

Kevin Larson, Dennis Thompson, Deborah Harn, and Calvin Thompson

The majority of grain sorghum produced in Southeastern Colorado is grown using conventional tillage (disc, sweep plow, or chisel) in a continuous grain sorghum rotation. There are problems with conventional tillage: it leaves little soil-protecting residue and removes precious soil water. No-till solves conventional-till shortcomings by leaving residue that conserves both soil and soil water. However, long-term, continuous no-till grain sorghum is reported to be unprofitable (Peterson, et al., 1993). Continuous no-till yields tend to drop with each subsequent grain sorghum crop because of increasing grassy weed competition, and treatment costs are very high. Ridge-till has some of the moisture saving benefits of no-till, and grassy weeds are controlled with cultivation. In dry years, the moisture conserving ridge-till system would produce higher yields than conventional-till. In this study, we compared yield and economics of ridge-till, no-till and conventional-till for dryland continuous grain sorghum production.

Materials and Methods

We imposed three tillage systems, no-till, ridge-till and conventional-till, on large 20 ft. by 1300 ft. strips in a Silty Clay Loam soil with three replications. In order to set up the tillage systems, we planted continuous sorghum crops. After harvesting the first sorghum crop, we ripped the entire study site to a depth of 15 in. with an inline, straight shank subsoiler on 30 in. spacing. On the subsequent sorghum crops, we implemented the tillage systems to the same plots for five years from 1998 to 2003 (there was no crop sown in 2002 because of drought). We planted MYCOGEN 627 at 40,000 Seeds/A in early June to mid-June. At planting we seedrow applied 5 Gal 10-34-0/A (20 Lb P_2O_5/A, 6 Lb N/A). All treatments received a preplant application of Atrazine 1.0 Lb/A. To control early season weeds, we sprayed the no-till and ridge-till systems with LandMaster 54 Oz/A; the minimum-till system was swept. To control the weeds prior to planting, we sprayed the no-till and ridge-till systems with Roundup 16 Oz/A; and again, the minimum-till system was swept. When possible, we applied Roundup 16 Oz/A to the no-till system to control volunteer grain sorghum and weeds before crop emergence. Early in the season, both the ridge-till and minimum-till were cultivated. Later, we cultivated the ridge-till system a second time to build up the ridges. Beginning in 2001, we eliminated one of the two ridge-till cultivations, and combined cultivating and ridge building in one cultivation operation. We harvested the plots in November with a self-propelled combine and weighed them in a digital grain cart. Grain yields were corrected to 14% seed moisture content.

Results

There was no significant yield difference between no-till and ridge-till, until 2003, when ridge-till yielded significantly more than no-till ($P > 0.20$) (Table 20). For two out of five years, no-till produced significantly more than conventional-till, and three years ridge-till produced significantly more than conventional-till ($P > 0.20$). The no-till and ridge-till systems frequently produced higher yields than conventional-till; however, because the production costs of no-till and ridge-till are higher than conventional-till, in three out of five years, conventional-till provided higher variable net income than one or both of the no-till and ridge-till systems. The linear trends of yield and income for no-till and conventional-till significantly decrease with time compared to ridge-till (Fig. 7).

Discussion

The advantages of ridge-till compared to conventional-till are reported to be higher soil moisture (less moisture loss from tillage), higher soil conservation (the stocks are left standing until planting), better weed control (weeds are moved into the furrow and are cultivated out), reduced soil compaction in the crop zone (the ridge where the crop is grown does not have wheel traffic and is not tilled) and higher yield (from the moisture savings) (Pfost, 1993). The first two years of this study were much wetter than average: 29 in. for 1998, and 23 in. for 1999 of annual precipitation. The last three crop years of this study were drier than the first two years with above to average annual precipitation: 16 in. for 2000, 19 in. for 2001, and 20 in. for 2003. Presumably because of soil moisture savings, ridge-till yields were higher than conventional-till yields in the drier years of this study. Variable net income levels of conventional-till compared to ridge-till have likewise declined.

The advantages of ridge-till compared to no-till are reported to be earlier plant date due to higher soil temperature in the planting ridge, and less weed pressure because of ridge building cultivation (Pfost, 1993). There has been an obvious increase in grassy weeds in the no-till system compared to the ridge-till system. The increase in sandbur, shattercane, and volunteer in the no-till system have steadily decrease yields and income compared to ridge-till. The increase in grassy weeds and the decrease in yield and income for the no-till continuous grain sorghum system will undoubtedly continue with each subsequent year of the study.

The longer the system is held in dryland continuous grain sorghum, the greater the advantages of ridge-till are compared to no-till and conventional-till (especially in drier years). It takes a few years of no-till continuous grain sorghum before grassy weeds proliferate and reduce yields and income compared to ridge-till. In drier years, the moisture savings from herbicide weed control compared to tillage weed control helps ridge-till produce higher yields than conventional-till.

Literature Cited

Peterson, G. A., et al. 1993. Sustainable dryland agroecosystem management. Tech Bul. TB93-6. Colorado State University and Agricultural Experiment Station. Fort Collins, CO.

Pfost, D. L. 1993. Ridge-till Tips. Agricultural publication G1652, Department of Agricultural Engineering, University of Missouri, Columbia, Missouri.

Table 20.-Summary: Tillage Comparisons for Dryland Grain Sorghum at Walsh, 1998-2003.

Tillage Treatment	Tillage Passes	Cultivations	Chemical Sprayings	Variable Tillage Cost	Variable Chemical Cost	Variable Treatment Cost	Grain Yield	Variable Net Income
				$/A	$/A	$/A	Bu/A	$/A
		-------------1998-------------						
No-Till	0	0	4	0.00	31.50	31.50	70	93.80
Ridge-Till	0	2	3	10.00	24.00	34.00	65	82.35
Conventional-Till	2	1	1	13.00	6.50	19.50	55	78.95
1998 Average	1	1	3	7.67	20.67	28.33	63	85.03
LSD 0.20							13.3	
		-------------1999-------------						
No-Till	0	0	4	0.00	31.50	31.50	66	86.64
Ridge-Till	0	2	3	10.00	24.00	34.00	63	78.77
Conventional-Till	2	1	1	13.00	6.50	19.50	64	95.06
1999 Average	1	1	3	7.67	20.67	28.33	64	86.82
LSD 0.20							7.0	
		-------------2000-------------						
No-Till	0	0	3	0.00	24.00	24.00	17	6.43
Ridge-Till	0	2	3	10.00	24.00	34.00	17	-3.57
Conventional-Till	2	1	1	13.00	6.50	19.50	16	9.14
2000 Average	1	1	2	7.67	18.17	25.83	17	4.00
LSD 0.20							2.4	
		-------------2001-------------						
No-Till	0	0	3	0.00	24.00	24.00	25	20.75
Ridge-Till	0	1	3	5.00	24.00	29.00	24	13.96
Conventional-Till	2	1	1	13.00	6.50	19.50	20	16.30
2001 Average	1	1	2	6.00	18.17	24.17	23	17.00
LSD 0.20							3.8	
		-------------2003-------------						
No-Till	0	0	3	0.00	24.00	24.00	49	88.70
Ridge-Till	0	1	3	5.00	24.00	29.00	52	90.60
Conventional-Till	2	1	1	13.00	6.50	19.50	47	88.60
2003 Average	1	1	2	6.00	18.17	24.17	49	89.30
LSD 0.20							2.5	

Tillage Cost: Sweep plow, $4/A; Cultivation, $5/A. Chemical Cost: Application $3.50/A; LandMaster, $7.50/A; Roundup, $4/A; Atrazine, $3./A.
Grain Price: $1.79/Bu for 1998, 1999, 2000, and 2001; $2.30/Bu for 2003
Variable Net Income: Grain Yield @ Grain Price minus Variable Treatment Cost.

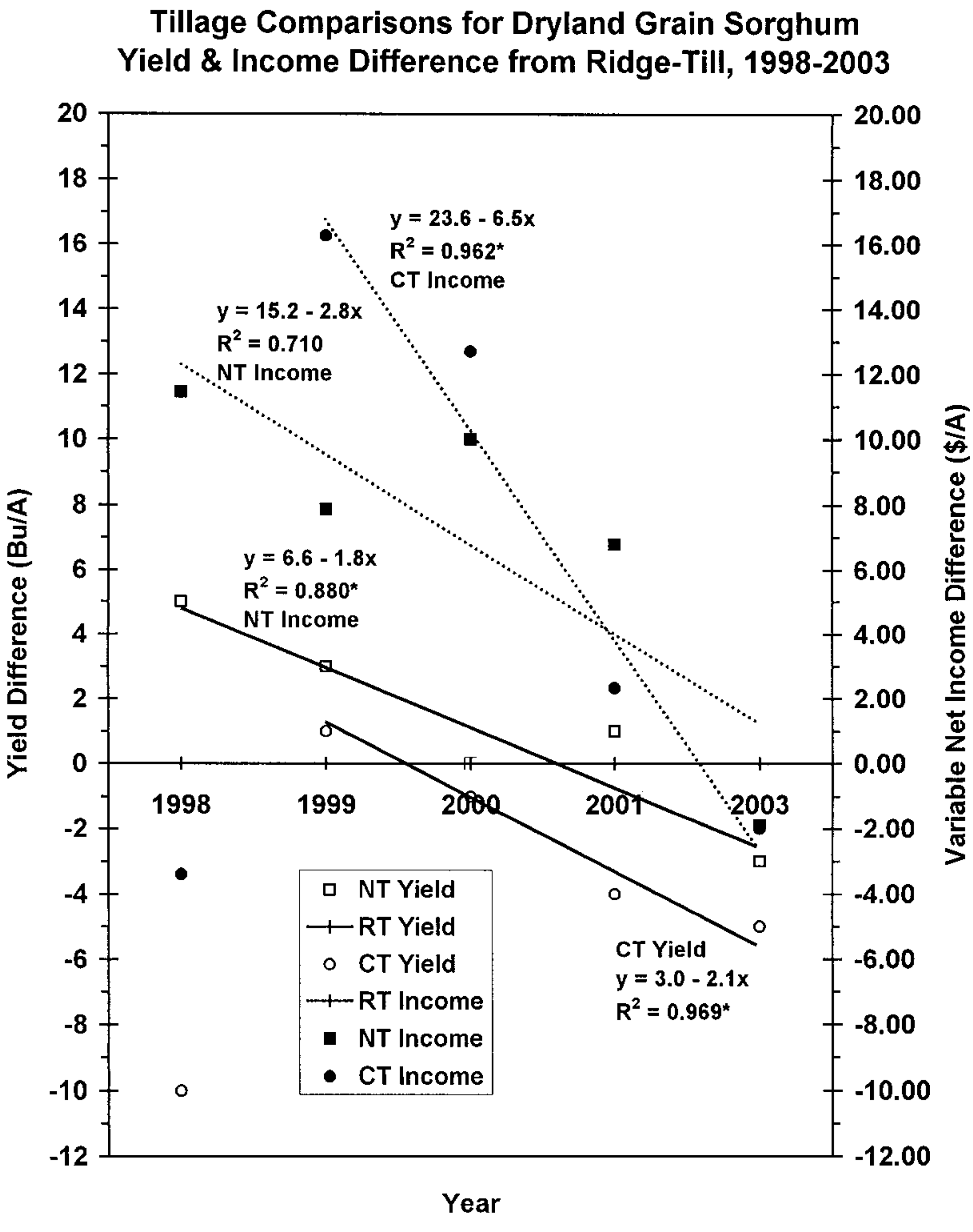


Fig. 7. Tillage comparison of yield and variable net income for dryland continuous grain sorghum at Walsh for 1998-2003 (no data from 2002 drought year). No-till (NT) and conventional-till (CT) yield and income difference from ridge-till (RT) base.

Long Term Ripping Study at Walsh, 2003

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

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

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

RESULTS: This year there was a significant linear decline in grain sorghum yield for the most recent ripping treatments ($R^2 = 0.823^*$). Only the first ripping treatment, 1997, yielded more than the non-ripped check. For the grain sorghum crop in 2000, all three ripping treatments and the check produced the same 26 Bu/A yield. The yields from the 1999 wheat crop were significantly higher than the check for the first ripping treatment (1997) but not for the second ripping (1998) treatment ($P > 0.05$). The grain sorghum crop following the first ripping (1997) produced significantly more yield than the non-ripped check ($P > 0.10$). For the four cropping years, the first ripping treatment is the only ripping treatment that produced higher yields that the non-ripped check.

DISCUSSION: This is the fourth crop of our long term ripping study. Only the first ripping treatment (1997) produced a higher yield than the non-ripped check. The first ripping treatment yielded more than or equaled the non-ripping check for all four of the cropping years: first crop (grain sorghum) 3 Bu/A more, second crop (wheat) 5 Bu/A more, third crop (sorghum) same yield, and fourth crop (sorghum) 1 Bu/A more. Therefore, the first ripping treatment is the only ripping treatment to provide a positive variable net income, $11.95/A ($20.95/A gross crop income minus $9.00/A ripping cost with 3 Bu/A at $2.10/Bu, 5 Bu/A at $2.47/Bu, and 1 Bu/A at $2.30/Bu).

This year, the significant linear decline in yield suggests that it takes up to six years to recover from ripping. Although this is a simple explanation, I do not believe it is the most probable explanation. Obviously, there is a strong connection between ripping, soil porosity and available soil water. In wet years, ripping may improve available soil moisture and root aeration by allowing percolation and preventing waterlogged conditions. Moreover, roots may explore larger areas and mine more of the soil water profile which increases yield. With soil compaction, roots are prevented from entering deeper, water-and-nutrient-rich, soil layers. In dry years, with limited soil water profiles, there may be no advantage with ripping. The greater soil porosity gained with ripping may allow easier soil water extraction. Therefore, when water is available it may be readily used, leaving no water untapped for drier times. Soil compaction limits root mining and water extraction from deeper layers where water may be stored until drier times. As the soil becomes drier it cracks, opening the lower soil layers and allowing root access to the stored water. Leaving the stored water below the compacted zone is one reason given for ripping on wide spacings, such as 60 in. spacing instead of 30 in. spacing.

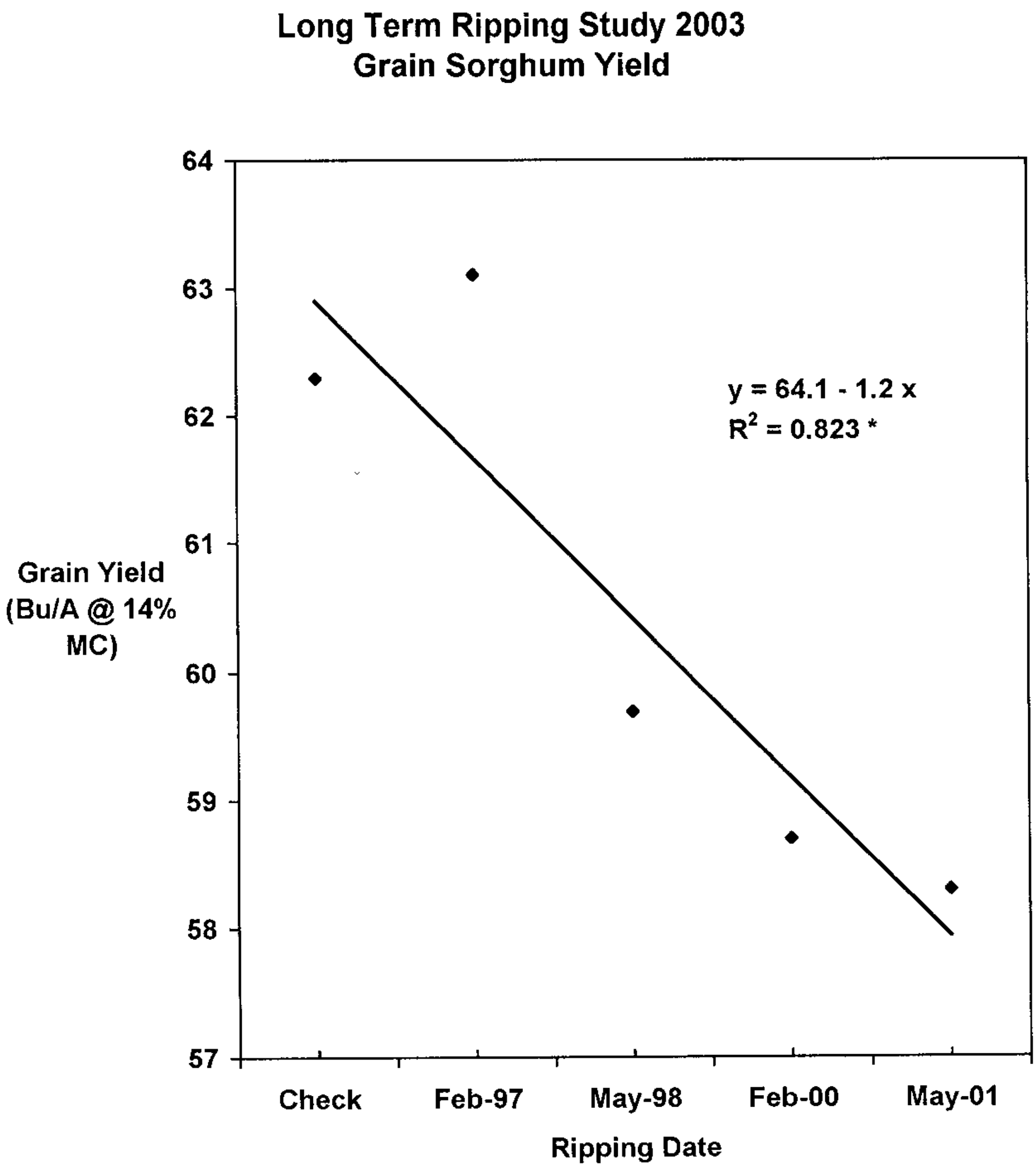


Fig. . Long-term ripping effects on dryland grain sorghum yield at Walsh two to six years after the initial ripping treatments. Ripping treatments were February 1997, May 1998, February 2000, May 2001, and a non-ripped check.

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 will follow itself and every other crop. We planted all the crops on June 10. We planted millet, Huntsman, at 18 Lb/A; grain sorghum, Mycogen 627, at 38,000 Seeds/A; corn, Dekalb DK 105 Bt/RR, at 18,000 Seeds/A; mung bean, Berkins, at 20 Lb/A; and sunflower, Mycogen 8N429 CL, at 20,000 Seeds/A. We applied 75 Lb N/A to the study site. Before planting we sprayed two applications of Roundup at 20 Oz/A each. For in-season weed control, we chose short-residual herbicides that should not interfere with crop rotations: millet, Clarity 5 Oz/A, 2,4-D amine 12 Oz/A, and Activator 90 1 Qt/100 Gall; grain sorghum, Clarity 5 Oz/A, 2,4-D amine 12 Oz/A, and Activator 90 1 Qt/100 Gal; corn, Roundup Ultra 20 Oz/A (twice); mung bean, Beyond 5 Oz/A, Basagran 12 Oz/A, and COC 1 Qt/A; sunflower, Beyond 5 Oz/A and COC 1 Qt/A; and fallow, Roundup 20 Oz/A and one sweeping. We harvested the crops with a self-propelled combine equipped with a digital scale: millet, September 10; grain sorghum, November 12; corn, October 23; mung bean, September 11; and sunflower, October 16. We will record cost of production and crop revenues in order to determine the crop rotation sequences that produce highest incomes.

Results and Discussion

This is the first year of this dryland crop rotation sequencing study; therefore, all the crops followed fallow. Millet produced the highest viable net income, $126.83/A. The high variable net income of millet is due to low seed cost ($2.30/A), low weed control cost ($9.33/A), high yield (43 Bu/A), and a good crop price ($3.22/Bu). Rotations with millet in the mix will already have an economic advantage. Millet and mung bean are known for their low water use. The crops following millet and mung bean should have higher available soil water and nutrients that should increase yields and incomes.

Weed control costs were too high for some crops. To keep weed control costs down, we will endeavor to select less expensive, short residual herbicides.

Table .-Crop Rotation Sequencing Study, Walsh, 2003.

Crop	Seeding Density	Seed Cost	Weed Control Cost	Yield	Crop Price	Gross Income	Variable Net Income
	*/A	$/A	$/A	*/A	$/*	$/A	$/A
Millet	18 lb	2.30	9.33	43 bu	3.22/bu	138.46	126.83
Grain Sorghum	38,000 seeds	2.00	9.33	51 bu	2.30/bu	117.30	105.97
Corn	18,000 seeds	18.00	22.22	25 bu	2.56/bu	64.00	23.78
Mung Bean	20 lb	8.00	27.95	550 lb	0.10/lb	55.00	19.05
Sunflower	20,000 seeds	15.00	24.23	550 lb	0.10/lb	55.00	15.77
Fallow	---	---	12.50	---	---	-12.50	-12.50
Average			17.59			69.54	46.48

Planted: All crops on June 10, 2003; Millet, Huntsman; Grain Sorghum, Mycogen 627; Corn, Dekalb DK 105 Bt/RR; Mung Bean, Berkins; Sunflower, Mycogen 8N 429CL.
Harvested: Millet, September 10; Grain Sorghum, November 12; Corn, October 23; Mung Bean, September 11; Sunflower, October 16.

Long-Term N Effects on Wheat-Sunflower-Fallow Rotation, Walsh, 2003

K. Larson, D. Thompson, D. Harn, 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, Prairie Red, at 45 Lb Seed/A on September 25, 2002, and sunflower on June 10, 2003 at 20,000 Seeds/A using MYCOGEN 8N429 CL. 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 on March 14, 2003 for wheat and July 16, 2003 for sunflower. The N fertilizer treatments were applied to both sides of the wheat plots and only one side of the sunflower plots were N fertilized to test the response of sunflower to residual N left by the wheat. We seedrow applied 20 Lb P_2O_5/A at planting. 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 2 for wheat and October 15 for sunflower with a self-propelled combine and weighed them in a digital weigh cart. Yields were corrected to 12.0% for wheat and 10% for sunflower.

Results: Wheat yields did not respond to increasing N rates. The wheat produced only 9 to 10 Bu/A. There was no sunflower yield response to the residual N left by N fertilization of the wheat. Sunflower yields increased with applied N fertilization.

Discussion: This is the third 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). We were unable to obtain a sunflower stand because of the extremely dry conditions in the spring and early summer; therefore, no sunflower crop was included in our study this year.

This is the third 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 two years. For the last two years, moisture was the primary yield-limiting factor, not N. The yield average range was only 10 to 15 Bu/A for the last two wheat crops.

There was a positive linear response of sunflower yields to increasing N rate. However, the sunflower yield increase was less than the yield increase needed to compensate for the expense of the N. The yield response to the N rate was 1.05 Lb of seed yield to 1 Lb of N. The price of sunflower seed is $0.10/Lb and the cost of N is $0.15/Lb (anhydrous) or $0.25/Lb (liquid). No matter which N form is used, the yield response loses revenue.

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.

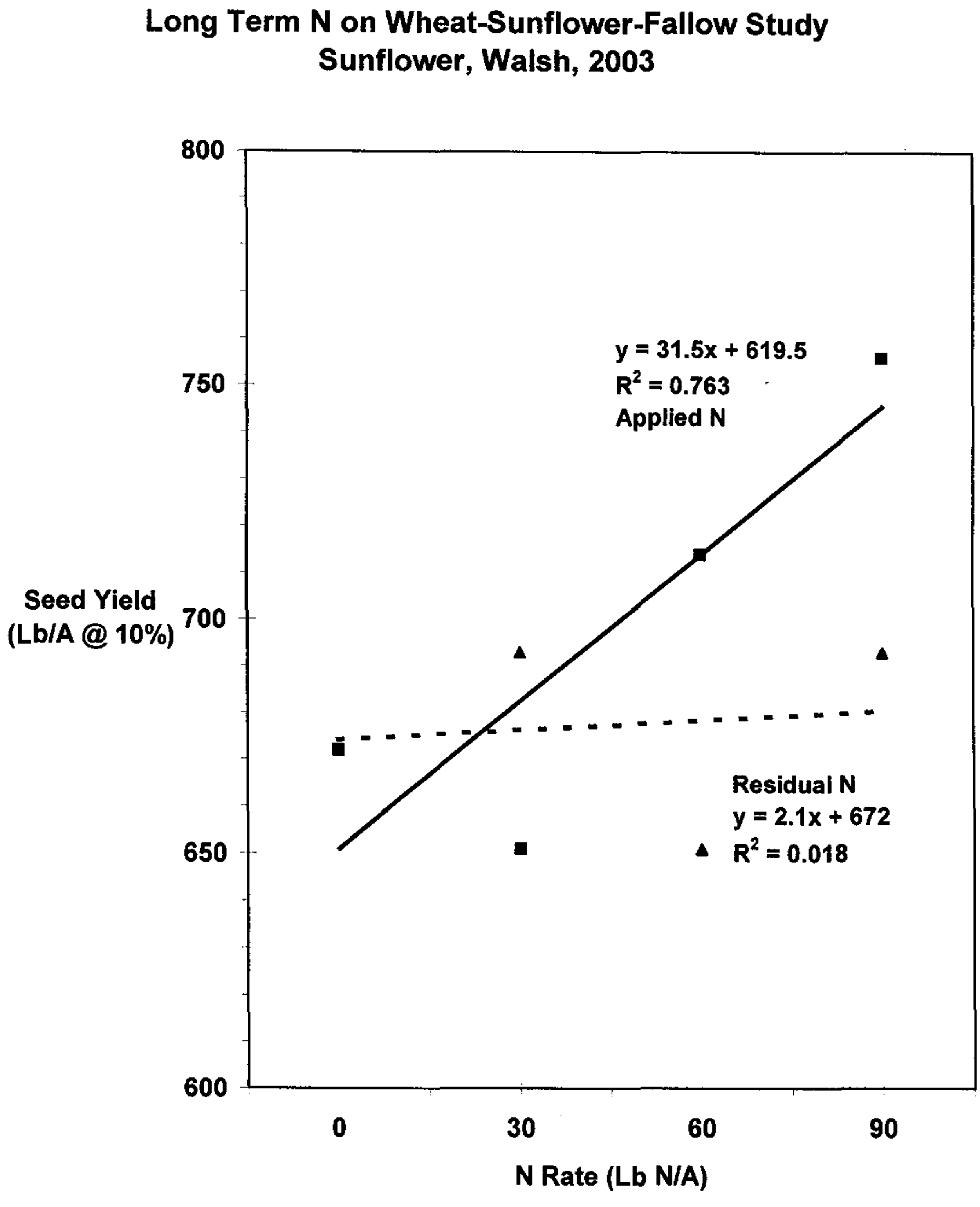


Fig. . N rate on dryland sunflower in Wheat-Sunflower-Fallow rotation at Walsh. The N rates were 0, 30, 60, and 90 Lb N/A as 32-0-0. Applied N is N applied to the sunflowers in the current season. Residual N is N applied to the wheat the previous season. The sunflower hybrid was MYCOGEN 8N429 CL planted at 20,000 Seeds/A.

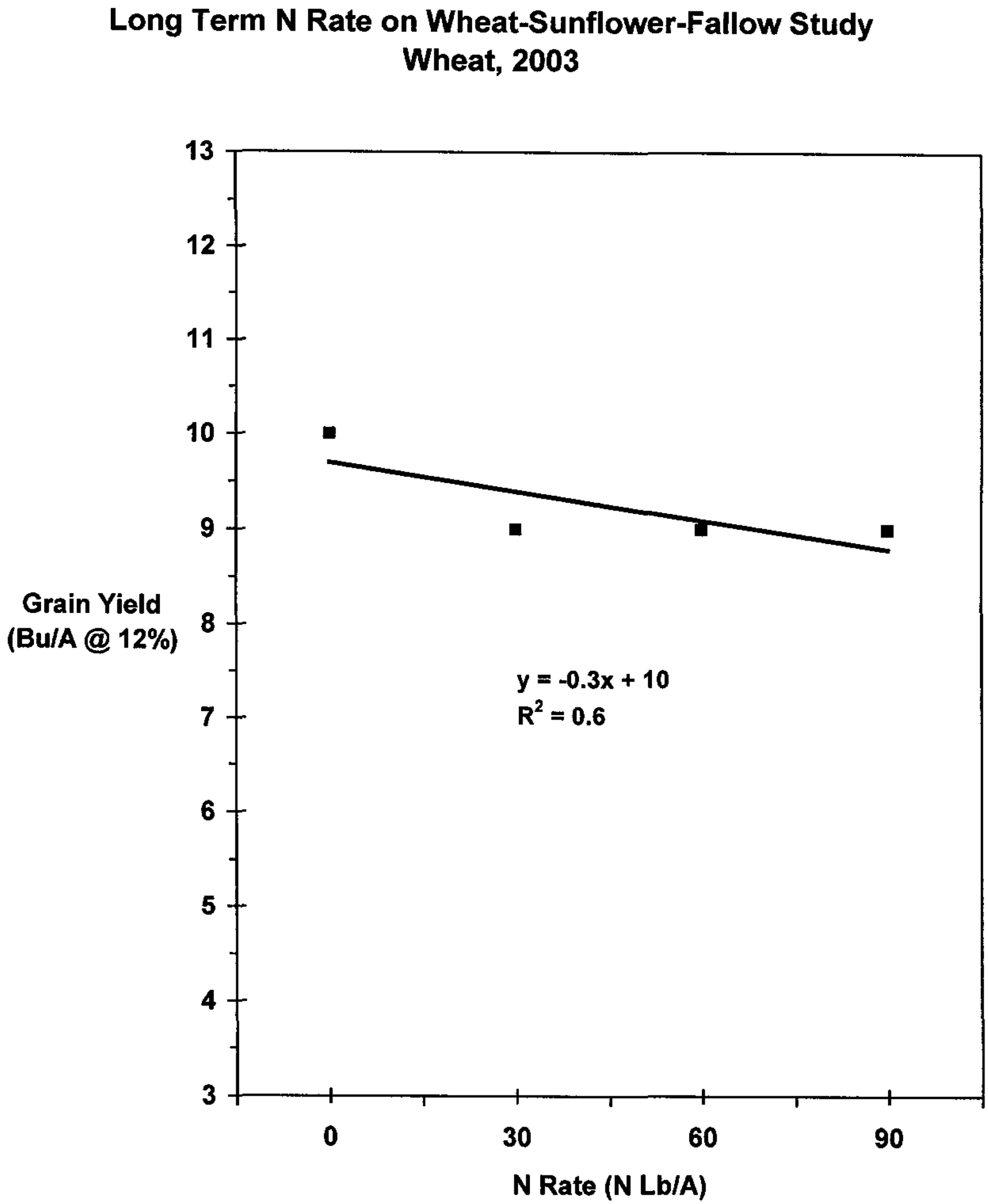


Fig. . N rate on dryland wheat in Wheat-Sunflower-Fallow rotation at Walsh. The N rates were 0, 30, 60, and 90 Lb N/A as 32-0-0. The wheat variety was Prairie Red sown at 45 Lb/A.

Irrigated Sunflower Hybrid Performance Test at Walsh, 2003

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

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

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 24,000 Seed/A. PLANTED: May 29. HARVESTED: October 15.

IRRIGATION: Two furrow irrigations: July 2 and August 1, total applied 10 A-in./A.

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

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	0.04	61	2	2	2
June	6.89	626	14	3	32
July	1.62	963	28	13	63
August	2.72	829	24	3	94
September	0.77	495	3	0	124
October	0.08	186	0	0	139
Total	12.12	3160	71	23	139

\1 Growing season from May 29 (planting) to October 15 (harvest).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in good soil moisture. Weed control was good. Near normal precipitation for the growing season with a wet June and dry July and September months. Head moths were controlled with an aerial pesticide application. Seed yields were fair.

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

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	--------------ppm--------------				
0-8"	7.7	0.6	2.3	14	2.0	395	0.6	5.2
8"-24"				5				
Comment	Alka	VLo	VHi	Mod	VLo	VHi	Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	-----------------Lb/A-----------------			
Recommended	75	20	0	0
Applied	125	0	0	0

Yield Goal: 2000 Lb/A .
Actual Yield: 1315 Lb/A.

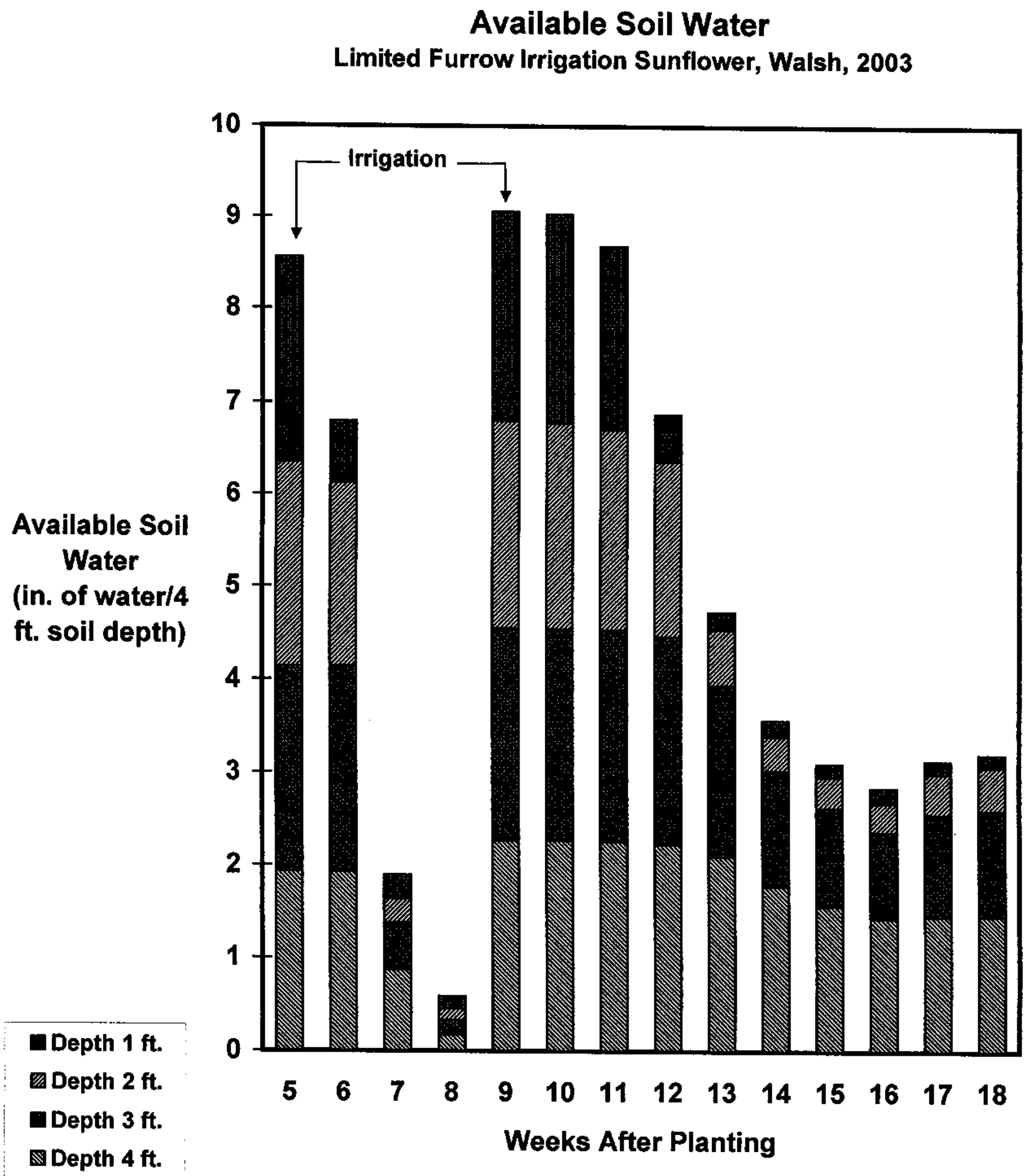


Fig. . Available soil water in limited furrow irrigation sunflower at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 12.12 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .-Furrow Irrigated Sunflower, NuSun Variety Trial, PRC, Walsh, 2003.

Firm	Hybrid	Plant Density	Seed Moisture	Test Weight	Seed Yield
		Plants/A (X1000)	%	Lb/Bu	Lb/A
INTERSTATE	4049 AK	14.9	Below 8	32	1518
TRIUMPH	TR 665	13.7	Below 8	34	1504
INTERSTATE	HySun 424	13.4	Below 8	34	1450
MYCOGEN	8N421	16.3	Below 8	34	1402
TRIUMPH	TR 645 (w/Cruiser)	17.4	8.7	31	1393
TRIUMPH	TR 636	13.4	Below 8	31	1306
MYCOGEN	8N429 CL	17.6	Below 8	31	1299
MYCOGEN	8N327	16.8	Below 8	35	1265
TRIUMPH	TR 645	19.7	8.9	30	1226
FONTANELLE	902 NS	14.7	Below 8	31	1088
TRIUMPH	TR 658	13.6	Below 8	29	1016
Average		15.6	Below 8	32	1315
LSD 0.20					238.7

Planted: May 29; Harvested: October 15.
Seed Yield corrected to 10% seed moisture content.
Two furrow irrigations with approximately 10 in/A of total applied water.

Dryland Sunflower Hybrid Performance Test at Vilas, 2003

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: 18,000 Seed/A. PLANTED: June 2; Replanted: June 25. HARVESTED: October 17.

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: Sorghum. FIELD PREPARATION: Chisel.

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	6.89	595	14	3	28
July	1.62	963	28	13	59
August	2.72	829	24	3	90
September	0.77	495	3	0	120
October	0.08	359	2	0	146
Total	12.08	3241	71	19	146

\1 Growing season from June 2 (planting) to October 26 (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 poor. Below normal precipitation for the growing season, June was wet but the rest of the season was very dry. Very low plant densities even after replanting. 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"	7.6	0.3	1.3	3	1.5	296	0.4	6.8
8"-24"				4				
Comment	Alka	Vlo	Mod	Lo	V Lo	VHi	V Lo	Adeq

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	---------------Lb/A---------------			
Recommended	17	20	0	0
Applied	60	0	0	0

Yield Goal: 1200 Lb/A.
Actual Yield: 354 Lb/A.

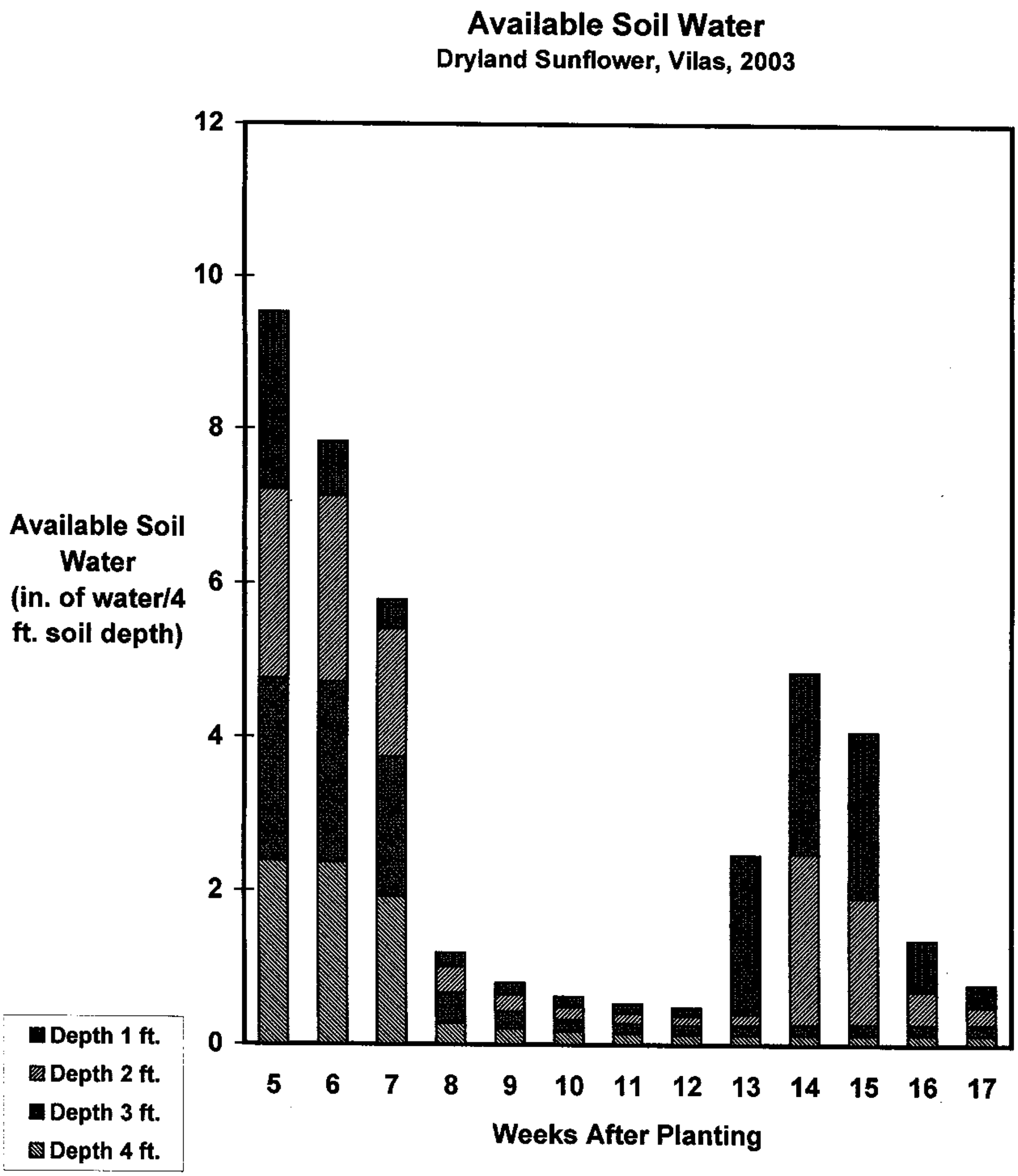


Fig. . Available soil water in dryland sunflower at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 12.08 in. Any increase in available soil water between weeks is from rain.

Table .-Dryland Sunflower, NuSun Variety Trial, Vilas, 2003.

Firm	Hybrid	Plant Density	Seed Moisture	Test Weight	Seed Yield
		Plants/A (X1000)	%	Lb/Bu	Lb/A
INTERSTATE	4049 AK	7.7	Below 8	29	489
MYCOGEN	8N429 CL	6.8	Below 8	28	415
MYCOGEN	8N421	9.1	Below 8	28	359
TRIUMPH	TR 645 (w/Cruiser)	6.2	8.4	30	355
INTERSTATE	HySun 424	3.9	8.3	31	346
FONTANELLE	902 NS	6.2	Below 8	28	337
TRIUMPH	TR 658	5.4	Below 8	28	334
MYCOGEN	8N327	5.8	Below 8	30	334
TRIUMPH	TR 665	5.2	8.2	31	318
TRIUMPH	TR 645	7.2	8.2	31	318
TRIUMPH	TR 636	4.5	8.2	29	290
Average		6.2	Below 8	29	354
LSD 0.20					55.9

Planted: June 2, replanted: June 25; Harvested: October 17.
Seed Yield corrected to 10% seed moisture content.

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 MYCOGEN 8N429 CL planted at 18,000 Seed/A on June 17. We harvested the 10 ft. by 540 ft. plots on October 16 with a self-propelled combine equipped with a four-row crop header. Seed yields were corrected to 10% seed moisture content.

Results and Discussion

There was a minor yield increase to approximately 3.0 Gal/A of 10-34-0; however, the yield increase was not economical. The yield increase was less than the cost of the P fertilizer. There was a significant linear decline in plant density as seedrow 10-34-0 rates increased ($R^2 = 0.915^{**}$). The lowest seedrow 10-34-0 rate, 1.5 Gal/A, did not lower plant population, but higher rates decreased plant population by about 700 plants per gallon of seedrow 10-34-0 applied. Sunflower yields remained relatively high until the 4.5 Gal/A rate despite the sharp decline in plant density. This suggests that sunflower production benefits from seedrow 10-34-0 application. There is no economic benefit for seedrow 10-34-0 on low-yielding, low-population sunflowers; however, there may be yield and income advantages for higher yielding, higher population sunflowers.

This is the second year that we have tested seedrow 10-34-0 on dryland sunflower. The last seedrow P study we reported an optimum at 3.0 Gal/A. Seedrow rates above 3.0 Gal/A lowered yields. We will continue this study for the next few years; nonetheless, from our results, we currently recommend from 3 Gal/A to 4.5 Gal/A of seedrow 10-34-0 on dryland sunflower. Seedrow rates above 4.5 Gal 10-34-0/A on 30 in. row spacing may cause stand and yield losses to dryland sunflower.

Literature Cited

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

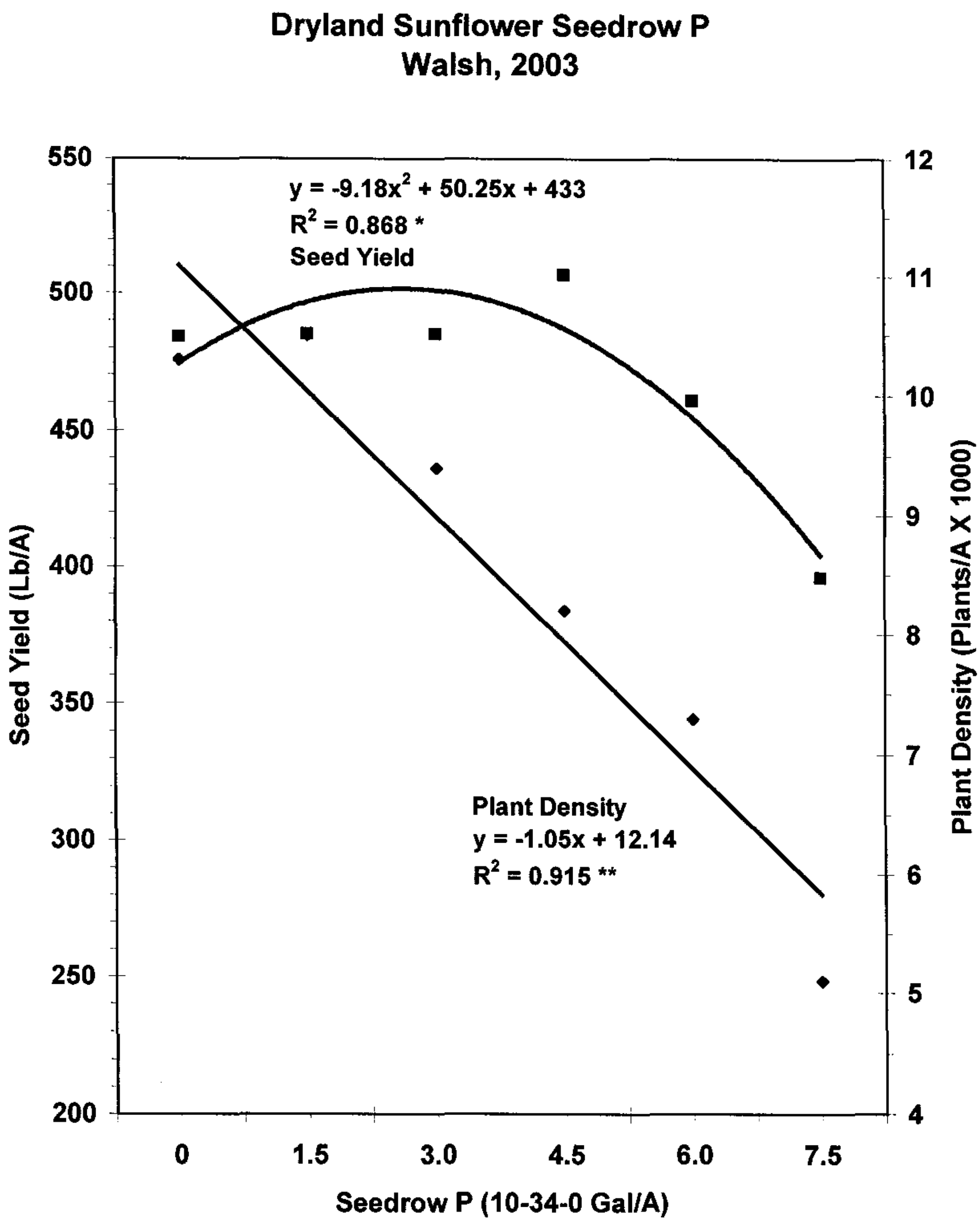


Fig. . Seedrow 10-34-0 on dryland sunflower at Walsh. MYCOGEN 8N429 CL was planted at 18,000 Seeds/A. The P and N fertilizer was 10-34-0, which contains 4 Lb P_2O_5/Gal and 1.2 Lb N/Gal.

National Winter Canola Variety Performance Test, Walsh 2003

Kevin Larson, Charlie Rife, and Dennis Thompson

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

Results and Discussion: On June 3, a hailstorm shattered seeds, dropped pods, and broke branches resulting in approximately 50 to 70% seed loss in the winter canola. The hailstorm also lowered yield in the two spring canola trials but yield losses were more difficult to estimate. An adjacent wheat field had yield loss around 30%. This illustrates that canola cannot withstand hail near harvest.

The yield average of spring canola varieties was less than half produced by the winter canola varieties. Before the hail, the winter canola trials appear as if they had the potential of 2000 Lb/A yield averages. The spring canola trials never look as if they would be high yielding tests. None of the spring canola varieties appeared to be well adapted to our environment.

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

Canola would be a good candidate as a limited irrigated crop. This year, we had good soil moisture at planting. However, lack of soil moisture at planting is a more common scenario. Because we frequently have dry conditions at planting, and recommend maximum planting depth for canola is only 1.5 in., irrigating after planting 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 27 winter canola varieties for the National Winter Canola Trial and 32 varieties for the Great Plains Nursery on September 6, 2002. We planted 16 spring canola varieties for the Regional Spring Canola Variety Trial on March 26, 2003, and 8 varieties for the Blue Sun Spring Canola (B. *juncea*) Variety Trial on April 11. All four trials were planted at 6 Lb Seed/A with a 12 in. row-spaced drill to a depth of 1.5 inches in good 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. The soil test was: N, 14 ppm; P, 2.0 ppm; and K, 395 ppm. 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. We harvested both winter canola variety trials on June 27. The spring canola trials were harvested on July 21 for the Regional Spring Canola

Variety Trial and August 12 for the Blue Sun Spring Canola Variety Trial. All plots were harvested using a small grain head attached to a self-propelled combine equipped with a digital scale.

National Winter Canola Trials, NVT, Walsh, CO 2003.

Line	Fall Stand	Winter Survival	50% Flowering	Plant Height	Seed Yield
	0-10	0-10	Date	In	Lb/A
Casino	9.3	10.0	25-Apr	43	890
Celius	9.8	10.0	26-Apr	43	870
Jetton	9.5	10.0	20-Apr	37	860
Banjo	9.2	10.0	23-Apr	41	840
GT-2	8.2	10.0	26-Apr	39	820
ARC91022-59-L4	9.7	10.0	23-Apr	39	810
GT-3	9.5	10.0	21-Apr	36	750
ARC91019-50-E2	9.8	10.0	24-Apr	42	740
VSX-1	8.7	10.0	21-Apr	36	730
ARC90016-PR377	10.0	10.0	24-Apr	40	720
KS7436	9.8	10.0	23-Apr	36	710
Wichita	9.5	10.0	24-Apr	38	700
Plainsman	7.7	10.0	26-Apr	42	690
ARC91023-63-L5	9.8	10.0	22-Apr	43	670
Abilene	7.7	10.0	22-Apr	37	650
Ceres	6.5	10.0	26-Apr	40	650
KS8200	9.5	10.0	22-Apr	37	640
KS9198	8.7	10.0	17-Apr	39	640
KS8073	9.5	10.0	25-Apr	43	600
KS8227	9.8	10.0	23-Apr	37	600
ARC91016-41-L2	9.5	10.0	25-Apr	44	590
KS8285	9.3	10.0	24-Apr	39	590
KS8367	9.0	10.0	23-Apr	39	570
KS-SU-W05	7.2	10.0	15-Apr	37	570
USI2002	9.3	10.0	22-Apr	38	570
GT-1	9.0	10.0	22-Apr	36	560
KS9012	8.8	10.0	22-Apr	42	520
Mean	9.1	10.0	22-Apr	39	688
LSD 0.05	1.3				256
CV %					35.6

Planted: September 6, 2002 at 6 lb/A; Harvested: June 27, 2003.
Hail damage from a June 3 storm was estimated at 50% to 70%.

Winter Canola, Great Plains ICN, Walsh CO, 2003.

Line	Fall Stand	Winter Survival	50% Flowering	Plant Height	Seed Yield
	0-10	0-10	Date	In	Lb/A
KS9124	8.3	10.0	21-Apr	39	640
Ceres	8.7	10.0	25-Apr	40	630
KS9117	8.5	10.0	21-Apr	38	620
Plainsman	7.7	10.0	28-Apr	38	620
Jetton	9.7	10.0	19-Apr	33	600
Wichita	9.0	10.0	25-Apr	37	590
KS9126	8.7	10.0	25-Apr	37	550
KS9153	8.0	10.0	21-Apr	33	550
KS9020	8.3	10.0	22-Apr	37	530
KS9069	8.8	10.0	25-Apr	34	530
KS9121	7.8	10.0	20-Apr	36	530
KS9133	8.3	10.0	18-Apr	37	530
KS9172	9.2	10.0	16-Apr	40	530
KS9112	7.3	10.0	21-Apr	34	520
KS9135	8.8	10.0	24-Apr	34	520
KS8339	9.3	10.0	21-Apr	38	500
KS9197	6.7	10.0	17-Apr	33	500
KS9183	6.7	10.0	20-Apr	36	490
KS9195	7.5	10.0	22-Apr	39	490
KS9107	9.2	10.0	15-Apr	34	480
KS9146	9.0	10.0	23-Apr	37	480
KS9129	6.8	10.0	19-Apr	36	450
KS9018	8.2	10.0	19-Apr	35	440
KS9023	8.8	10.0	24-Apr	34	420
KS9073	7.8	10.0	24-Apr	38	410
KS9201	9.2	10.0	15-Apr	37	410
KS9120	8.7	10.0	26-Apr	36	380
KS8372	9.7	10.0	22-Apr	34	370
KS8144	7.8	10.0	25-Apr	40	360
KS9025	6.5	10.0	17-Apr	33	360
KS9194	8.8	10.0	19-Apr	36	350
KS9051	8.7	10.0	20-Apr	36	340
Mean	8.3	10.0	21-Apr	36	490
LSD 0.05	1.56				160
CV%					19.5

Planted: September 6, 2003, 6 lb/A; Harvested: June 27, 2003.
A hail storm on June 3 lowered seed yields by 50% to 70%.

Spring Canola, B. juncea, Variety Trial, Walsh CO, 2003.

Line	Stand	50% Flowering	Plant Height	Seed Yield
	0-10	Date	In	lb/A
Ames 19180 [c]	6.2	3-Jun	24	290
CII3 [h]	7.8	11-Jun	34	280
PI 390134 [c]	6.7	1-Jun	31	270
Ames 725 [j]	8.7	27-Jul	37	270
PI 458934 [j]	8.5	2-Jun	48	260
PI 531217 [j]	8.2	24-Jun	55	260
Hyola 401 [n]	5.2	2-Jun	27	260
PI 360882 [c]	7.7	10-Jun	36	220
ZEM I [j]	8.7	31-May	42	220
Legend [n]	6.3	1-Jun	35	220
PI 331377 [c]	7.2	3-Jun	38	210
Cyclone [n]	6.2	11-Jun	40	210
Hyola 308 [n]	5.8	30-May	28	200
Hyola 330 [n]	5.8	26-May	25	200
Brigade [n]	7.3	12-Jun	32	190
CI3 [h]	5.3	6-Jun	36	160
Mean	7.0	8-Jun	36	231
LSD 0.05	2.52			84.4
CV%				11.1

Planted: March 26, 2003, 6 lb/A; Harvested: July 21, 2003.
A hailstorm on June 3 broke branches and lowered yield.

Spring Canola, B. juncea, Blue Sun, Walsh CO, 2003.

Line ID	Line	Stand	50% Flowering	Plant Height	Seed Yield
		0-10	Date	In	lb/A
7566	Arid	6.5	4-Jun	32	220
7567	Amulet	7.3	5-Jun	36	150
7568	JOOD-01925	7.7	6-Jun	37	160
7569	JOOD-09439	7.8	2-Jun	32	110
7570	JOOD-11028	7.2	14-Jun	36	210
7571	JN004	4.7	30-May	34	150
7572	JO006	4	31-May	35	170
7573	Q2	7.2	16-Jun	34	220
Mean		6.6	5-Jun	35	174
LSD 0.05		2.54			57.4
CV%					6.2

Planted: April 11, 2003 at 6 lb/A; replanted in same rows: May 8, 2003
Harvested: August 12, 2003.
A hailstorm on June 3 broke branches and lowered yield.