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Colorado State University

Agricultural Experiment Station

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

Plainsman Research Center 2011 Research Reports

Kevin Larson, Superintendent/Research Scientist

Plainsman Research Center

Box 477

42790 Hwy 160

Walsh, CO 81090

(719) 324-5643

Kevin.Larson@colostate.edu

Funded by the Colorado Agricultural Experiment Station

in cooperation with the Plainsman Agri-Search Foundation

This Plainsman Research Center booklet is dedicated to:

Dean Nichols

Dean was one of the original Plainsman Agri-Search Foundation Board Members

Dean and I had a friendly yield competition, although neither of us ever acknowledged that fact. Every year we would compare wheat yields. He would tell me his yields first and I still seldom won. Truth be told, he was simply a better farmer than me.

A Founding Father and a Good Friend and Farmer

We miss you Dean.

Plainsman Research Center, 2011 Research Reports

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2011 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.
Brett Pettinger (719) 324-5643	Research Associate, Plainsman Research Center, Agricultural Experiment Station, Colorado State University.
Deborah Harn (720) 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.
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	Professor, Soil and Crop Sciences Department Wheat Breeder, Colorado State University.
Gary Peterson (970) 491-6501	Professor and Head, Soil and Crop Sciences Department, Colorado State University.
Neil Hansen (970) 491-6804	Associate Professor, Sustainable Dryland Agroecosystem Management Project Leader, Soil and Crop Sciences Department, Colorado State University.
Mark Brick (970) 491-6551	Professor, Bean Breeder, Soil and Crop Sciences Department, Colorado State University.
Wilma Trujillo (719) 336-7734	Cropping System Specialist, Cooperative Extension Southeast Area, Colorado State University.

PLAINSMAN AGRI-SEARCH FOUNDATION BOARD

2013

Paul Hinds (Vice President)
12785 Road 34
Campo, CO 81029

James Hume
21491 Road 55
Walsh, CO 81090

Brian Brooks
19511 Road 36
Walsh, CO 81090

Don Wood
36663 Road UU
Two Buttes, CO 81084

Lyndell Herron
Box 64
Manter, KS 67862

Truman Wright (Secretary/Treasurer)
19625 Road 50
Walsh, CO 81090

2011

Max Smith
21715 Road 51
Walsh, CO 81090

Bill Brooks
37701 Road V
Walsh, CO 81090

Perry Jones
342 N. Nevada
Walsh, CO 81090

Calvin Melcher
300 N. Main
Holly, CO 81047

Matt Tedder
20923 Road 49
Walsh, CO 81090

Todd Randolph (President)
53766 Road GG
Walsh, CO 81090

2012

Dean Sides
49681 Road X
Walsh, CO 81090

Don Lohrey
Box 279
Walsh, CO 81090

Jack Walker
30780 Road 51
Walsh, CO 81090

Ron Batterton
1550 Hwy 89
Holly, CO 81047

Robert Wood
721 Barkley
Springfield, CO 81073

Douglas Melcher
12845 Hwy 89
Holly, CO 81047

2011 Climatological Summary
Plainsman Research Center, Walsh, Colorado

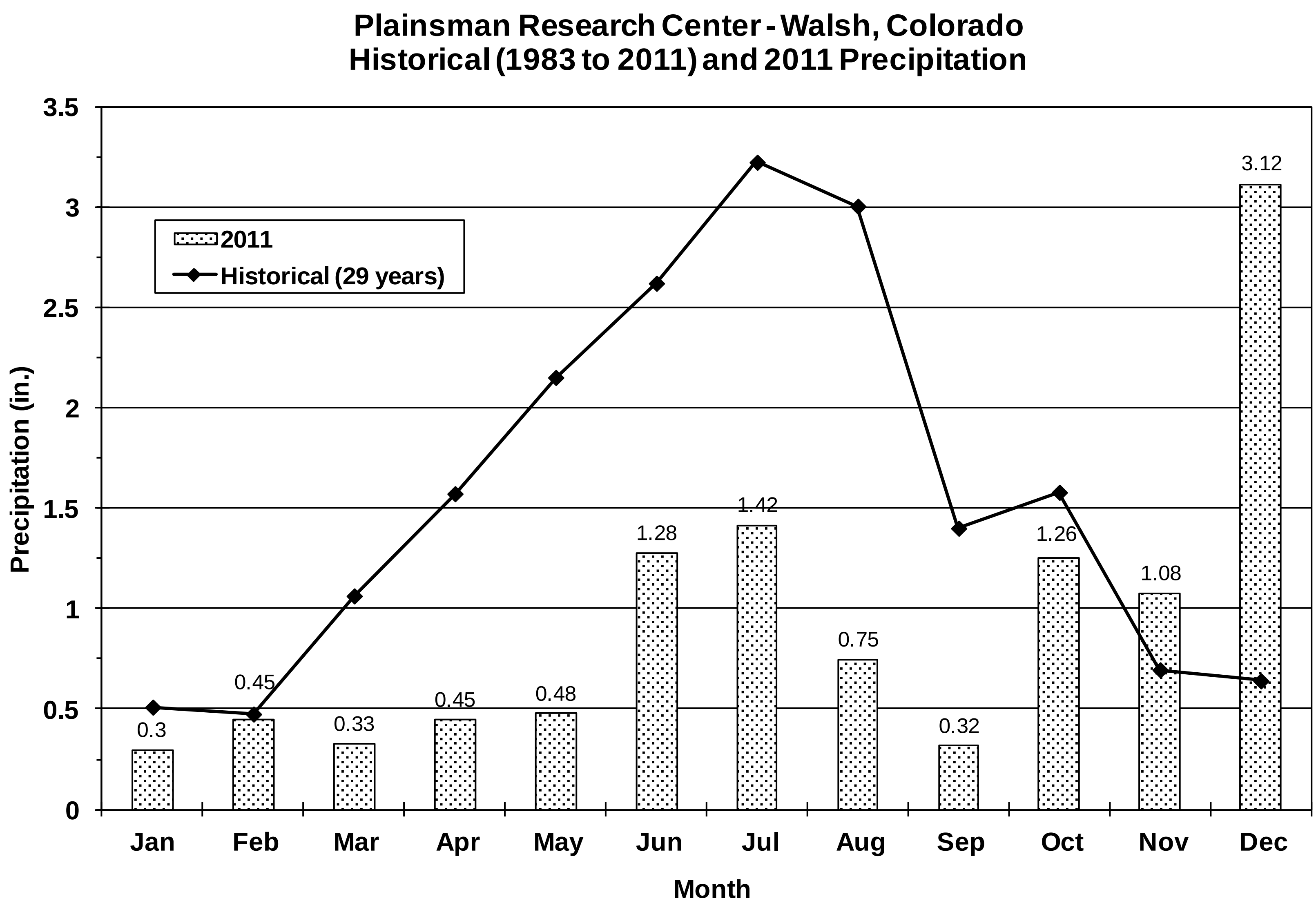
Month	Temperature Max. F	Min. F	Max. Mean F	Min. Mean F	Precip. In.	Greatest Day of Precip-atation	Snow-Fall In.	Greatest Snow Depth In.	Average Soil Temp F	Evapor-ation In.
Jan.	67	-8	45.3	16.0	0.30	0.23	0.75	0.50	30.5	
Feb.	78	-13	47.0	15.5	0.45	0.22	7.50	5.00	32.2	
Mar.	83	18	59.9	28.4	0.33	0.16	2.50	1.50	42.7	
Apr.	90	27	71.1	47.3	0.45	0.38	0.00	0.00	52.5	5.49
May	98	30	77.8	44.9	0.48	0.34	0.00	0.00	59.7	14.31
Jun.	104	48	92.3	58.1	1.28	0.61	0.00	0.00	70.6	15.81
Jul.	106	58	100.2	65.6	1.42	0.32	0.00	0.00	78.9	16.58
Aug.	106	60	97.1	65.6	0.75	0.28	0.00	0.00	79.0	13.89
Sep.	102	41	82.7	51.6	0.32	0.11	0.00	0.00	68.5	10.82
Oct.	92	23	70.9	39.5	1.26	1.01	2.30	2.30	53.9	4.13
Nov.	74	20	54.7	29.2	1.08	0.61	5.00	3.50	39.5	
Dec.	67	-2	36.6	17.3	3.12	2.11	21.90	18.00	31.3	
Total Annual			**69.6**	**39.9**	**11.24**		**39.95**			**81.03**

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

	2011	2010
Highest Temperature:	106 F on Jul 21 & Aug 25	102 F on Jun 11
Lowest Temperature:	-13 F on Feb 3	-7 F on Jan 8
Last freeze in spring:	31 F on May 3	32 F on May 14
First freeze in fall:	30 F on Oct 19	31 F on Oct 26
Frost free season:	169 frost free days	165 frost free days
Avg. for 29 years:	18.96 inches	

Maximum Wind:

Jan.	38 mph on the 22rd	July.	36 mph on the 1st
Feb.	45 mph on 2nd & 28th	Aug.	35 mph on the 2nd
Mar.	44 mph on the 22nd & 25th	Sept.	32 mph on the 4th
Apr.	48 mph on the 10th	Oct.	50 mph on the 7th
May	51 mph on the 25th	Nov.	62 mph on the 6th
Jun.	44 mph on the 4th & 21st	Dec.	43 mph on the 20th



Plainsman Research Center - Walsh, Colorado
Historical (1983 to 2011) and 2011 Precipitation
2011
Historical (29 years)
Precipitation (in.)
Month
0
0.5
1
1.5
2
2.5
3
3.5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0.3
0.45
0.33
0.45
0.48
1.28
1.42
0.75
0.32
1.26
1.08
3.12

2011 Eastern Colorado Winter Wheat Variety Performance Trials

Jerry Johnson and Scott Haley

Colorado State University provides current, reliable, and unbiased wheat variety information as quickly as possible to Colorado producers for making better variety decisions. It provides excellent research faculty and staff, a focused breeding program, graduate and undergraduate students, and dedicated agricultural extension specialists. However, wheat improvement in Colorado would not be possible without the support and cooperation of the entire Colorado wheat industry. On-going and strong support for a public breeding program is critical because variety development and testing is a long process, especially under the highly variable climatic conditions in Colorado.

Our wheat variety performance trials, and collaborative on-farm testing, represent the final stages of a wheat breeding program where promising experimental lines are tested under an increasingly broad range of environmental conditions. As a consequence of large environmental variation, Colorado State University annually conducts a large number of performance trials that serve to guide producer variety decisions and to assist our breeding program to more reliably select and advance the most promising lines toward release as new varieties.

2011 variety performance trials

Dry soil conditions characterized the fall 2010 planting at Burlington, Genoa, Roggen, Akron, and Orchard dryland trials. Variety trial emergence in the fall was poor to non-existent at these locations, and contributed to trial failure at Burlington, Genoa, and Roggen. Fall and winter precipitation was below average at most dryland trial locations and most of the dryland trials were showing significant drought stress coming out of the winter. Timely spring and early summer precipitation improved stands and growth at most locations. Sheridan Lake, Arapahoe, and Genoa trials were lost to heavy hail events that accompanied spring precipitation. Brown wheat mite infestations were observed in SE Colorado and the dryland trial at Lamar was sprayed. Russian wheat aphid was not a problem in 2011 trials except at Walsh where insecticide was applied.

The Irrigated Variety Performance Trials (IVPT) at Fort Collins, Rocky Ford and Haxtun were excellent. Low levels of lodging were observed at Rocky Ford and Fort Collins although some entries were heavily lodged at Haxtun where very high yields were recorded. At Rocky Ford, barley yellow dwarf virus, tan spot, leaf and stripe rust, and brown wheat mites were present at low levels. Leaf rust, stripe rust, and barley yellow dwarf virus were present at Fort Collins which also had light hail damage.

There were 44 entries in the dryland performance trials (UVPT) and 26 entries in the irrigated performance trials (IVPT). All trials included a combination of public and private varieties and experimental lines from Colorado and surrounding states. All dryland and irrigated trials were planted in a randomized complete block design with three replicates. Plot size was approximately 180 ft2 and all varieties were planted at 700,000 viable seeds per acre for dryland trials and 1.2 million viable seeds per acre for irrigated trials. Yields are corrected to 12% moisture. Test weight information was obtained from a combine equipped with a Harvest Master measuring system.

2011 Dryland Winter Wheat Variety Performance Trial at Lamar

Dryland Winter Wheat Variety Performance Trial at L

Variety	Yield	Test Weight
	bu/ac	lb/bu
CO07W245	62.8	61.6
CO050322	61.5	61.7
CO050303-2	61.5	61.8
Hatcher	60.8	61.4
CSU Blend09	60.7	61.0
Bill Brown	60.2	61.2
CO06424	60.2	61.5
Snowmass	59.9	60.9
CO050337-2	58.8	62.0
Danby	58.2	62.9
Settler CL	57.6	60.8
Infinity CL	57.2	60.8
Above	56.9	60.8
CO050233-2	56.4	61.0
CO07MAS114	56.3	59.7
CO07RWA15	55.2	61.4
SY Gold	55.2	60.9
Duster	55.0	61.8
Bond CL	54.9	60.3
CO08RWA050	54.5	61.2
Ripper	54.3	60.4
Prairie Red	54.3	60.3
CO050173	54.3	61.2
Winterhawk	54.1	61.2
TAM 112	53.9	61.4
CO05W111	53.8	62.1
T163	53.0	60.9
Robidoux	52.1	61.5
CO08RWA060	51.3	60.5
Thunder CL	51.0	60.6
WB-Stout	51.0	60.7
Armour	50.6	61.0
McGill	50.5	59.5
CO06052	50.4	61.8
CO07RWA2	50.3	60.2
Fuller	50.1	60.9
Smoky Hill	50.1	60.9
OK05312	50.0	61.4
SY Wolf	48.9	60.8
Everest	48.9	62.0
Camelot	48.7	61.3
WB-Cedar	44.4	60.7
Greer	44.4	59.7
Jagger	42.7	59.4
Average	**54.0**	**61.0**
$LSD_{(0.30)}$	2.8	

Harvest date: 6/27/2011
Planting date: 9/27/2010
Cooperator: Jensen Stulp
Comments:
Soil moisture was very good at planting. Field sprayed for brown wheat mites. Field had good soil moisture from recent rains in mid-June. Yield and test weight were higher than expected from visual evaluation.

2011 Dryland Winter Wheat Variety Performance Trial at Walsh

Dryland Winter Wheat Variety Performance Trial at V

Variety	Yield	Test Weight	Plant Height
	bu/ac	lb/bu	in
CO07W245	44.7	59.5	24
Hatcher	41.7	59.2	21
CO06424	41.2	58.5	25
TAM 112	40.9	58.9	24
Ripper	40.8	58.1	22
CO07MAS114	40.6	56.2	23
CO05W111	39.7	58.1	24
CO07RWA15	39.4	58.8	24
CO050322	39.2	57.9	23
CSU Blend09	39.2	58.2	21
Bill Brown	39.1	59.3	22
Duster	38.7	58.0	23
Above	38.6	57.9	22
Danby	38.2	59.3	22
Settler CL	37.9	57.9	22
WB-Stout	37.9	56.7	24
OK05312	37.9	59.4	22
Infinity CL	37.7	58.6	23
CO050303-2	37.6	59.8	23
CO08RWA050	37.1	57.8	21
SY Gold	37.0	58.4	23
Snowmass	36.9	58.2	23
CO050233-2	36.6	59.6	23
McGill	36.6	57.3	25
CO07RWA2	36.2	56.6	22
Prairie Red	35.8	57.7	20
Armour	35.3	57.7	20
Thunder CL	34.6	59.1	22
Greer	34.6	56.7	22
CO08RWA060	34.5	57.9	22
Robidoux	34.0	58.7	22
Winterhawk	33.9	59.6	24
CO050173	33.8	59.4	23
CO050337-2	33.8	58.1	21
T163	33.7	59.0	21
Bond CL	33.4	56.6	23
Smoky Hill	33.2	57.9	21
CO06052	33.0	59.6	23
SY Wolf	32.4	57.5	22
Camelot	31.9	58.4	24
Jagger	31.3	58.6	23
WB-Cedar	30.6	56.6	21
Fuller	28.5	57.8	22
Everest	27.8	57.1	20
Average	**36.3**	**58.2**	**22**
$LSD_{(0.30)}$	3.1		

Harvest date:	6/27/2011
Planting date:	9/28/2010
Cooperator:	Plainsman Research Center
Previous crop:	Fallow (the site is wheat-fallow rotation)
Fertilizer:	50 lb/a of N (preplant as NH_3), 20 lb/a of P_2O_5 (seedrow applied)
Herbicides:	0.3 oz/a of Ally Extra, 0.38 lb/a of 2,4-D ester
Insecticides:	Lorsban (for RWA control)
Soil:	Richfield Silty Loam

Comments:

Good emergence followed by dry conditions until harvest. Russian wheat aphid infestation surpassed the economic threshold and Lorsban was applied for control. Considering the dry weather, yields were much better than anticipated.

Summary of 2011 Dryland Variety Performance Results

Origin[a] and Release Year	Variety[b]	Market Class[c]	Yield[d]	Yield	Test Weight	Height
			bu/ac	% of avg	lb/bu	in
CSU exp	CO06424	HRW	56.0	115%	59.4	30
CSU exp	CO07W245	**HWW**	54.8	113%	59.4	29
CSU 2004	Hatcher	HRW	52.8	109%	58.9	27
CSU exp	CO050303-2	HRW	52.1	108%	59.4	30
CSU exp	CO07MAS114	HRW	52.0	107%	57.3	29
CSU exp	CO050322	HRW	51.8	107%	58.2	28
CSU exp	CO050337-2	HRW	51.1	105%	58.6	28
CSU 2007	Bill Brown	HRW	51.0	105%	59.3	26
CSU 2006	Ripper	HRW	50.6	104%	58.1	26
TX/W 2005	TAM 112	HRW	50.3	104%	60.2	28
NE 2008	Settler CL	HRW	50.3	104%	58.6	27
CSU 2009	Snowmass	**HWW**	50.2	103%	58.6	29
CSU exp	CO050233-2	HRW	50.1	103%	58.9	29
CSU exp	CO050173	HRW	50.0	103%	59.9	29
CSU exp	CO07RWA15	HRW	49.7	103%	59.5	29
CSU 2004/2006	CSU Blend09	HRW	49.7	103%	58.7	26
CSU-TX 2001	Above	HRW	49.7	103%	58.1	27
AP 2011	SY Wolf	HRW	49.2	102%	58.5	28
CSU exp	CO07RWA2	HRW	49.2	102%	58.6	29
KSU 2005	Danby	**HWW**	49.2	101%	59.5	28
OK exp	OK05312	HRW	49.1	101%	59.3	28
NE 2004	Infinity CL	HRW	49.0	101%	58.6	30
CSU exp	CO05W111	**HWW**	48.9	101%	58.7	29
CSU 1998	Prairie Red	HRW	48.8	101%	57.3	25
CSU exp	CO08RWA050	HRW	48.7	100%	58.5	28
WB 2007	Winterhawk	HRW	48.4	100%	59.4	29
T 2010	T163	HRW	48.2	99%	58.2	27
AP 2010	SY Gold	HRW	48.0	99%	58.9	27
NE 2008	Camelot	HRW	47.9	99%	58.9	29
WB 2010	WB-Stout	HRW	46.8	97%	56.9	29
CSU 2008	Thunder CL	**HWW**	46.8	97%	58.2	28
CSU 2004	Bond CL	HRW	46.5	96%	57.4	29
NE 2010	Robidoux	HRW	46.4	96%	58.8	29
OK 2006	Duster	HRW	46.4	96%	58.5	27
WB 2008	Armour	HRW	46.2	95%	57.9	24
CSU exp	CO06052	HRW	45.9	95%	59.1	28
NE 2010	McGill	HRW	45.4	94%	58.1	29
KSU 2009	Everest	HRW	45.3	93%	59.6	26
KSU 1994	Jagger	HRW	45.2	93%	58.3	28
KSU 2006	Fuller	HRW	44.8	92%	58.3	28
WB 2006	Smoky Hill	HRW	44.0	91%	59.3	27
CSU exp	CO08RWA060	HRW	43.6	90%	58.0	27
AP 2009	Greer	HRW	41.6	86%	57.1	28
WB 2010	WB-Cedar	HRW	41.4	86%	59.2	24
		Average	48.5		58.6	28

[a]Variety origin code: CSU=Colorado State University; CSU-TX=Colorado State University/Texas A&M University; WB=WestBred (Monsanto); AP=AgriPro (Syngenta); T=Trio (Limagrain); TX/W=Texas A&M release, marketed by Watley Seed Co.; KSU=Kansas State University; NE=University of Nebraska; OK=Oklahoma State University.

[b]Varieties ranked according to average yield in 2011

[c]Market class: HRW=Hard Red Winter Wheat; **HWW**=Hard White Winter Wheat

[d]2011 average yield and test weight based on six 2011 trials.

Summary of 2-Yr Dryland Variety Performance Results

Origin[a] and Release Year	Variety[b]	Market Class[c]	2-Yr Average[d] Yield	Yield	Test Weight	Height
			bu/ac	% of avg	lb/bu	in
CSU exp	CO06424	HRW	61.9	113%	59.9	30
CSU exp	CO050303-2	HRW	59.0	108%	61.0	31
CSU exp	CO050322	HRW	59.0	108%	59.5	29
CSU exp	CO050173	HRW	58.1	106%	61.4	30
CSU exp	CO050337-2	HRW	58.1	106%	59.9	30
CSU exp	CO050233-2	HRW	57.6	105%	59.8	30
NE 2008	Settler CL	HRW	56.8	103%	59.8	28
CSU exp	CO05W111	**HWW**	56.4	103%	60.4	31
CSU 2004	Hatcher	HRW	56.4	103%	60.1	28
CSU 2007	Bill Brown	HRW	55.9	102%	60.1	28
CSU 2006	Ripper	HRW	55.7	101%	58.7	28
WB 2007	Winterhawk	HRW	55.6	101%	60.9	30
CSU 2009	Snowmass	**HWW**	55.4	101%	60.1	31
CSU 2004/2006	CSU Blend09	HRW	55.3	101%	59.5	28
NE 2004	Infinity CL	HRW	54.6	100%	60.0	31
TX/W 2005	TAM 112	HRW	54.6	99%	60.5	29
CSU-TX 2001	Above	HRW	54.4	99%	59.3	29
KSU 2005	Danby	**HWW**	54.0	98%	61.3	29
NE 2008	Camelot	HRW	53.8	98%	60.1	31
AP 2010	SY Gold	HRW	53.6	98%	60.4	29
CSU 2004	Bond CL	HRW	53.6	98%	58.2	30
CSU 2008	Thunder CL	**HWW**	53.5	98%	59.1	29
WB 2008	Armour	HRW	53.4	97%	58.9	26
CSU exp	CO06052	HRW	53.1	97%	60.5	29
CSU 1998	Prairie Red	HRW	52.7	96%	58.4	28
KSU 2009	Everest	HRW	52.4	95%	60.8	28
OK 2006	Duster	HRW	51.8	94%	59.9	29
WB 2010	WB-Stout	HRW	51.8	94%	58.0	30
KSU 2006	Fuller	HRW	50.9	93%	59.6	29
WB 2006	Smoky Hill	HRW	50.8	93%	59.9	28
KSU 1994	Jagger	HRW	50.3	92%	59.6	30
		Average	54.9		59.9	29

[a]Variety origin code: CSU=Colorado State University; CSU-TX=Colorado State University/Texas A&M University; WB=WestBred (Monsanto); AP=AgriPro (Syngenta); TX/W=Texas A&M release, marketed by Watley Seed Co.; KSU=Kansas State University; NE=University of Nebraska; OK=Oklahoma State University.

[b]Varieties ranked according to average 2-yr yield

[c]Market class: HRW=Hard Red Winter Wheat; **HWW**=Hard White Winter Wheat

[d]2-yr average yield and test weight are based on nine 2010 trials and six 2011 trials.

Summary of 3-Yr Dryland Variety Performance Results

Origin[a] and Release Year	Variety[b]	Market Class[c]	3-Yr Average[d] Yield	Yield	Test Weight	Height
			bu/ac	% of avg	lb/bu	in
NE 2008	Settler CL	HRW	56.8	104%	59.8	29
CSU 2004/2006	CSU Blend09	HRW	56.5	104%	59.6	29
CSU 2009	Snowmass	**HWW**	56.3	103%	60.3	31
CSU 2006	Ripper	HRW	56.3	103%	59.1	29
CSU 2004	Hatcher	HRW	56.3	103%	60.1	28
CSU 2007	Bill Brown	HRW	56.0	103%	60.3	29
WB 2007	Winterhawk	HRW	55.6	102%	60.9	30
TX/W 2005	TAM 112	HRW	55.6	102%	60.9	29
CSU-TX 2001	Above	HRW	55.5	102%	59.5	29
CSU 2004	Bond CL	HRW	55.3	101%	58.5	30
NE 2004	Infinity CL	HRW	54.9	101%	59.9	31
KSU 2005	Danby	**HWW**	54.4	100%	61.0	29
CSU 1998	Prairie Red	HRW	54.1	99%	58.9	28
NE 2008	Camelot	HRW	54.0	99%	60.0	31
AP 2010	SY Gold	HRW	53.9	99%	60.3	29
CSU 2008	Thunder CL	**HWW**	53.6	98%	59.3	29
OK 2006	Duster	HRW	53.5	98%	59.9	30
WB 2008	Armour	HRW	53.5	98%	58.9	26
WB 2006	Smoky Hill	HRW	52.5	96%	60.0	29
KSU 2006	Fuller	HRW	51.4	94%	59.3	29
KSU 1994	Jagger	HRW	50.7	93%	59.6	29
		Average	54.6		59.8	29

[a]Variety origin code: CSU=Colorado State University; CSU-TX=Colorado State University/Texas A&M University; WB=WestBred (Monsanto); AP=AgriPro (Syngenta); TX/W=Texas A&M release, marketed by Watley Seed Co.; KSU=Kansas State University; NE=University of Nebraska; OK=Oklahoma State University.

[b]Varieties ranked according to average 3-yr yield

[c]Market class: HRW=Hard Red Winter Wheat; **HWW**=Hard White Winter Wheat

[d]3-yr average yield and test weight are based on ten 2009 trials, nine 2010 trials, and six 2011 trials.

Dryland Wheat Strips for Forage and Grain Yield at Walsh, 2011

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

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

MATERIALS AND METHODS: Fourteen wheat varieties were planted on October 10, 2010 at 50 lb seed/a in 20 ft. by 800 ft. strips with two replications. We applied 50 lb N/a with a sweep and seedrow applied 5 gal/a of 10-34-0 (20 lb P_2O_5, 6 lb N/a). Ally Extra 0.3 oz/a and 2,4-D 0.38 lb/a was sprayed for weed control. Two 2 ft. by 2.5 ft. forage samples were taken at jointing (April 7) and at boot (May 5). We measure the forage for fresh weight, oven-dried the samples, and recorded dry weight at 15% moisture content. Russian Wheat Aphid reached the critical threshold and the field was sprayed with Losban. We harvested the plots on June 27 and 28 with a self-propelled combine and weighed them in a digital weigh cart. Grain yields were adjusted to 12% seed moisture content.

RESULTS: Grain yields were good, especially considering the dry conditions, averaging 24 bu/a. About 9 bu/a separated the highest yielding variety, Ripper, from the lowest yielding variety, Armour. Ripper had the highest grain yield, 28.3 bu/a, but it was not significantly higher than 9 other varieties tested. NuDakota had the highest forage yield at jointing, and Thunder CL had the highest forage yield at boot. Five varieties had higher three-year grain yield averages than the trial averages. The variety with the highest three-year average yield was Ripper.

DISCUSSION: My choice for the best overall dual-purpose wheat variety is NuDakota. NuDakota produced above average grain yield, the highest forage yield at jointing, and the second highest forage yield at boot. The high forage yield of Armour at jointing indicated that it was again on track for the best overall dual-purpose wheat this year; however, at grain harvest, Armour had the lowest yield. I do not know the reason for its low yield, but dry weather during grain-filling appeared particularly hard on Amour.

Grain yields of the last three years have been near the long term Baca County average for 2009 and 2011, and higher than the Baca County average for 2010. Three wheat varieties: Hatcher, Ripper, and Bill Brown, had above average grain yields each of the last three seasons. Producing above average yields in response our wide-ranging seasonal conditions shows that these three varieties are well adapted for our environment. Hatcher, Ripper, and Bill Brown would be good varietal choices for our variable year-to-year precipitation fluctuations.

Table .Dryland Wheat Strips, Forage and Grain Yield at Walsh, 2011.

Variety	Jointing		Boot		Plant		Test	Grain	Grain
	Fresh Wt.	Dry Wt.	Fresh Wt.	Dry Wt.	Ht.	Residue	Wt.	Protein	Yield
	-----------------------lb/a-----------------------				in	lb/a	lb/bu	%	bu/a
Ripper	3060	1027	8782	3265	21	1024	61	13.2	28.3
Bill Brown	3932	1254	8528	2970	22	938	61	13.3	26.4
Hatcher	3338	1246	9026	2972	21	1215	61	12.7	26.3
Snowmass	3156	1092	10273	3681	24	1238	62	12.9	26.0
Thunder CL	4007	1319	13272	4352	19	1409	61	13.2	25.5
Jagalene	3216	1113	9752	3471	21	1298	62	14.1	25.2
NuDakota	4003	1440	11939	4161	20	1206	60	13.7	25.0
Winterhawk	2842	1079	8401	2986	22	1138	62	13.6	24.3
Above	3991	1360	12494	4185	20	1123	61	12.7	24.1
TAM 112	3234	1139	9361	3285	21	1070	61	14.0	23.5
TAM 111	3120	1098	9782	3307	23	1191	62	13.0	21.4
Prarie Red	3165	1049	9675	3427	20	962	61	13.5	20.5
Bond CL	2933	1057	8656	2788	21	989	61	12.3	20.4
Armour	3693	1329	7584	2754	17	684	61	14.6	18.8
Average	3406	1186	9823	3400	21	1106	61	13.3	24.0
LSD 0.05	1598.6	448.4	1861.3	604.6		445.2			4.84

Planted: October 10, 2010; 50 lb seed/a; 5 gal/a 10-34-0.
Harvested: June 27 and 28, 2011.
Grain Protein adjusted to 12% moisture content.
Jointing sample taken April 7, 2011.
Boot sample taken May 5, 2011.
Wet Weight is reported at field moisture.
Dry Weight is adjusted to 15% moisture content.
Residue is reported at field moisture.

Table .--Summary: Dryland Wheat Strips Variety Performance Tests at Walsh, 2009-2011.

		Grain Yield					Yield as % of Trial Average				
Firm	Variety	2009	2010	2011	2-Year Avg	3-Year Avg	2009	2010	2011	2-Year Avg	3-Year Avg
		bu/a					%				
AGSECO	TAM 110	23	43	--	--	--	92	98	--	--	--
AgriPro	TAM 111	26	45	21	33	31	104	102	88	97	99
AgriPro	Jagalene	20	43	25	34	29	80	98	104	100	95
AgriPro	NuDakota	--	45	25	35	--	--	102	104	103	--
AgriPro	Hawken	22	42	--	--	--	80	95	--	--	--
Colorado State	Hatcher	27	45	26	36	33	108	102	108	104	105
Colorado State	Prairie Red	27	--	21	--	--	108	--	88	--	--
Colorado State	Ankor	26	44	--	--	--	104	100	--	--	--
Colorado State	Bond CL	28	42	20	31	30	112	95	83	91	97
Colorado State	Ripper	27	45	28	37	33	108	102	117	107	108
Colorado State	Bill Brown	25	46	26	36	32	100	105	108	106	104
Colorado State	Snowmass	--	44	26	35	--	--	100	108	103	--
Kansas State	Danby	25	43	--	--	--	100	98	--	--	--
Watley	TAM 112	25	46	24	35	32	100	105	100	103	102
Westbred	Armour	--	46	19	33	22	--	105	79	96	70
Westbred	Winterhawk	23	46	24	35	31	100	105	100	103	100
Average		25	44	24	34	31					

Grain Yields were adjusted to 12.0 % seed moisture content.

CRP Conversion Back into Wheat Production, Lycan, 2011

Kevin Larson, Calvin Thompson and Curtis Miller

The Conservation Reserve Program has been one of the most important USDA programs for Colorado. It has added millions of dollars to Colorado farm income, regardless of weather and commodity fluctuations. Colorado has 1.87 million acres in CRP, and of that total, 571,000 acres will expire in October, 2012 (USDA, FSA, 2011). Because of high commodity prices and government funding uncertainty for CRP extensions, many CRP acres may be converted back into crop production. CRP has provided soil erosion protection by growing perennial grass cover. To keep the grass cover intact while converting the land back into crop production, our study compared chemical burn down rates to tillage.

Materials and Methods

We used a split-split plot design with glyphosate rates and tillage as the main plots and mowing and Beyond as the subplots. The main plot chemical treatments were Maddog Plus (glyphosate) at 40, 48, 56, and 64 oz/a with three application times. The application dates were: first application: June 18, 2010 (Maddog Plus, Dicamba 12 oz/a; Low Vol 6, 16 oz/a); second application: July 20, 2010 (Maddog Plus); and third application: August 27, 2010 (Maddog Plus; Salvo 20 oz/a). We mowed the mechanical grass control subplots on June 17, 2010 and applied Beyond for the in-season grass control subplots on April 18, 2011 (Beyond 6 oz/a, NIS 32 oz/100 gal, 28-0-0, 10 gal/100 gal). Curtis Miller performed all seven tillage operations to our tillage plots and to the surrounding CRP field. For the tillage treatment, he chiseled (one time), disked (three times), and swept (three times). For in-season broadleaf weed control to the entire site, we applied Ally Extra 0.4 oz/a; NIS 8 oz/a; 28-0-0, 5 gal/100 gal. For N fertilization, we streamed 28-0-0 at 75 lb N/a on 18 in. spacing. We planted Bond CL at 50 lb/a on October 8, 2010 and seedrow applied 5 gal 10-34-0/a. We harvested on July 7, 2011 with a self-propelled combine equipped with a digital scale.

Results and Discussion

Calvin Thompson surveyed the CRP site and identified the grass species present. He estimated the cover percentage of the perennial grasses: Side Oats Grama, 50%; Blue Grama, 15%; Buffalo Grass, 10%; Little Bluestem, 10%; Western Wheatgrass, 4%; and Big Bluestem, 2%.

The glyphosate applications did not adequately control the perennial grasses, even with three applications of our highest glyphosate rate of 64 oz/a. At planting, some grasses were still green in all of the glyphosate rate treatments; whereas, the seven tillage operations for the tillage treatment did control the CRP grasses. Wheat yields were very low and some treatments had no wheat at all. The combination of mowing with glyphosate rates produced 0.04 to 0.17 bu/a, while the glyphosate rates without mowing produced no yield. The tillage treatment without Beyond applied produced the highest yield of 6.2 bu/a. We included the Beyond treatment to see if Beyond would improve perennial grass control in growing wheat. Beyond appeared to have some activity on the CRP grasses, but applying Beyond lowered the overall wheat yield compared to treatments without Beyond. This yield reduction with Beyond was particularly evident in the tillage treatment. The tillage treatment controlled the perennial grasses and produced some yield; whereas, the chemical treatments (glyphosate rates and Beyond) and the mowing treatment only partially controlled the perennial grasses and produced almost no yield.

Reference Cited

USDA, FSA. December 30, 2011. Conservation Reserve Program - Monthly CRP Acreage Report, Summary of Active and Expiring CRP Acres by State. Accessed: January 12, 2012. ftp://ftp.fsa.usda.gov/crpstorpt/RMEPEGG/MEPEGGR1.HTM

Table .-CRP Conversion Back into Wheat Production, Lycan, 2011.

Tillage Treatment	Mow Treatment	Beyond Applied	Glyphosate Rate	Grain Yield
		6 oz/a	oz/a (X3)	bu/a
No-till	Mowed	Beyond	40	0.10
No-till	Mowed	Beyond	48	0.07
No-till	Mowed	Beyond	56	0.10
No-till	Mowed	Beyond	64	0.07
No-till	Unmowed	Beyond	40	0.00
No-till	Unmowed	Beyond	48	0.00
No-till	Unmowed	Beyond	56	0.00
No-till	Unmowed	Beyond	64	0.00
Tillage		Beyond		3.31
No-till	Mowed	None	40	0.04
No-till	Mowed	None	48	0.10
No-till	Mowed	None	56	0.13
No-till	Mowed	None	64	0.17
No-till	Unmowed	None	40	0.00
No-till	Unmowed	None	48	0.00
No-till	Unmowed	None	56	0.00
No-till	Unmowed	None	64	0.00
Tillage		None		6.19

Planted: October 8, 2010; Bond CL at 50 lb seed/a; 5 gal 10-34-0/a.
Harvested: July 7, 2011.
Mowed: June 17, 2010.
Herbicide applied: first application: June 18 (Maddog Plus; Dicamba 12 oz/a; Low Vol 6, 16 oz/a); second application: July 20 (Maddog Plus); third application: August 27 (Maddog Plus; Salvo 20 oz/a).
Beyond applied: April 18 (Beyond 6 oz/a; NIS 32 oz/100 gal; 28-0-0, 10 gal/100 gal).
In-season broadleaf weed control: April 18 (Ally Extra 0.4 oz/a; NIS 8 oz/a; 28-0-0, 5 gal/100 gal).
N fertilization: 32-0-0 at 75 lb N/a.

N Timing on Dryland Wheat for Protein and Yield at Walsh, 2011

Kevin Larson and Wilma Trujillo

The impetus for this study comes from the Con Agra program that pays protein premiums for two white wheat varieties, Snowmass and Thunder CL. Southeast Colorado tends to raise winter wheat with lower than the standard 12% protein level during years of good production. Con Agra's protein premium scale starts at 12% protein and ends at 15% protein (Johnson, et al., 2011). For each 0.2% protein increase, they pay a premium of $0.02 per bushel. At 13% and 13.5% protein, an additional $0.05 per bushel is added to the premium. The maximum protein premium is $0.40 per bushel at 15% protein. In this study, we tested N application timing for potential increase of protein and yield.

Materials and Methods

We applied 60 lb N/a as 28-0-0 streamed in 18 in. spacing at four application dates: August 10 (pre-plant), March 14 (pre-jointing), April 1 (jointing), and May 5 (boot). We also included a check with no N applied. In addition to the N timing treatments, we foliar sprayed SRN 28/70 (72% Slow Release Nitrogen) on May 5 (boot) at 2 gal/a (6 lb N/a). We planted two wheat varieties, Snowmass and Hatcher, on October 9, 2010 at 50 lb seed/a in 20 ft. by 200 ft. plots with two replications. Our plot design was split-split plot with N timing as the main plots and varieties and foliar SRN as subplots. At planting, we seedrow applied 5 gal/a of 10-34-0 (20 lb P_2O_5, 6 lb N/a). A tank mix of Ally Extra 0.3 oz/a and 2,4-D 0.38 lb/a was sprayed for weed control. Russian Wheat Aphid reached the critical threshold and the field was sprayed with Losban. We harvested the plots on June 24 with a self-propelled combine equipped with a digital scale. Grain yields were adjusted to 12% seed moisture content.

Results

Grain yields were good, especially considering the dry conditions, averaging 31 bu/a. The soil test analysis revealed that no N was needed for our 35 bu/a yield goal. Nonetheless, yields increased for all N timing treatments (60 lb N/a) compared to the 0 N check. The N timing yield range for Hatcher was 30 to 35 bu/a, and the yield range for Snowmass was 27 to 31 bu/a. The highest yield for N timing occurred at boot for Hatcher and at pre-plant for Snowmass. The N timing response of Hatcher and Snowmass followed one another with Hatcher producing 2 to 5 bu/a more than Snowmass at each N application stage. The highest yielding N timing stages for both varieties were pre-plant and boot. The lowest yielding N timing stage for both varieties was pre-jointing, although the yield responses at pre-jointing were higher than the 0 N check.

N timing protein levels peaked at the pre-jointing stage for both Hatcher (14.1% protein) and Snowmass (14.5% protein). The lowest protein percentages occurred at the boot N timing stage and with the 0 N check for both varieties. Both varieties had similar protein responses to N timing, except at jointing where Snowmass fell below Hatcher.

The addition of the foliar application of SRN 28/70 at boot to the N timing and 0 N check produced some surprising results. The yield response to foliar SRN was frequently inversed compared to the response of N timing. Where yields were low at the N timing pre-jointing stage and with the 0 N check, they were high with foliar SRN. The opposite response occurred at the pre-plant and boot stages. Yield responses were high with at pre-plant and boot stages for N timing, but foliar SRN produced low yield response at these stages. The yield response of Hatcher and Snowmass to foliar SRN mimicked each other at all N timing stages as well as the 0 N check. Hatcher produced 4 to 6 bu/a more than Snowmass in response to foliar SRN at all N timing stages including the 0 N check. The highest overall yields for both varieties occurred at the N timing pre-jointing stage with the addition of foliar SRN (at boot).

The protein responses to foliar SRN applied at boot were also surprising. Since the foliar SRN treatment (6 lb N/a) was applied solely at boot to all of the N timing applications and to the 0 N check, we expected increased protein levels and no yield response for all N timing stages and the 0 N check. Instead, foliar SRN lowered protein levels and produced yield responses (both positive and negative) compared to the N timing applications without the addition of SRN.

Discussion

The N timing applications were streamed on the soil surface. Therefore, precipitation should be necessary to make the N available to the roots. Since the winter and spring were dry, we thought that precipitation events surrounding the N timing applications would explain the yield responses. There was a precipitation event of 0.28 in. near the pre-plant application and yields increased. No precipitation surrounded the pre-jointing application and yields decreased. Only 0.01 in. of rain occurred near the jointing application and yields increased. Precipitation events could only provide a partial explanation for the yield response to N timing applications.

We were able to increase both protein and yield with N timing applications and foliar SRN to winter wheat grown on a field which required no additional N fertilizer to reach our 35 bu/a yield goal. However, it was cost prohibitive to apply 60 lb N/a at our N timing stages. The average net income loss for the N timing applications ranged from -$12.07/a to -$34.16/a for Hatcher and -$13.46/a to -$28.90/a for Snowmass. The only positive net incomes were from foliar SRN on the 0 N check. Hatcher provided $20.28/a and Snowmass $1.86/a in positive net incomes because of the high yield response and low cost of foliar SRN on the 0 N check.

The current protein premium scale is too low to justify costly N applications. For example, if you applied 30 lb N/a at a total cost of $26.70/a ($20.70/a N cost and $6.00/a application cost) and harvested 35 bu/a at 13.5% protein, your protein premium would be $8.75/a ($0.25/bu times 35 bu/a). By applying N for the protein premium alone, you would have lost $17.95/a. Based solely on the protein premium, it would require a yield of 106.8 bu/a ($26.70/a divided by $0.25/bu) with 13.5% protein to meet the marginal cost of applying 30 lb N/a.

Literature Cited

Johnson, J.J., et al. 2011. Making Better Decision, 2011 Colorado Winter Wheat Variety Performance Trials. CSU, Crop Testing Program, AES, Extension, Dept. of Soil and Crop Sciences, Colorado State University, Fort Collins.

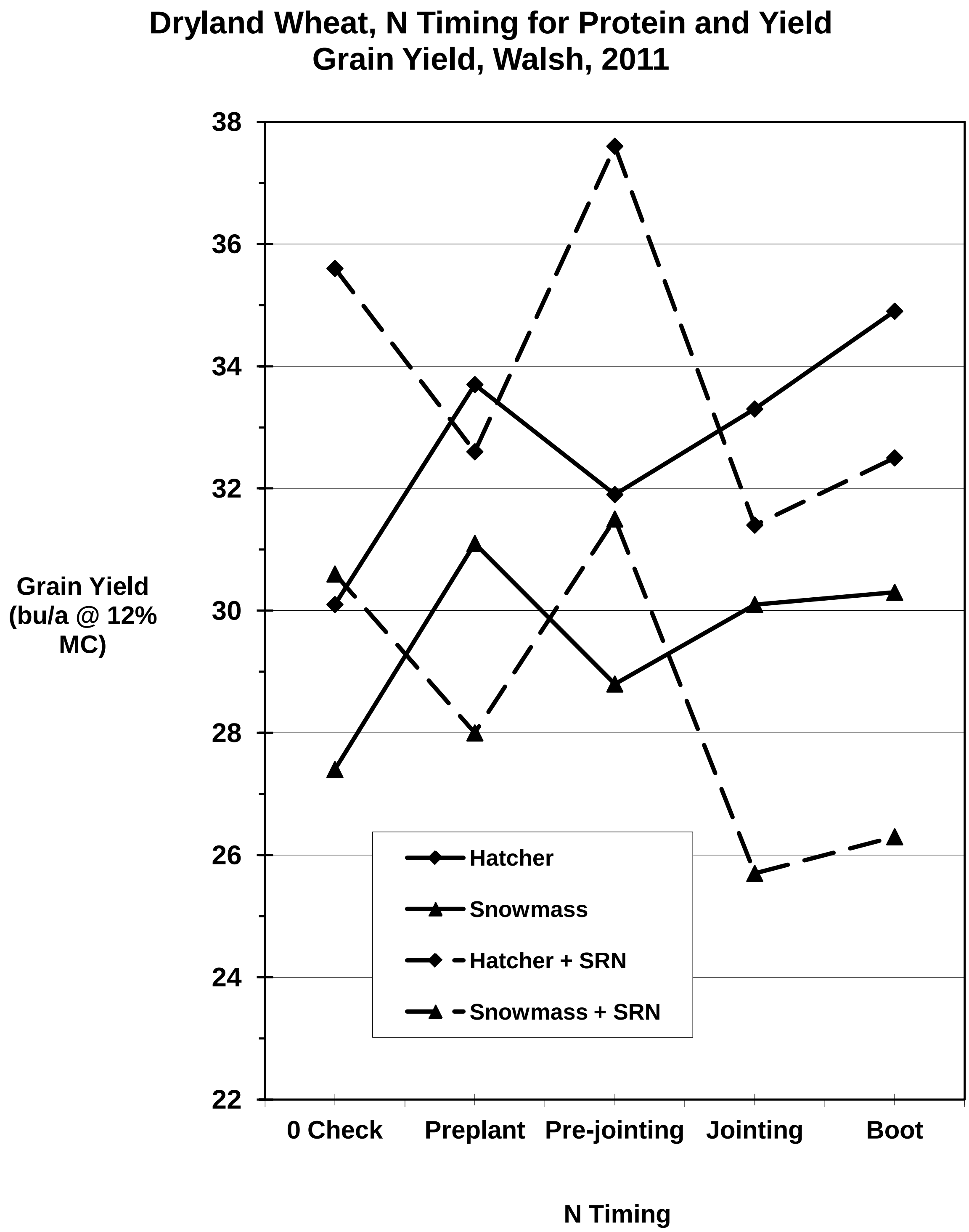


Fig. .Dryland Wheat, N Timing Yield at Walsh, 2011. N Timing: Check, 0 lb/a; Preplant, 60 lb/a; Pre-jointing, 60 lb/a; Jointing, 60 lb/a; Boot, 60 lb/a; and + SRN at Boot, 2 gal/a. All N Timing treatments were streamed 28-0-0, except SRN which was foliar sprayed. Planted: October 9, 2010 at 50 lb seed/a. Harvested: June 24, 2011.

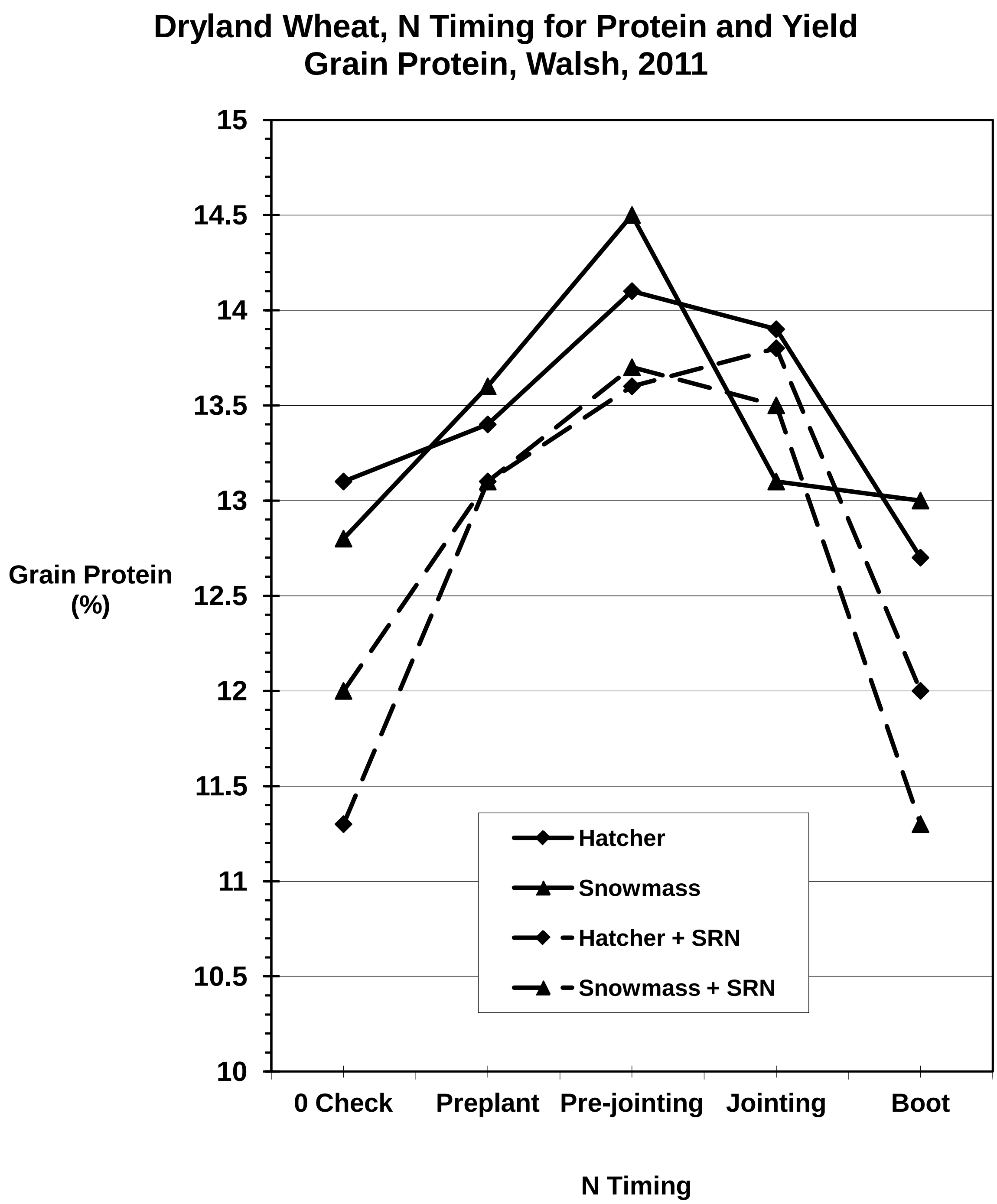


Fig. .Dryland Wheat, N Timing Protein at Walsh, 2011. N Timing: Check, 0 lb/a; Preplant, 60 lb/a; Pre-jointing, 60 lb/a; Jointing, 60 lb/a; Boot, 60 lb/a; and + SRN at Boot, 2 gal/a. All N Timing treatments were streamed 28-0-0, except SRN which was foliar sprayed. Planted: October 9, 2010 at 50 lb seed/a. Harvested: June 24, 2011.

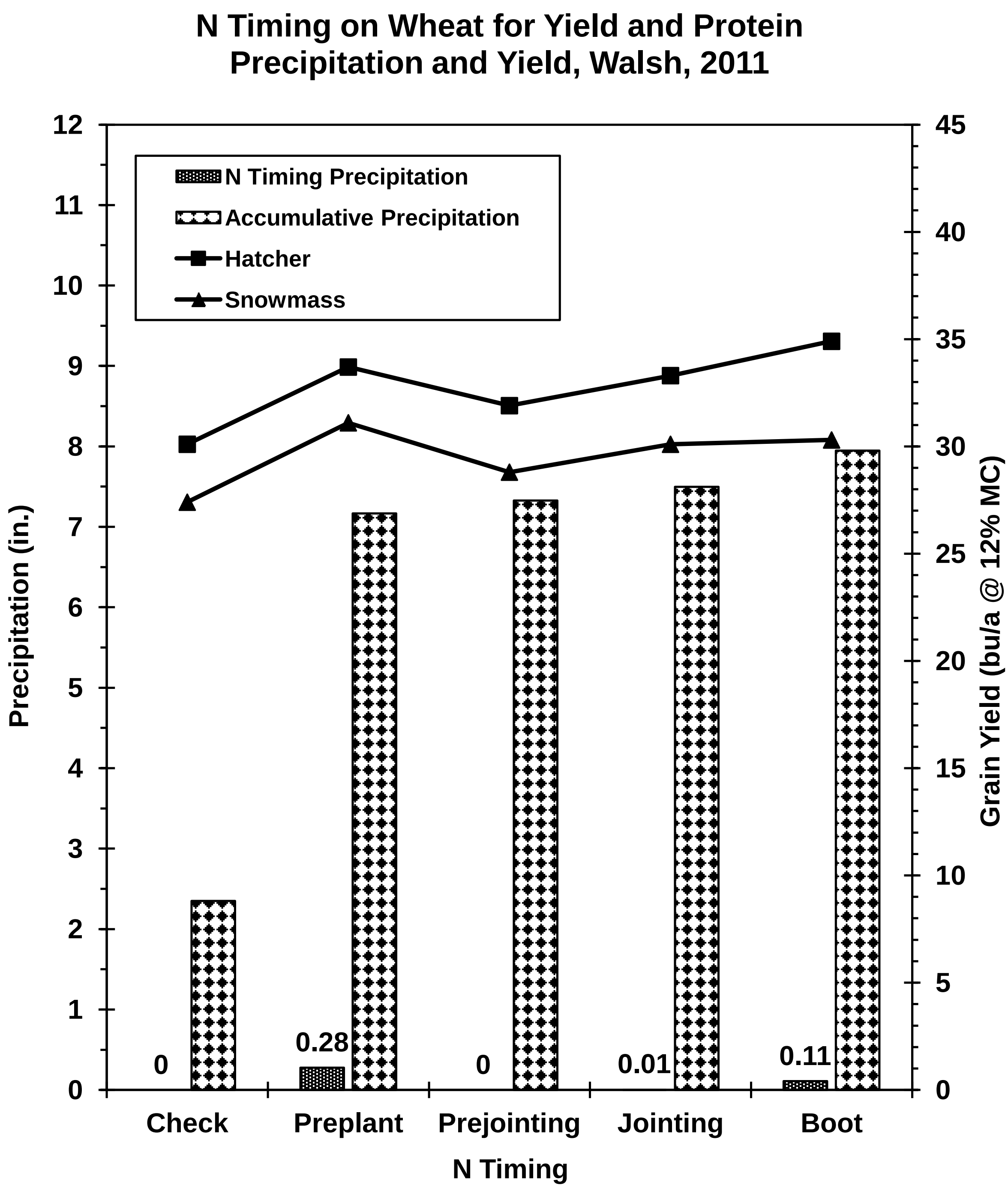


Fig. .Dryland Wheat, N Timing Yield and Precipitation at Walsh, 2011. N Timing: Check, 0 lb/a; Preplant, 60 lb/a; Pre-jointing, 60 lb/a; Jointing, 60 lb/a; Boot, 60 lb/a; and + SRN at Boot, 2 gal/a. All N Timing treatments were streamed 28-0-0, except SRN which was foliar sprayed. Planted: October 9, 2010 at 50 lb seed/a. Harvested: June 24, 2011. Total precipitation from planting to boot was 7.95 in.

Table .--Dryland Wheat, N Timing for Protein and Yield, Walsh, 2011.

N Timing	N Applied	Boot Foliar	Variety	Test Weight	Protein	Grain Yield	Protein & Grain Income	Applied N Net Income
	lb N/a	gal/a		lb/bu	%	bu/a	$/a	$/a
Check	0	None	Hatcher	59.0	13.1	30.1	0.00	0.00
Preplant	60	None	Hatcher	59.0	13.4	33.7	26.50	-20.90
Pre-jointing	60	None	Hatcher	59.0	14.1	31.9	13.24	-34.16
Jointing	60	None	Hatcher	59.0	13.9	33.3	23.55	-23.85
Boot	60	None	Hatcher	59.5	12.7	34.9	35.33	-12.07
Average			**Hatcher**	**59.1**	**13.4**	**32.8**	**19.72**	**-18.20**
Check	0	None	Snowmass	59.0	12.8	27.4	0.00	0.00
Preplant	60	None	Snowmass	59.0	13.6	31.1	33.94	-13.46
Pre-jointing	60	None	Snowmass	59.0	14.5	28.8	18.50	-28.90
Jointing	60	None	Snowmass	59.5	13.1	30.1	23.09	-24.31
Boot	60	None	Snowmass	59.0	13.0	30.3	24.34	-23.07
Average			**Snowmass**	**59.1**	**13.4**	**29.5**	**19.94**	**-27.46**
Check	0	+ 2 gal SRN	Hatcher	59.0	11.3	35.6	40.48	20.28
Preplant	60	+ 2 gal SRN	Hatcher	59.0	13.1	32.6	18.40	-49.20
Pre-jointing	60	+ 2 gal SRN	Hatcher	59.0	13.6	37.6	55.20	-12.40
Jointing	60	+ 2 gal SRN	Hatcher	59.5	13.8	31.4	9.57	-58.03
Boot	60	+ 2 gal SRN	Hatcher	59.0	12.0	32.5	17.66	-49.94
Average		**+ 2 gal SRN**	**Hatcher**	**59.1**	**12.8**	**33.9**	**28.26**	**-29.86**
Check	0	+ 2 gal SRN	Snowmass	60.0	12.0	30.6	22.06	1.86
Preplant	60	+ 2 gal SRN	Snowmass	59.5	13.1	28.0	6.84	-60.76
Pre-jointing	60	+ 2 gal SRN	Snowmass	59.0	13.7	31.5	37.39	-30.21
Jointing	60	+ 2 gal SRN	Snowmass	59.0	13.5	25.7	-8.91	-76.51
Boot	60	+ 2 gal SRN	Snowmass	59.5	11.3	26.3	-10.53	-78.13
Average		**+ 2 gal SRN**	**Snowmass**	**59.4**	**12.7**	**28.4**	**9.35**	**-58.25**
Test Average				**59.2**	**13.1**	**31.2**	**19.32**	**-33.44**

Income grain yield x $7.36/bu for Hatcher and $7.66/bu for Snowmass ($7.36/bu plus $0.30/bu premium).
Protein Premium: $0.02 per 0.2 % greater than 12% protein with an additional $0.05 added to both 13% and 13.5% protein levels.
Applied N cost $0.69/lb of N as 28-0-0; SRN (28-0-0) cost $7.10/gal; application cost $6.00/a.
Applied N Net Income is applied N income of protein premium and grain income minus N and application costs.

Table .-Split-Split Plot ANOVA of Grain Yield with N Timing as Main Plots and Wheat Varieties and Foliar SRN as Subplots.

Source	ANOVA SS	df	F	P	
Blocks	58.0810	1			
N Timing	23.4265	4	1.2232	0.4250	NS
Var	192.7210	1	28.0628	0.0032	**
Var x N Timing	3.9215	4	0.1428	0.9587	NS
SRN	0.0090	1	0.0026	0.9602	NS
SRN x N Timing	121.0985	4	8.8213	0.0026	**
SRN x Var	13.2250	1	3.8534	0.0780	NS
SRN x Var x N Timing	0.5675	4	0.0413	0.9962	NS

Dryland Millet and Wheat Rotation Study

Kevin Larson, Dennis Thompson, and Deborah Harn

This would have been the fourth year of harvest for our dryland millet and wheat rotation study. We established these rotations to identify which millet and wheat and fallow rotation sequence produces the highest net income. Each rotation represents different fallow length. We began this new dryland rotation study with these six rotations in 2006: 1) Wheat-Fallow (15-month fallow period), 2) Wheat-Wheat (3-month fallow period), 3) Millet-Millet (8-month fallow period), 4) Wheat-Millet-Fallow (23-month fallow period, 11 months between wheat harvest and millet planting, and 12 months between millet harvest and wheat planting), 5) Millet/Wheat-Fallow, (no fallow between millet harvest and wheat planting and 11 months between wheat harvest and millet planting), and 6) Wheat/Millet-Fallow (no fallow between wheat harvest and millet planting and 11 months between millet harvest and wheat planting).

Materials and Methods

This would have been our fourth harvest-year in testing the following rotations: Wheat-Fallow (W-F), Wheat-Wheat (W-W), Millet-Millet (M-M), Wheat-Millet-Fallow (W-M-F), Millet/Wheat-Fallow (M/W-F), and Wheat/Millet-Fallow (W/M-F). We planted wheat, Hatcher, at 50 lb/a on October 5, 2010. The soil was too dry to plant proso millet. We applied 50 lb N/a to the study site. Before planting we sprayed two applications of Glystar Plus at 24 oz/a, Banvel 4.0 oz/a, and LoVol 0.5 lb/a. For in-season weed control, we chose short-residual herbicides that should not interfere with crop rotations: wheat, Express 0.33 oz/a, LoVol 0.38 lb/a, and Penetrant II 8 oz/a; and fallow, Glystar Plus 24 oz/a, Banvel 4 oz/a and LoVol 0.5 lb/a two times. Since the millet was not planted, no in-crop herbicides were used, only fallow chemicals were used on the millet plots. We harvested the wheat with a self-propelled combine equipped with a digital scale on June 29, 2011. No millet was harvest (it was not planted). Grain yields for the wheat were adjusted to 12% moisture content. We recorded cost of production and yields in order to determine rotation revenues. There were no crops harvested in 2008 because of drought.

Results and Discussion

Wheat yields of the three highest rotations, W-F, W-M-F, and W/M-F, produced within 2.5 bu/a of one another, 26.1, 27.2, and 28.4 bu/a, respectively. The M/W-F rotation had the lowest yield, 0.6 bu/a, and the yield of the W-W rotation was intermediate between high and low yields, 15.0 bu/a. The rotations with the highest wheat yields, M-F, W-M-F, and W/M-F, had the highest variable net incomes, each above $150.00/a. The variable net income of the W-W rotation was intermediate with $78.46/a, while the M/W-F rotation had a net income loss of -$23.31/a. Because of the very dry season, the soil was too dry to plant millet.

We are still in the establishment phase with these rotations and we already have had crop failures and missed plantings, therefore rotational affects are, at best, difficult to generalize and quantify. This year, we had wheat production, but no millet production; therefore, we were able to plant and harvest only the wheat for in all phases of the rotations containing wheat. In 2010, there was sufficient precipitation to plant and harvest all wheat and millet crops in all rotations. The W-W rotation had the highest annual rotation variable net income in 2010. In 2009, adequate spring and summer moisture produced good yields for most crops with the wheat and millet producing similar yields. No crops were harvested in 2008 because of drought. Winter wheat performed better than millet in both yield and income in 2007. In 2007, it was too dry for the millet planted immediately after wheat harvest (millet in the W/M-F) to establish a stand. We missed planting wheat in the M/W-F rotation in 2008. In 2009, we did not plant millet in the W/M-F rotation because of delayed volunteer wheat control.

Table .-Dryland Millet and Wheat Rotation Study, Walsh, 2011.

Crop Rotation	Seeding Density	Seed Cost	Weed Control Cost	Yield	Crop Price	Gross Income	Variable Net Income
	lb/a	$/a	$/a	bu/a	$/a	$/a	$/a
Wheat	50	6.67	12.37	19.5	6.50	126.49	107.45
W-F	50	6.67	12.37	26.1	6.50	169.65	150.61
W-W	50	6.67	12.37	15.0	6.50	97.50	78.46
W-M-F	50	6.67	12.37	27.2	6.50	176.80	157.76
M/W-F	50	6.67	20.54	0.6	6.50	3.90	-23.31
W/M-F	50	6.67	12.37	28.4	6.50	184.60	165.56
Millet	0	0.00	0.00	0.0	0	0.00	0.00
M-M	0	0.00	0.00	0	0	0.00	0.00
W-M-F	0	0.00	0.00	0	0	0.00	0.00
M/W-F	0	0.00	0.00	0	0	0.00	0.00
W/M-F	0	0.00	0.00	0	0	0.00	0.00
Fallow	---	---	23.30	---	---	0.00	-23.30
Average			15.55			126.49	84.30

Planted: Millet, not planted; Wheat, Hatcher at 50 lb/a on October 5, 2010.
Harvested: Millet, not harvested; Wheat on July 17, 2011.
Wheat herbicides: Express 0.33 oz/a, 2,4-D, 0.38 lb/a; Wheat hericide cost: $6.87/a.
Millet herbicides: no in-crop herbicides (not planted).
Fallow herbicides: Gylstar Plus 24 oz/a, 2,4-D 0.5 lb/a, Banvel 4 oz/a;
Fallow herbicide cost: $12.30/a (two application, $6.15/a per application)
Wheat in M/W-F additional herbicide: Glystar 24 oz/a cost $2.67/a.
Millet in W/M-F herbicides: Glystar 24 oz/a, Atrazine 0.75 lb/a; W/M-F herbicide cost: $6.86/a.
Weed control cost is herbicide cost and $5.50/a application cost for each application.

Long-Term N Effects on Wheat-Sunflower-Fallow Rotation, Walsh, 2011

Kevin Larson, Dennis Thompson, and Deborah Harn

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

Materials and Methods: We planted wheat, Hatcher, at 50 lb seed/a on October 5, 2010, and sunflower on June 28, 2011 at 18,000 seeds/a using Mycogen 8H449 HO/DM. We banded liquid N (32-0-0) at 0, 30, 60, and 90 lb N/a to the treatment plots with two replications to both N and N residual sides on April 14, 2011 to the wheat. No N was applied to the sunflower this season because the sunflowers failed to establish a stand. We seedrow applied 5 gal/a of 10-34-0 (20 lb P_2O_5/a) at planting to the wheat, but not the sunflowers. For weed control in the wheat, we applied pre-emergence Glystar Plus 24 oz/a, Banvel 4.0 oz/a, and 2,4-D 0.5 lb/a and post emergence Express, 0.33 oz/a and 2,4-D, 0.38 lb/a. For weed control in the sunflower, we applied pre-emergence Glystar Plus 30 oz/a and Spartan 2 oz/a. We harvested two replications of the 20 ft. by 1100 ft. wheat plots on June 28 with a self-propelled combine and weighed them in a digital weigh cart. Wheat yields were adjusted to 12.0% seed moisture content. Because of the dry season, the sunflower crop failed and was not harvested.

Results: Wheat yields had slightly negative response to increasing N rates. The yields were flat and somewhat scattered. Yields declined at a rate of 1.1 bu per 30 lb N applied (R^2 = 0.326). The low coefficient of determination (R^2) indicates that the yields were flat and somewhat scattered. The 0 N rate had the highest grain yield, 19 bu/a. Wheat yields were low, averaging 17 bu/a. No sunflowers were harvested.

Discussion: This is the tenth harvest 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 sunflowers (Vigil and Bowman, 1998).

This year, the wheat had a slightly negative response to applied N. Only one time in ten years did the wheat positively respond to applied N. Since the wheat this year had a slightly negative response to applied N, applying N could not be justified. The lack of response of wheat yields to increasing N rates for nine out of ten years can be explained by sufficient residual N for the first year and low to average yields for the subsequent years. In 2007, there was sufficient winter moisture to produce very good wheat yields (over 50 bu/a), and in 2009 the wheat responded to N rates. However in 2009, this positive response to applied N was not economical. Generally, however, moisture has been the primary yield-limiting factor for this study, not N.

With the exception of 2007, we have reported no wheat yield response to N rates since establishing this wheat-sunflower-fallow rotation study. For nine out of ten years, wheat yields in this rotation were very low to average, 6 to 33 bu/a. The low to average wheat yields can be attributed to the lack of moisture remaining after sunflower extracted all available soil water and little soil water replenishment due to dry conditions during fallow.

This year no sunflowers were harvested because of drought. For most years of this study, sunflower yields increased with increasing N rates; however the yield response failed to offset the cost of the N fertilizer. The no N fertilizer treatment produced the highest income every year of sunflower production (there was no sunflower crop in 2002, 2008, and 2011 because of drought). This lack of N response suggests that N fertilizer is not needed for dryland sunflower production if the expected yield is 1200 lb/a or less.

Generally in previous years, we observed no response or a decline in oil content with increasing N rates. This negative correlation of oil content with N rate has been previously reported (Vigil and Bowman, 1998).

Literature Cited

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

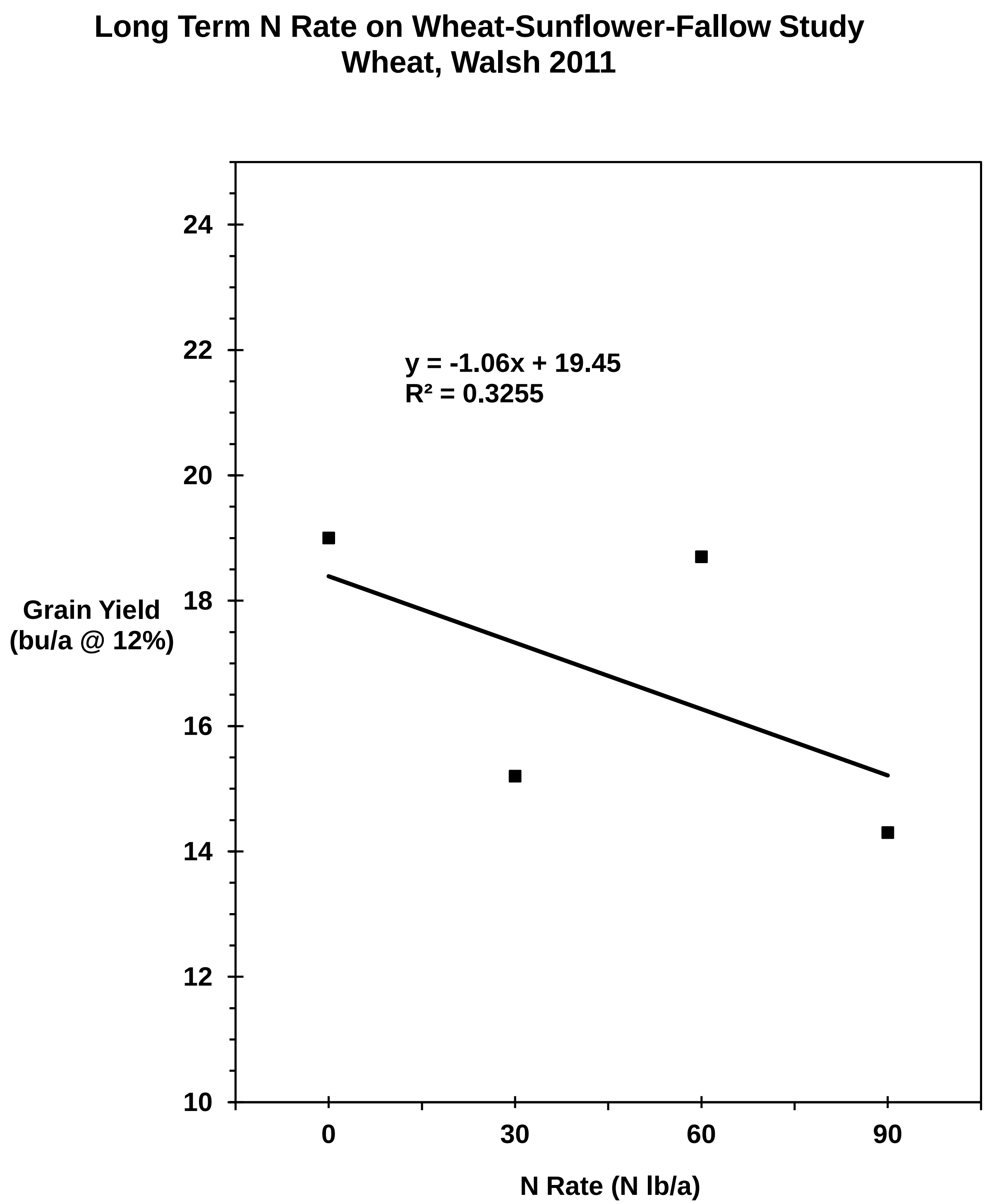


Fig. . N rates on dryland wheat in Wheat-Sunflower-Fallow rotation at Walsh. The N rates were 0, 30, 60, and 90 lb N/a as 32-0-0. The wheat variety was Hatcher sown at 50 lb/a.

Long-Term N Effects on Irrigated Sunflower-Corn Rotation, Walsh, 2011

K. Larson, D. Thompson, D. Harn, and B. Pettinger

Purpose: To study the long-term N fertilizer effects on irrigated Sunflower-Corn and Corn-Corn (continuous corn) rotations where N rates are applied to the same treatment site for multiple years.

Materials and Methods: All crop phases (corn and sunflower) of Sunflower-Corn and Corn-Corn rotations were planted each year. We planted corn, Mycogen 2D744, on May 6 at 24,500 seeds/a, and sunflower, Mycogen 8H449 HO/DM, on June 28 at 32,000 seeds/a. For our N treatments, we streamed liquid N (32-0-0) at 100, 150, or 200 lb/a with two replications. We seedrow applied 20 lb P_2O_5/a to the corn, but not the sunflowers. In addition to the seedrow applied P, the corn received 0.38 lb/a of Zn chelate. We disked the site prior to planting. For weed control, we applied pre-emergence Glystar Plus 24 oz/a, 0.5 lb/a of 2,4-D, and Banvel 4 oz/a to both the corn and sunflower plots. The corn also received pre-emergence Balance Pro 2.0 oz/a, Sharpen 3.0 oz/a, Atrazine 1.0 lb/a, and COC 16 oz/a. For postemergence weed control in the corn, we applied two applications of Glystar Plus at 30 oz/a and cultivated once. For weed control in the sunflower, we applied pre-emergence Spartan 2 oz/a. Because of dry planting conditions, we furrow irrigated the corn and sunflowers for seed germination and stand establishment. The corn produced good stands in all plots, but the sunflowers failed to emerge. The corn received approximately 23 in./a of drip irrigation. We harvested two replications of the 20 ft. by 650 ft. corn plots on October 24 with a self-propelled combine and weighed them in a digital weigh cart. Corn yields were adjusted to 15.5%. There was no sunflower crop to harvest.

Results and Discussion: The corn in Sunflower-Corn and continuous corn rotations produced a similar response to increasing N rates: they both increased linearly with increasing N rates. The results from past years showed the corn in the Sunflower-Corn rotation had no or little response to increasing N rates. However, this year the Sunflower-Corn rotation responded like the continuous corn rotation and required high rates of N for high grain yields. High rates of N for high yields would be the acceptable practice for corn production. Therefore, the increased yields with increasing N rates for the continuous corn and Sunflower-Corn rotations are not surprising.

There was no production from the sunflowers in this study because they did not emerge. We furrow irrigated the seeded beds of the sunflowers, and the seeds germinated, but the seedlings failed to emerge. By uncovering the germinated sunflower seeds, we found that the seedlings grew parallel to the soil surface but did not progress through the soil surface. The Southeast Colorado Area Agronomist, Wilma Trujillo, thought the emergence failure was due to high soil surface temperatures.

The recommended N fertilizer rates for our corn yield goal was 50 lb/a. Our yield goal for the corn was 175 bu/a, our actual average grain yield was 106 bu/a. The hot, dry season depressed corn yields, even though we applied 28% more water than we typically apply to this drip irrigated corn study.

Table .-Soil Analysis.

Depth	pH	Salts mmhos/cm	OM %	N	P	K	Zn	Fe	Mn	Cu
				----------	----------	----------	ppm	----------	----------	----------
0-8”	7.5	0.6	2.4	15	3.4	390	0.7	4.0	16.0	2.7
8-24”				13						

This is the sixth year of this long-term N on Sunflower-Corn rotation study. We started this study because of 1) the lack of N response for dryland sunflower in our long-term N on Wheat-Sunflower-Fallow study, 2) the role of N in reducing oil yield, and 3) reports from growers that their irrigated corn following sunflower often produced their highest yields. This year, the difference in average corn yield between the Sunflower-Corn and continuous corn rotations was 26 bu/a with the corn following sunflower producing higher yields than the continuous corn. Under dryland conditions, crop yields are often reduced following sunflower in the rotation. The yield reduction in the crop following sunflower is due to the deep and thorough extraction of the available water in the soil profile, leaving the subsequent crop with little soil water profile base. With irrigation, the dry soil profile left by sunflower is not a detriment since the soil profile can be refilled by irrigation. We think that the reason irrigated corn produces high yields following sunflower is the deep water extraction of sunflower loosening the soil and providing better root penetration by the corn.

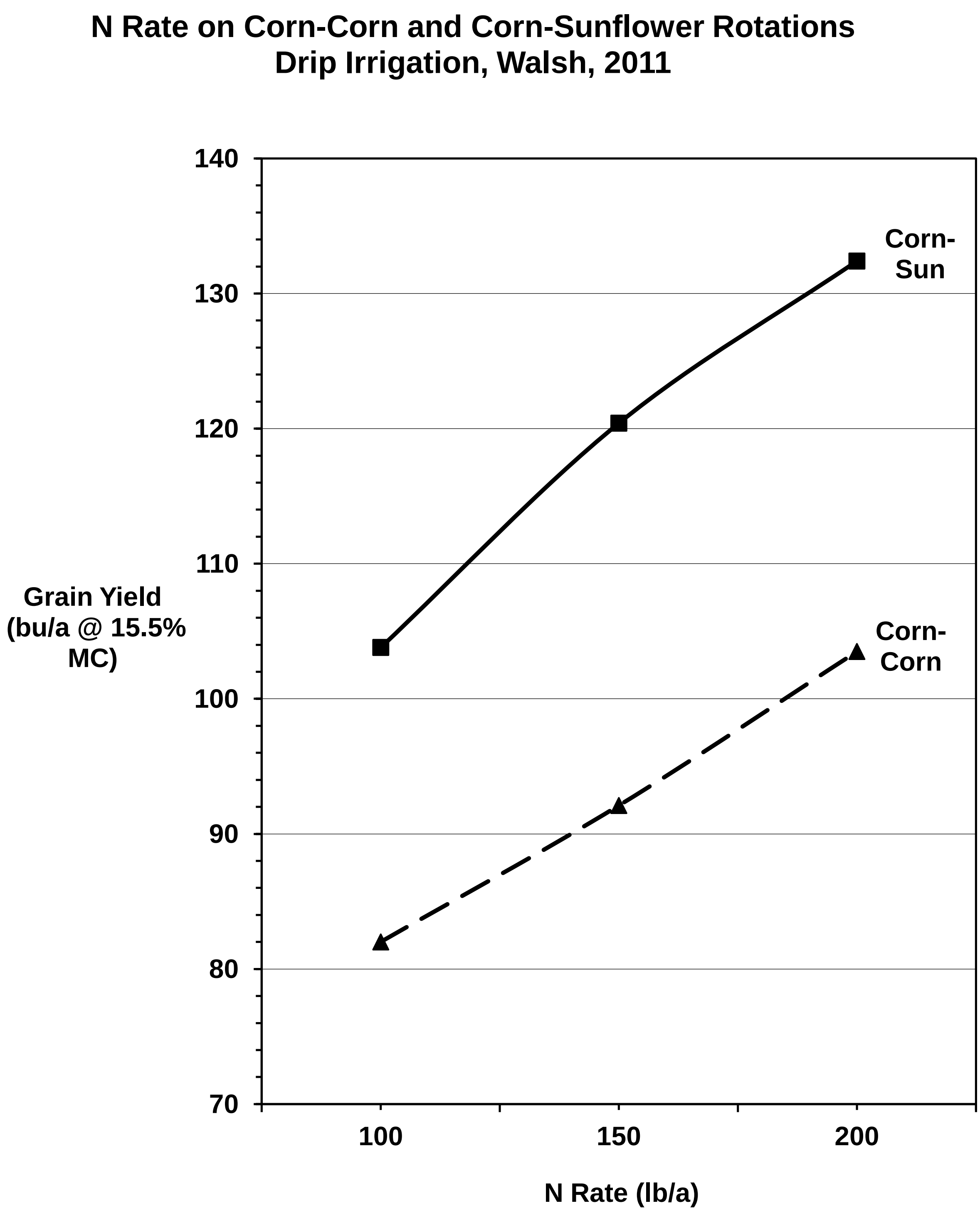


Fig. . N rate on drip irrigated sunflower and corn in Sunflower-Corn rotations at Walsh. The N rates were 100, 150, and 200 lb N/a as 32-0-0. The corn hybrid was MYCOGEN 2D744 planted at 24,500 seeds/a.

Limited Sprinkler Irrigation Corn Study at Walsh, 2011

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

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

RESULTS: Of the 16 hybrids tested, Triumph 1217x was the highest yielding hybrid with 189 bu/a. For this limited irrigation trial, we applied 22.5 in./a of water, which was much more irrigation than we typically apply due to the hot, dry conditions.

PLOT: Four rows with 30” row spacing, at least 600’ long. SEEDING DENSITY: 24,000 seeds/a. PLANTED: May 4. HARVESTED: November 24.

IRRIGATION: Fifteen sprinkler rotations applied 22.5 a-in/a of total water.

PEST CONTROL: Pre Herbicides: Balance 1.75 oz/a, Atrazine 1.0 lb/a, Sharpen 3.0 oz/a, Glystar Plus 28 oz/a; Post Herbicides: Roundup WeatherMax 24 oz/a, Banvel 6 oz/a. CULTIVATION: None. 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--------		
May	0.37	440	5	0	27
June	1.28	758	21	4	57
July	1.42	1021	30	20	88
August	0.75	973	29	10	119
September	0.32	539	8	2	149
October	1.01	237	1	0	173
Total	5.15	3968	94	36	168

\1 Growing season from May 4 (planting) to October 19 (first freeze, 30 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

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

COMMENTS: Planted in dry soil and irrigated up. Weed control was good. Well below normal precipitation for the growing season, May to September was hot and dry. The nonresistant corn borer hybrid had only light second-generation corn borer damage. Grain yields were very good especially considering the hot and dry growing conditions.

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

Summary: Soil Analysis from Sprinkler Site.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8”	7.6	0.9	2.1	39	2.5	391	0.8	4.5
8”-24”				25				
Comment	Alka	Vlo	Hi	VHi	VLo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization for Sprinkler Site.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------lb/a------------------			
Recommended	0	40	2	0
Applied	150	20	0.4	0

Yield Goal: 150 bu/a.
Actual Yield: 175 bu/a.

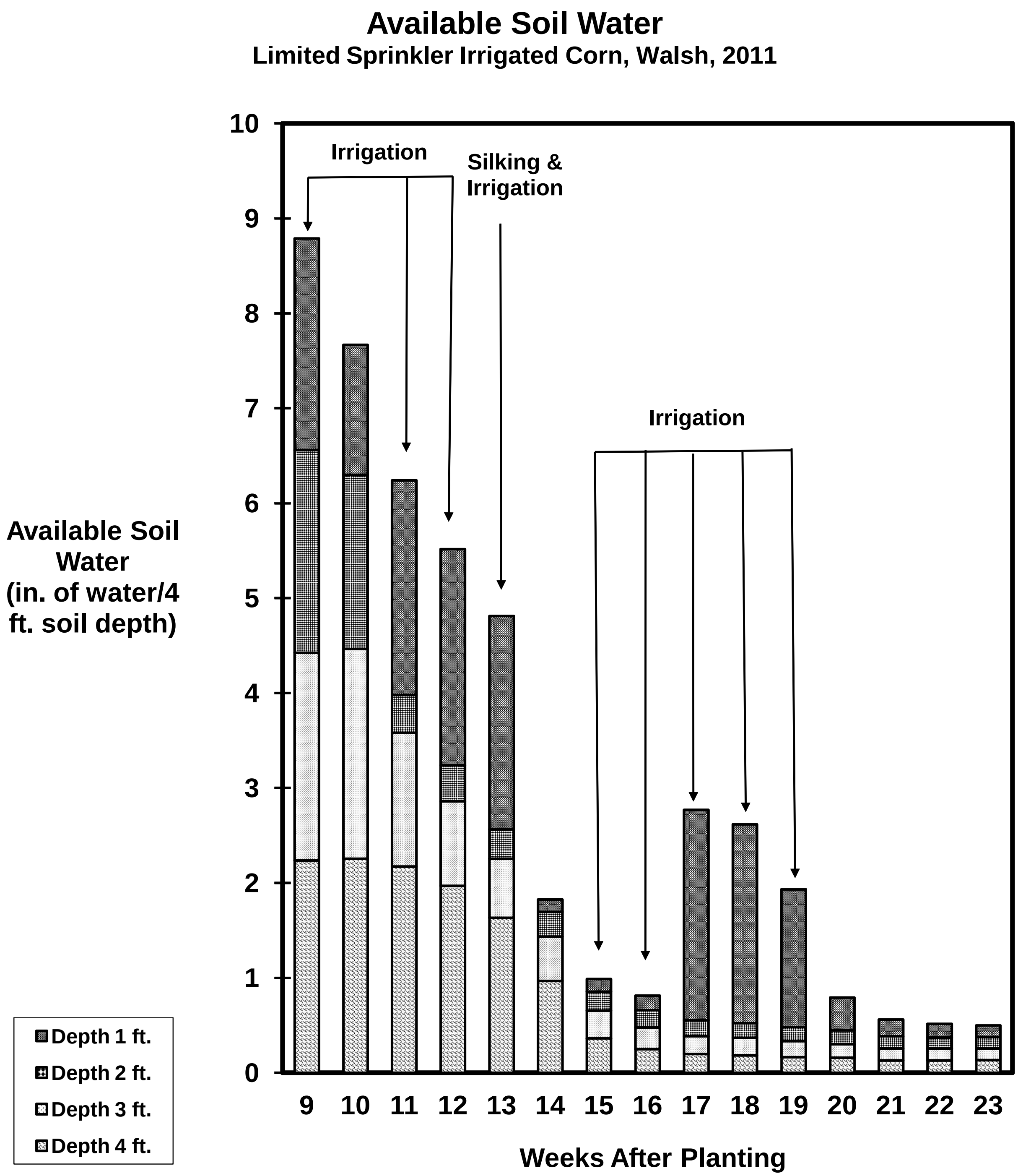


Fig. . Available soil water in limited sprinkler irrigation corn at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 5.15 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .Limited Sprinkler Irrigation Corn, Plainsman Research Center, 2011.

Firm	Hybrid	Grain Yield	Seed Moisture	Test Wt.	Ear Drop Loss	Ear Drop	Plant Density	50% Silking Date
		bu/a	%	lb/bu	bu/a	ears/a	plants/a (X 1000)	
TRIUMPH	1217X	189	17.2	58	1	100	22.6	28-Jul
GARST	83E90-3111	186	18.7	57	0	0	20.4	30-Jul
CHANNEL	214-14VT3P	186	16.9	59	1	100	22.4	28-Jul
CHANNEL	213-40VT3P	181	16.3	58	0	0	22.6	29-Jul
GARST	84U58-3111	181	16.7	57	0	0	20.6	29-Jul
CHANNEL	211-99VT3P	181	15.8	58	0	0	21.6	25-Jul
GARST	82H82-3111	179	19.2	59	2	300	21.8	29-Jul
TRIUMPH	1204S	176	16.5	58	4	500	21.8	28-Jul
TRIUMPH	1157X	174	16.0	57	0	0	21.4	28-Jul
MYCOGEN	2T806	174	18.1	58	1	100	20.8	28-Jul
GARST	83R38-3000GT	168	19.3	58	8	1000	21.6	29-Jul
MYCOGEN	2D772 (non Bt)	168	15.8	57	0	0	21.6	25-Jul
MYCOGEN	2T789	165	17.1	58	6	700	21.2	31-Jul
TRIUMPH	1334X	165	16.9	58	0	0	20.4	29-Jul
MYCOGEN	2H736	162	16.9	57	3	400	22.8	29-Jul
MYCOGEN	2D744	158	15.7	59	2	300	22.0	27-Jul
Average		175	17.1	58	2	219	21.6	28-Jul
LSD 0.20		5.8						

Planted: May 4; Harvested: October 24, 2011.
Ear Drop Loss was estimated using 0.45 lb of grain per ear.
Grain Yield adjusted to 15.5% moisture content.
Fifteen sprinkler rotations applied a total of 22.5 acre-in./acre of water.

Corn Borer Resistant and Nonresistant Hybrid Comparisons, Walsh, 2011

K. Larson, D. Thompson, D. Harn, B. Pettinger

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

RESULTS: Only the nonresistant corn borer hybrid displayed any second-generation corn borer damage and this lodging damage was very minor. A few corn borer resistant hybrids lodged, but their lodging was not due to second-generation corn borer damage. Grain yields were very good.

DISCUSSION: All 15 Bt hybrids tested showed excellent resistance to corn borer compared to the nonresistant hybrid. The nonresistant corn borer hybrid had 8% of plants lodged due to corn borer damage. This level of corn borer lodging is comparable to recent corn borer damage levels since Bt corn hybrids became widely accepted. The low level of corn borer damage may be attributable to our region's extensive use of corn borer resistant hybrids. Even with a few years of low corn borer levels, we still advocate the use of corn borer resistant hybrids. Nonetheless, if these low infestation levels continue, it may be economical to replace some acreage with less expensive nonresistant corn borer hybrids. Growers can monitor the corn borer infestation levels in their refuges to indicate if switching is warranted. Corn borer resistant Bt hybrids continue to be a very effective tool against corn borer damage. Therefore, to keep Bt hybrids effective in controlling corn borer, always remember to plant nonresistant hybrids as a mating refuge to help delay corn borer resistance to the Bt events.

We define limited sprinkler corn as receiving 10 inches or less of irrigation above normal precipitation. This year we applied 22.5 inches of irrigation. The growing season was extremely dry, but there was some soil water profile from the previous season's precipitation. If we did not have some soil water profile to start the season, our yields would have been much lower than we received.

Table .Limited Sprinkler Irrigated Corn, Corn Borer Ratings, Plainsman Research Center, 2011.

Firm	Hybrid	Grain Yield	Test Weight	Non 2nd Gen Ear Drop	2nd Gen Plant Lodging	Non 2nd Gen Plant Lodging	Plant Density	50% Silking Date
		bu/a	lb/bu	ears/a	plants/a	plants/a	plants/a (X 1000)	
TRIUMPH	1217X	189	58	100	0	0	22.6	28-Jul
GARST	83E90-3111	186	57	0	0	0	20.4	30-Jul
CHANNEL	214-14VT3P	186	59	100	0	0	22.4	28-Jul
CHANNEL	213-40VT3P	181	58	0	0	0	22.6	29-Jul
GARST	84U58-3111	181	57	0	0	0	20.6	29-Jul
CHANNEL	211-99VT3P	181	58	0	0	0	21.6	25-Jul
GARST	82H82-3111	179	59	300	0	0	21.8	29-Jul
TRIUMPH	1204S	176	58	500	0	0	21.8	28-Jul
TRIUMPH	1157X	174	57	0	0	0	21.4	28-Jul
MYCOGEN	2T806	174	58	100	0	0	20.8	28-Jul
GARST	83R38-3000GT	168	58	1000	0	0	21.6	29-Jul
MYCOGEN	2D772 (non Bt)	168	57	0	8	0	21.6	25-Jul
MYCOGEN	2T789	165	58	700	0	3	21.2	31-Jul
TRIUMPH	1334X	165	58	0	0	0	20.4	29-Jul
MYCOGEN	2H736	162	57	400	0	3	22.8	29-Jul
MYCOGEN	2D744	158	59	300	0	3	22.0	27-Jul
Average		175	58	219	1	1	21.6	28-Jul
LSD 0.05		5.8			1.9	3.3		

Planted: May 4; Harvested: October 24, 2011.
Grain Yield adjusted to 15.5% moisture content.
Fifteen sprinkler rotations applied a total of 22.5 acre-in./acre of water.

Limited Sprinkler Irrigation Grain Sorghum Study at Walsh, 2011

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, Syngenta H-390W, produced 99 bu/a. The lowest yielding hybrid, Triumph TRX00464, produced 63 bu/a and had the lowest test weight of 58 lb/bu.

PLOT: Four rows with 30” row spacing, at least 600’ long. SEEDING DENSITY: 82,000 seeds/a. PLANTED: June 3. HARVESTED: November 17 and 18.

IRRIGATION: Eight sprinkler rotations applied 12 acre-in/a of total water.

PEST CONTROL: Preemergence Herbicides: Glyphosate 28 oz/a, Sharpen 3.0 oz/a; Post Herbicides: Atrazine 1.0 lb/a, Banvel 4 oz/a, COC 1.0 qt/a. CULTIVATION: Once. INSECTICIDE: None.
FIELD HISTORY: Last Crop: Corn. FIELD PREPARATION: Sweep plow.

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

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
June	1.12	682	21	4	27
July	1.42	1021	30	20	58
August	0.75	973	29	10	89
September	0.32	539	8	2	119
October	1.01	237	1	0	138
Total	4.62	3452	89	36	138

\1 Growing season from June 3 (planting) to October 19 (first freeze, 30 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in dry soil and irrigated up. Weed control was good. Much below normal precipitation for the growing season, June to September was hot and dry. All the hybrids fully matured because of the warm season. Grain yields were good especially considering the hot and dry growing conditions.

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”	7.6	0.8	2.1	24	3.7	373	0.8	4.2
8”-24”				15				
Comment	Alka	Vlo	Hi	Hi	Lo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------lb/a------------------			
Recommended	0	20	0	0
Applied	100	20	0.3	0

Yield Goal: 90 bu/a.
Actual Yield: 80 bu/a.

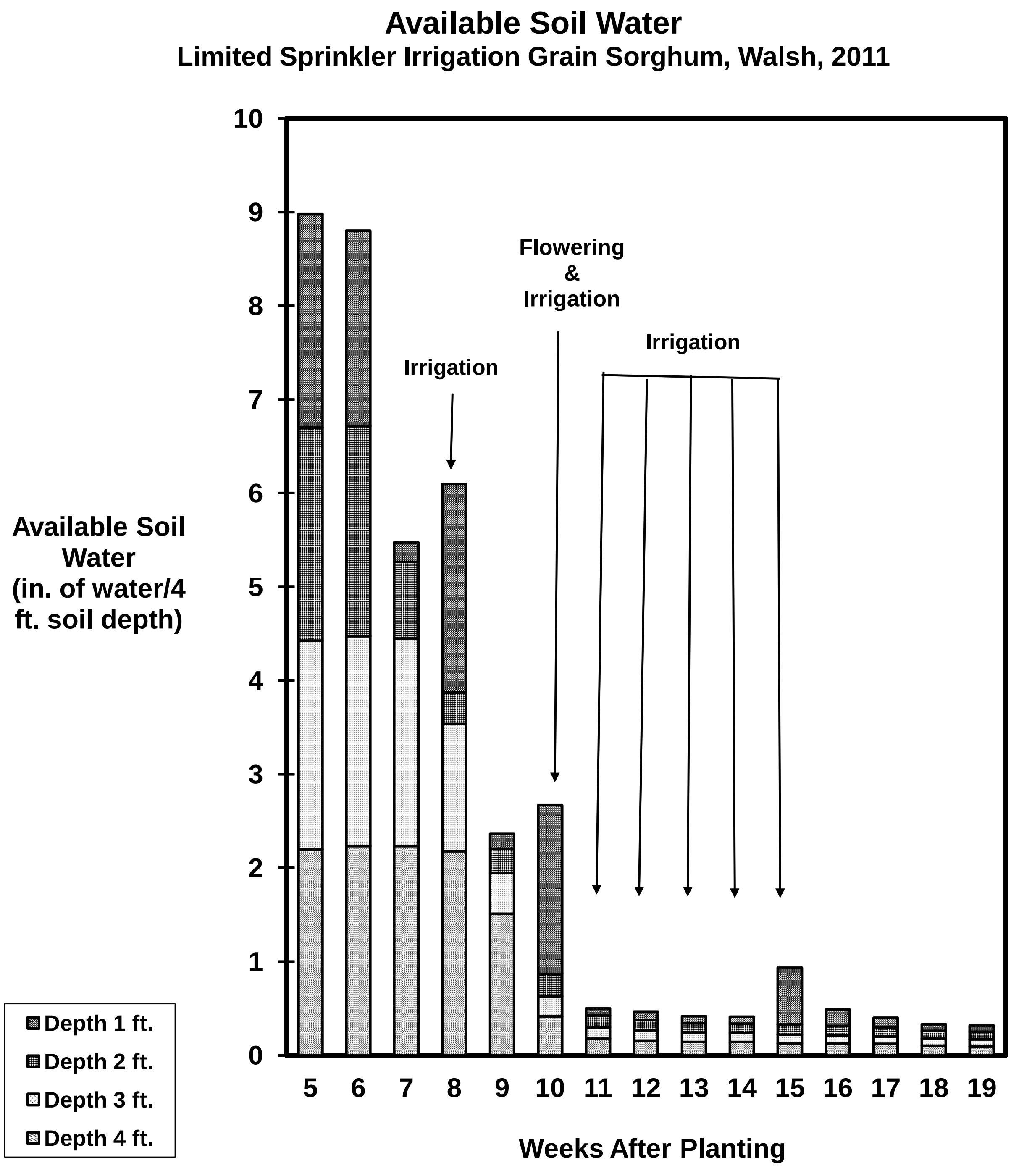


Fig. . Available soil water in limited sprinkler irrigation grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 4.62 in. Any increase in available soil water between weeks not attributed to applied irrigation is from rain.

Table .Limited Sprinkler Irrigation Grain Sorghum, Plainsman Research Center, Walsh, 2011.

Brand	Hybrid	Grain Yield	Seed Moisture Content	Test Weight	Plant Density	Plant Height	50% Flowering Date	50% Maturity Date
		bu/a	%	lb/bu	plants/a (1000X)	in		
SYNGENTA	H-390W	99	12.6	59	48.1	38	8/15	9/25
CHANNEL	MSI 280 SP	92	13.1	62	53.3	41	8/18	9/28
CHANNEL	NC+ 6B50	88	12.9	60	54.5	42	8/17	9/27
TRIUMPH	TR448	87	12.9	61	47.7	40	8/17	9/27
CHANNEL	NC+ 6B85	84	12.9	61	58.5	46	8/20	10/2
MYCOGEN	M3838	84	12.8	61	46.1	40	8/17	9/27
TRIUMPH	TRX03473	83	12.8	61	50.9	42	8/18	9/27
MYCOGEN	627	82	12.8	60	54.9	41	8/16	9/24
SYNGENTA	5613	76	13.0	63	51.7	42	8/14	9/21
TRIUMPH	TR424	73	12.8	62	55.3	37	8/3	9/11
SYNGENTA	5875	68	12.4	59	50.1	34	8/2	9/9
SYNGENTA	5745	67	12.6	60	60.1	43	8/12	9/19
TRIUMPH	TRX00464	63	12.2	58	54.1	35	8/4	9/10
Average		80	12.8	61	52.7	40	8/13	9/22
LSD 0.20		6.9						

Planted: June 3; Harvested: November 17 and 18, 2011.
50% Flowering Date: minimum date on which a hybrid flowers on half of its population.
50% Maturity Date or maturation of seed at first freeze.
Seed Maturation: LM, late milk; ED, early dough, SD, soft dough; HD, hard dough; mature (date).
The limited sprinkler irrigation grain sorghum received 12 acre-in of applied water.
Yields are adjusted to 14.0% seed moisture content.

Weed Control Efficacy of Huskie in Grain Sorghum at Walsh, 2011

COOPERATORS: Bayer CropScience; Kevin Larson, Plainsman Research Center, Walsh, Colorado.

PURPOSE: To evaluate Huskie for post emergence weed control in grain sorghum.
RESULTS: Huskie treatments provided 92% to 100% control of pigweed, kochia, and devil's claw compared to the untreated control. Huskie treatments caused slight crop injury (bleaching of leaves) but grew out of it in 3 weeks. There was no significant yield difference between the Huskie treatments and the untreated control.

PLOT: Four rows with 30" row spacing, 50 ft. long with 3 replications. SEEDING DENSITY: 40,000 seeds/a. PLANTED: June 9. HYBRID: Mycogen 627. HARVESTED: November 4, 2011.

IRRIGATION: The site was furrow irrigated up for stand establishment. No additional irrigation was applied.

SITE PEST CONTROL: CULTIVATION: Twice. INSECTICIDE: None.

TREATMENT APPLICATION: Backpack CO_2 sprayer at 20 psi and 20 gal/a. All treatments applied July 15, grain sorghum 14 in. tall with 8 leaves.
FIELD HISTORY: Last Crop: Wheat. FIELD PREPARATION: No-till.

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

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------No. of Days--------		
June	1.11	523	21	4	21
July	1.42	1021	30	20	52
August	0.75	973	29	10	83
September	0.32	539	8	2	113
October	1.01	237	1	0	132
Total	4.61	3293	89	36	132

\1 Growing season from May 27 (planting) to October 19 (first freeze, 30 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in dry soil moisture and furrow irrigated for stand establishment. Huskie performed well on all broadleaf weeds present: pigweed, kochia, and devil's claw. Very dry growing season, well below normal precipitation. Grain yields were poor to fair and variable due to dry weather and extensive sandbur infestation.

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"	7.6	0.9	5.2	20	4.3	425	0.7	4.0
8"-24"				15				
Comment	Alka	VLo	VHi	Hi	Lo	VHi	Lo	Marg

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: 24 bu/a.

Table .--Huskie on Grain Sorghum, Crop Injury, Plainsman, Walsh, 2011.

Treatment	AI Conc.	Product Dosage	Dosage Unit	5 DAT Crop Injury %	21 DAT Crop Injury %
1 Untreated				0	0
2 Huskie	256.875	13	oz/a	7	0
2 Atrazine	480	1	pt/a		
2 Ammonium Sulfate	21	1	lb/a		
3 Huskie	256.875	16	oz/a	8	0
3 Atrazine	480	1	pt/a		
3 Ammonium Sulfate	21	1	lb/a		
4 Huskie	256.875	13	oz/a	7	0
4 Atrazine	480	1	pt/a		
4 2,4-D Ester	480	4	oz/a		
4 Ammonium Sulfate	21	1	lb/a		
5 Huskie	256.875	13	oz/a	8	0
5 Atrazine	480	1	pt/a		
5 Banvel	480	4	oz/a		
5 Ammonium Sulfate	21	1	lb/a		
6 Atrazine	480	1	pt/a	7	0
6 Bucktril 2EC	240	1	pt/a		
7 Atrazine	480	1.5	pt/a	9	0
7 Banvel	480	4	oz/a		
7 Crop Oil		1	qt/a		
8 Atrazine	480	1.5	pt/a	10	0
8 2,4-D Ester	480	4	oz/a		
8 Crop Oil		1	qt/a		
Average				7	0
LSD 0.05				1.8	

Planted: June 2, 2011, grain sorghum hybrid Mycogen 627 at 40,000 seeds/a. Treatments applied: July 15, 2011, 10 ft. by 50 ft. with 3 replications. Grain sorghum: 8 leaves, 14 in. tall; pigweed: 6 in. tall, 4% coverage; kochia: 5 in. tall, 6% coverage; devil's claw: 6 in. tall, 8% coverage; sandbur: 4 in. tall, 50% coverage.

Table .--Huskie Post Pigweed Control on Grain Sorghum, Plainsman, Walsh, 2011.

Treatment	AI Conc.	Product Dosage	Dosage Unit	10 DAT PW Control %	14 DAT PW Control %	35 DAT PW Control %
1 Untreated				0	0	0
2 Huskie	256.875	13	oz/a	96	100	100
2 Atrazine	480	1	pt/a			
2 Ammonium Sulfate	21	1	lb/a			
3 Huskie	256.875	16	oz/a	98	99	100
3 Atrazine	480	1	pt/a			
3 Ammonium Sulfate	21	1	lb/a			
4 Huskie	256.875	13	oz/a	98	97	100
4 Atrazine	480	1	pt/a			
4 2,4-D Ester	480	4	oz/a			
4 Ammonium Sulfate	21	1	lb/a			
5 Huskie	256.875	13	oz/a	97	100	100
5 Atrazine	480	1	pt/a			
5 Banvel	480	4	oz/a			
5 Ammonium Sulfate	21	1	lb/a			
6 Atrazine	480	1	pt/a	82	80	57
6 Bucktril 2EC	240	1	pt/a			
7 Atrazine	480	1.5	pt/a	70	73	73
7 Banvel	480	4	oz/a			
7 Crop Oil		1	qt/a			
8 Atrazine	480	1.5	pt/a	83	83	80
8 2,4-D Ester	480	4	oz/a			
8 Crop Oil		1	qt/a			
Average				78	79	76
LSD 0.05				5.2	16.9	36.7

Planted: June 2, 2011, grain sorghum hybrid Mycogen 627 at 40,000 seeds/a. Treatments applied: July 15, 2011, 10 ft. by 50 ft. with 3 replications. Grain sorghum: 8 leaves, 14 in. tall; pigweed: 6 in. tall, 4% coverage; kochia: 5 in. tall, 6% coverage; devil's claw: 6 in. tall, 8% coverage; sandbur: 4 in. tall, 50% coverage.

Table .--Huskie Post Kochia Control on Grain Sorghum, Plainsman, Walsh, 2011.

Treatment	AI Conc.	Product Dosage	Dosage Unit	10 DAT K Control %	14 DAT K Control %	35 DAT K Control %
1 Untreated				0	0	0
2 Huskie	256.875	13	oz/a	92	97	98
2 Atrazine	480	1	pt/a			
2 Ammonium Sulfate	21	1	lb/a			
3 Huskie	256.875	16	oz/a	95	100	100
3 Atrazine	480	1	pt/a			
3 Ammonium Sulfate	21	1	lb/a			
4 Huskie	256.875	13	oz/a	93	97	93
4 Atrazine	480	1	pt/a			
4 2,4-D Ester	480	4	oz/a			
4 Ammonium Sulfate	21	1	lb/a			
5 Huskie	256.875	13	oz/a	100	100	100
5 Atrazine	480	1	pt/a			
5 Banvel	480	4	oz/a			
5 Ammonium Sulfate	21	1	lb/a			
6 Atrazine	480	1	pt/a	83	83	77
6 Bucktril 2EC	240	1	pt/a			
7 Atrazine	480	1.5	pt/a	65	60	50
7 Banvel	480	4	oz/a			
7 Crop Oil		1	qt/a			
8 Atrazine	480	1.5	pt/a	62	87	40
8 2,4-D Ester	480	4	oz/a			
8 Crop Oil		1	qt/a			
Average				74	78	70
LSD 0.05				29.9	30.2	35.5

Planted: June 2, 2011, grain sorghum hybrid Mycogen 627 at 40,000 seeds/a. Treatments applied: July 15, 2011, 10 ft. by 50 ft. with 3 replications. Grain sorghum: 8 leaves, 14 in. tall; pigweed: 6 in. tall, 4% coverage; kochia: 5 in. tall, 6% coverage; devil's claw: 6 in. tall, 8% coverage; sandbur: 4 in. tall, 50% coverage.

Table .--Huskie Post Devil's Claw Control on Grain Sorghum, Plainsman, Walsh, 2011.

Treatment	AI Conc.	Product Dosage	Dosage Unit	10 DAT DC Control %	14 DAT DC Control %	35 DAT DC Control %
1 Untreated				0	0	0
2 Huskie	256.875	13	oz/a	100	100	98
2 Atrazine	480	1	pt/a			
2 Ammonium Sulfate	21	1	lb/a			
3 Huskie	256.875	16	oz/a	100	100	100
3 Atrazine	480	1	pt/a			
3 Ammonium Sulfate	21	1	lb/a			
4 Huskie	256.875	13	oz/a	100	100	100
4 Atrazine	480	1	pt/a			
4 2,4-D Ester	480	4	oz/a			
4 Ammonium Sulfate	21	1	lb/a			
5 Huskie	256.875	13	oz/a	100	100	100
5 Atrazine	480	1	pt/a			
5 Banvel	480	4	oz/a			
5 Ammonium Sulfate	21	1	lb/a			
6 Atrazine	480	1	pt/a	65	53	27
6 Bucktril 2EC	240	1	pt/a			
7 Atrazine	480	1.5	pt/a	93	90	63
7 Banvel	480	4	oz/a			
7 Crop Oil		1	qt/a			
8 Atrazine	480	1.5	pt/a	97	93	88
8 2,4-D Ester	480	4	oz/a			
8 Crop Oil		1	qt/a			
Average				82	80	72
LSD 0.05				8.1	9.1	22.0

Planted: June 2, 2011, grain sorghum hybrid Mycogen 627 at 40,000 seeds/a.
Treatments applied: July 15, 2011, 10 ft. by 50 ft. with 3 replications. Grain sorghum: 8 leaves, 14 in. tall; pigweed: 6 in. tall, 4% coverage; kochia: 5 in. tall, 6% coverage; devil's claw: 6 in. tall, 8% coverage; sandbur: 4 in. tall, 50% coverage.

Table .--Huskie Post Sandbur Control on Grain Sorghum, Plainsman, Walsh, 2011.

Treatment	AI Conc.	Product Dosage	Dosage Unit	10 DAT SB Control %	14 DAT SB Control %	35 DAT SB Control %
1 Untreated				0	0	0
2 Huskie	256.875	13	oz/a	27	0	0
2 Atrazine	480	1	pt/a			
2 Ammonium Sulfate	21	1	lb/a			
3 Huskie	256.875	16	oz/a	35	0	0
3 Atrazine	480	1	pt/a			
3 Ammonium Sulfate	21	1	lb/a			
4 Huskie	256.875	13	oz/a	35	0	0
4 Atrazine	480	1	pt/a			
4 2,4-D Ester	480	4	oz/a			
4 Ammonium Sulfate	21	1	lb/a			
5 Huskie	256.875	13	oz/a	28	0	0
5 Atrazine	480	1	pt/a			
5 Banvel	480	4	oz/a			
5 Ammonium Sulfate	21	1	lb/a			
6 Atrazine	480	1	pt/a	0	0	0
6 Bucktril 2EC	240	1	pt/a			
7 Atrazine	480	1.5	pt/a	0	0	0
7 Banvel	480	4	oz/a			
7 Crop Oil		1	qt/a			
8 Atrazine	480	1.5	pt/a	0	0	0
8 2,4-D Ester	480	4	oz/a			
8 Crop Oil		1	qt/a			
Average				16	0	0
LSD 0.05				12.8		

Planted: June 2, 2011, grain sorghum hybrid Mycogen 627 at 40,000 seeds/a.
Treatments applied: July 15, 2011, 10 ft. by 50 ft. with 3 replications. Grain sorghum: 8 leaves, 14 in. tall; pigweed: 6 in. tall, 4% coverage; kochia: 5 in. tall, 6% coverage; devil's claw: 6 in. tall, 8% coverage; sandbur: 4 in. tall, 50% coverage.

Table .--Huskie on Grain Sorghum, Grain Yield and Test Weight,
Plainsman Research Center, Walsh, Colorado, 2011.

Treatment	AI Conc.	Product Dosage	Dosage Unit	Test Weight lb/bu	Grain Yield bu/a
1 Untreated				57	20.5
2 Huskie	256.875	13	oz/a	55	26.7
2 Atrazine	480	1	pt/a		
2 Ammonium Sulfate	21	1	lb/a		
3 Huskie	256.875	16	oz/a	58	26.9
3 Atrazine	480	1	pt/a		
3 Ammonium Sulfate	21	1	lb/a		
4 Huskie	256.875	13	oz/a	57	29.1
4 Atrazine	480	1	pt/a		
4 2,4-D Ester	480	4	oz/a		
4 Ammonium Sulfate	21	1	lb/a		
5 Huskie	256.875	13	oz/a	54	18.7
5 Atrazine	480	1	pt/a		
5 Banvel	480	4	oz/a		
5 Ammonium Sulfate	21	1	lb/a		
6 Atrazine	480	1	pt/a	56	25.4
6 Bucktril 2EC	240	1	pt/a		
7 Atrazine	480	1.5	pt/a	56	25.9
7 Banvel	480	4	oz/a		
7 Crop Oil		1	qt/a		
8 Atrazine	480	1.5	pt/a	55	20.1
8 2,4-D Ester	480	4	oz/a		
8 Crop Oil		1	qt/a		
Average				56	24.2
LSD 0.05					12.79

Planted: June 2, 2011, grain sorghum hybrid Mycogen 627 at 40,000 seeds/a. Treatments applied: July 15, 2011, 10 ft. by 50 ft. with 3 replications. Grain sorghum: 8 leaves, 14 in. tall; pigweed: 6 in. tall, 4% coverage; kochia: 5 in. tall, 6% coverage; devil's claw: 6 in. tall, 8% coverage; sandbur: 4 in. tall, 50% coverage.

Dryland Grain Sorghum Seeding Rate and Seed Maturation, Brandon, 2011

Kevin Larson, Dennis Thompson and Brett Pettinger

In Eastern Colorado, dryland seeding rates vary greatly from 20,000 to 60,000 seeds/a. Lower seeding rates are typically used in the extreme southeastern part of the state where the growing season is longer, and higher seeding rates are used northward where the growing season is shorter. With lower seeding rates, abundant tillering is expected, whereas with higher seeding rates single headed plants are desired. We have observed that the main head on a sorghum plant matures earlier and more uniformly than its tillers. To determine if there are yield and maturation benefits from increased seeding rates at a short season site, we tested a wide range of seeding rates using an early maturing and a medium early maturing grain sorghum hybrid.

Materials and Methods

The six seeding rates we tested were 20, 30, 40, 50, 60, and 70 seeds/a X 1000. We planted on June 2 with a four-row cone planter on 30 in. row spacing. The early maturing grain sorghum hybrid was Mycogen 1G557 and the medium early grain sorghum hybrid was Mycogen M3838. The site was fertilized with 90 lb N/a and 5 gal/a 10-24-0, 6 S, 0.1 Zn. Weed control was achieved with pre and post emergence herbicides (pre, glyphosate 32 oz/a, Dual 1.33 pts/a, atrazine 0.9 lb/a; post, 2,4-D amine 0.5 lb/a applied with drops). We harvested the study on November 1 with a self-propelled combine equipped with a digital scale. Grain yields were adjusted to 14% moisture content.

Results and Discussion

The highest seed rate (70,000 seeds/a) produced about 22,000 seeds/a for both the early and the medium early hybrids tested. Because of very low plant stands, no optimum seeding rate was achieved. The yield response from increasing seeding rate was linear for both the early and medium early hybrids. Nonetheless, time to maturation was shortened with increased seeding rates for the early maturing hybrid. For each 10,000 seeds/a increment, between 20,000 and 70,000 seeds/a, maturation time was shortened by approximately one day. Because of the low plant densities, it is surprising that the early maturing hybrid responded with abbreviated time to maturation. With low plant densities, tillering would not be significantly reduced and there would be few single headed plants.

This shortened time to maturation response to increasing seeding rate was true for the early maturing hybrid, but not the medium early maturing hybrid. Time to maturation was flat for the medium early hybrid at the higher seeding rates, and the hybrid did not fully mature for the lower seeding rates. This differential in seed maturation indicates a shift in time to maturation; however, the high test weights suggest that all seeding rates fully matured. For this study, the high test weights of the medium early hybrid may be incorrect. The high test weights for the medium early hybrid may be due to sampling error caused by low plot weights, resulting in insufficient volume for the combine to cleanly separate seed samples. Regardless of test weight indications, the medium early hybrid was less responsive to seeding rates shortening time to maturation than the early maturing hybrid.

Table .-Dryland Grain Sorghum Seeding Rate Study at Brandon, 2011.

Seeding Rate	Plant Density	Flowering Date	Maturation Date	Plant Height	Plant Lodging	Test Weight	Grain Yield
seeds/a (X1000)	plants/a (X1000)			In	%	lb/bu	bu/a
Early Maturing Hybrid							
20	6.9	8/16	9/26	31	5.8	59	12.8
30	8.6	8/15	9/26	32	3.5	58	13.5
40	12.2	8/14	9/25	29	8.3	58	18.3
50	14.9	8/13	9/23	31	5.0	58	19.4
60	18.5	8/12	9/22	32	3.5	58	22.9
70	22.2	8/12	9/21	29	7.8	57	22.3
Early Average	13.9	8/7	9/24	31	5.7	58	18.2
Medium Early Maturing Hybrid							
20	6.5	8/31	HD	29	0.8	57	3.2
30	9.9	8/31	HD	34	0.3	58	3.4
40	11.1	8/30	10/11	36	0.3	58	4.6
50	13.5	8/30	10/11	33	0.3	57	6.1
60	17.9	8/29	10/11	32	0.5	56	8.2
70	21.6	8/29	10/11	32	1.3	56	6.2
Medium Early Average	13.4	8/7	10/11	33	0.6	57	5.3

Planted: June 2; Harvested: November 1, 2011.
Early Maturing Hybrid: Mycogen 1G557.
Medium Early Hybrid: Mycogen M3838.
Grain yields were adjusted to 14% seed moisture content.

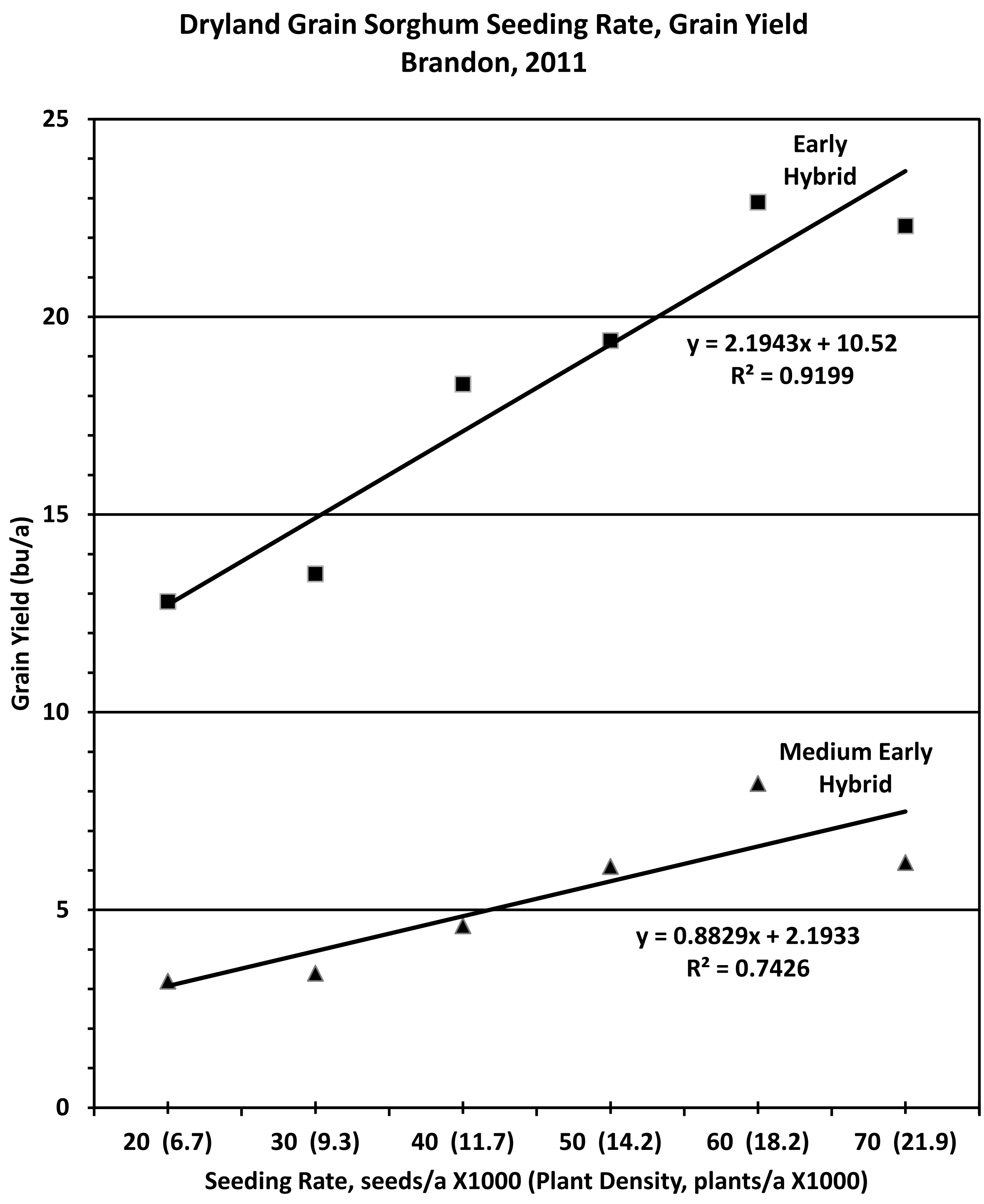


Fig. 1. Grain yield of dryland grain sorghum seeding rate study at Brandon. Seeding rates were 20, 30, 40, 50, 60, and 70 seeds/a X1000. The early maturing hybrid was Mycogen 1G557 and the medium early maturing hybrid was Mycogen M3838 planted on June 2, 2011.

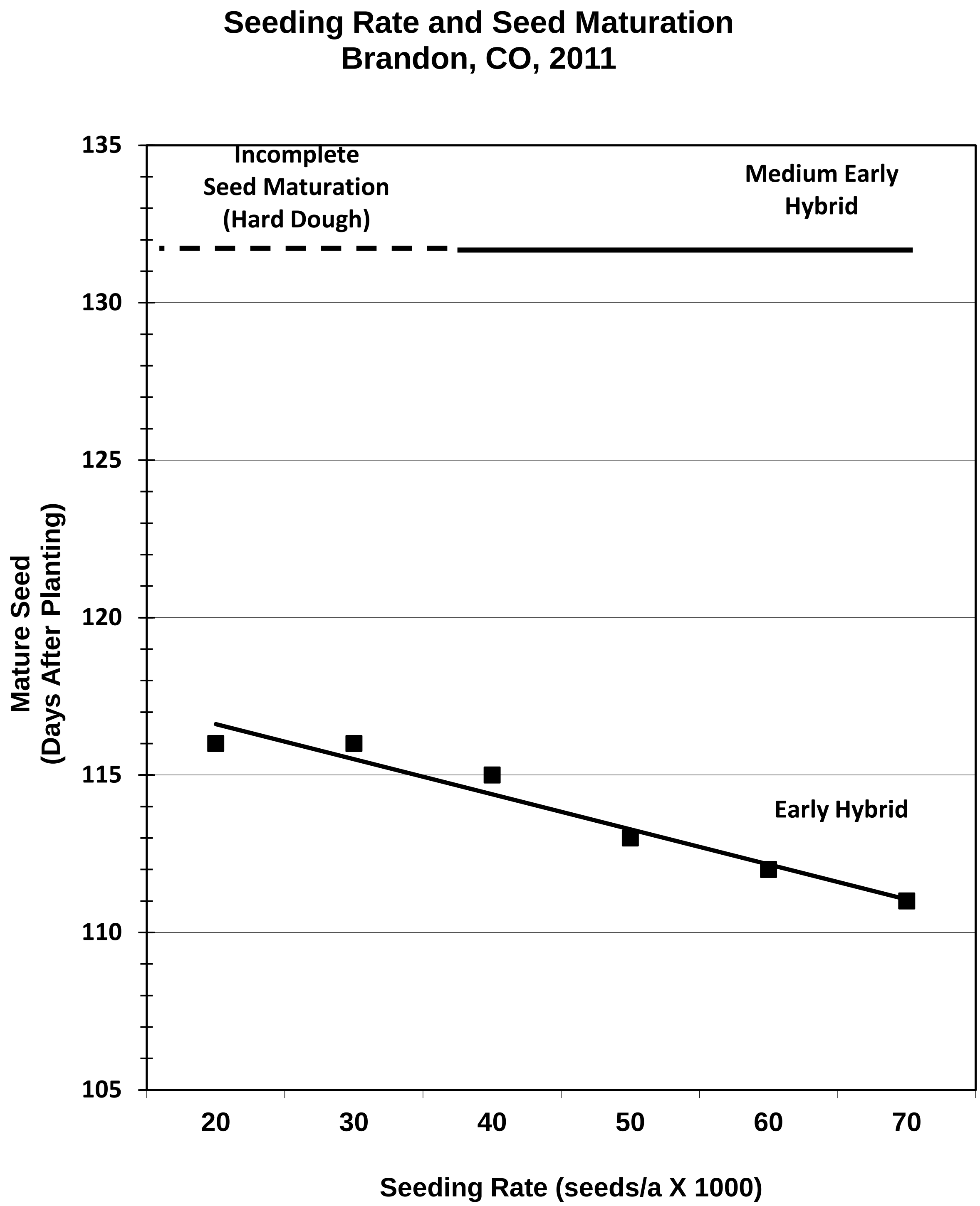


Fig. 2. Dryland grain sorghum seeding rate and days to seed maturation at Brandon. The seeding rates were 20, 30, 40, 50, 60, and 70 seeds/a (X1000). The early maturing grain sorghum hybrid was Mycogen 1G557 and the medium early grain sorghum hybrid was Mycogen M3838 planted June 2, 2011.

Dryland Grain Sorghum Hybrid Performance Trial at Brandon, 2011

COOPERATORS: Burl Scherler, Sand Creek, Inc., Brandon, Colorado, and Kevin Larson, Superintendent, Plainsman Research Center, Walsh, Colorado.

PURPOSE: To identify high yielding hybrids under dryland conditions with 3100 sorghum heat units in Silty Loam soil.

PLOT: Four rows with 30” row spacing, 50’ long. SEEDING DENSITY: 43,600 seed/a. PLANTED: June 2. HARVESTED: October 31 and November 1.

WEED CONTROL: Preemergence Herbicides: Glyphosate 32 oz/a, Atrazine 0.9 lb/a, Dual 21 oz/a. Post Emergence Herbicides: 2,4-D amine (with drops). CULTIVATION: None. INSECTICIDES: None.

Summary: Growing Season Precipitation and Temperature \1 Chivington, Kiowa County.

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------no. of days--------		
June	2.39	657	17	6	28
July	3.15	931	29	13	59
August	1.94	854	26	7	90
September	0.70	477	5	1	120
October	0.16	149	2	0	130
Total	8.34	3068	79	27	130

\1 Growing season from June 2 (planting) to October 10 (first freeze, 29 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

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

COMMENTS: Planted in good soil moisture. Weed control was good. Near normal precipitation for the growing season, however, September was dry. No greenbug infestation. Yields and test weights were fair. Because of the dry weather late in the season, later maturing hybrids did not fully mature and subsequently had low test weights and poor yields.

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

Summary: Soil Analysis of Plant Available Nutrients.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8”	7.5	0.6	1.9	10	5.6	467	0.6	3.5
8”-24”				11				
Comment	Alka	VLo	Hi	Mod	Lo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------lb/a------------------			
Recommended	0	20	0	0
Applied	90	20	0	0

Yield Goal: 45 bu/a.
Actual Yield: 16 bu/a.

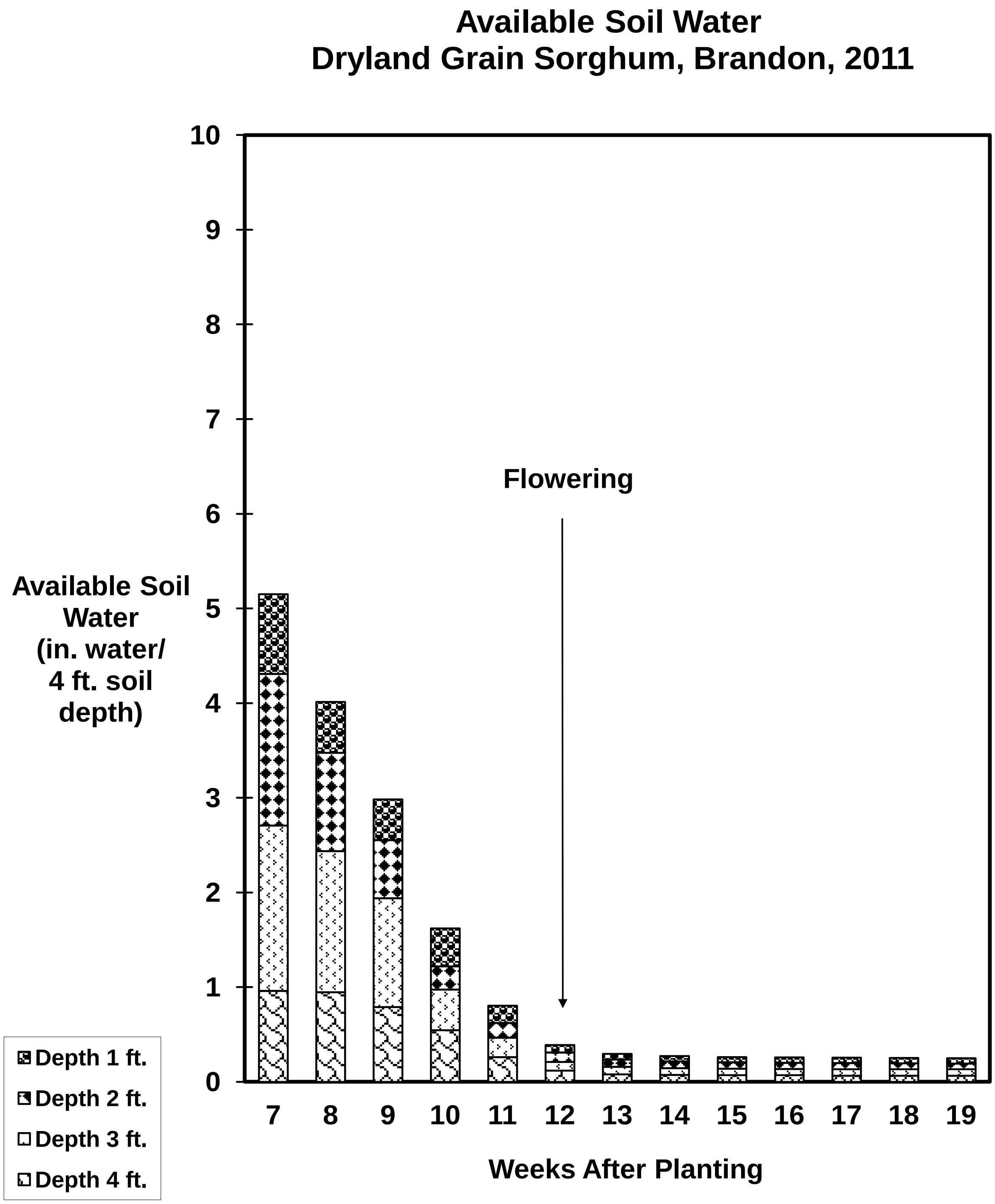


Fig. 1. Available soil water in dryland grain sorghum at Brandon. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Brandon from planting to first freeze was 8.32 in. Any increase in available soil water between weeks is from rain.

Table 4.--Dryland Grain Sorghum Hybrid Performance Trial at Brandon, 2011. \1

Brand	Hybrid	Grain Yield	Yield % of Test Average	Test Weight	Plants Lodged	Harvest Density	Plant Height	50% Bloom DAP	50% Bloom GDD	50% Mature DAP	50% Mature Group
		bu/a	%	lb/bu	%	plants/a (1000 X)	in				
DEKALB	DKS28-05	37	197	56	7	17.8	36	74	1990	115	E
TRIUMPH	TR424	32	172	56	5	18.4	33	74	1990	116	E
MYCOGEN	1G557	26	139	57	10	18.4	33	70	1883	112	E
DEKALB	DK-28E	14	76	57	6	14.3	34	68	1836	110	E
SORGHUM PARTNERS	251	11	57	58	5	15.5	32	66	1784	107	E
SORGHUM PARTNERS	SP3303	10	52	57	3	14.7	35	74	1990	117	E
SORGHUM PARTNERS	KS310	32	172	59	1	18.0	37	77	2071	118	ME
SORGHUM PARTNERS	K35-Y5	25	132	55	0	14.5	35	78	2097	121	ME
ASGROW	Pulsar	22	115	59	4	14.7	34	77	2071	122	ME
SORGHUM PARTNERS	NK4420	16	87	54	2	17.4	34	86	2358	129	ME
MYCOGEN	M3838	13	67	48	1	17.0	34	87	2385	HD	ME
SORGHUM PARTNERS	NK5418	21	111	55	1	19.9	33	89	2442	131	M
TRIUMPH	TRX03473	3	16	45	0	14.1	32	90	2472	HD	M
SYNGENTA	SY5556	2	9	NS	0	14.1	33	96	2568	SD	M
Average		16		51	3	15.1	31	74	1996	121	ME
LSD 0.20		10.8			2.9						

\1 Planted: June 2; Harvested: October 31 and November 1, 2011.

Yields are adjusted to 14.0% seed moisture content.

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

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

GDD: Growing Degree Days for sorghum.

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

Table 5.--Summary: Dryland Grain Sorghum Hybrid Performance Trials at Brandon, 2009-2011.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2009	2010	2011	2-Year Avg	3-Year Avg	2009	2010	2011	2-Year Avg	3-Year Avg
		------------------bu/a---------------------					----------------------%----------------------				
ASGROW	Pulsar	58	70	22	64	50	102	104	115	103	106
DEKALB	DKS37-07	66	61	--	64	--	117	91	--	102	--
DEKALB	DKS29-28	64	69	--	67	--	114	103	--	107	--
DEKALB	DKS28-05	61	80	37	71	59	115	105	197	114	126
MYCOGEN	1G557	67	78	26	73	57	118	116	139	117	121
MYCOGEN	M3838	49	48	13	49	37	87	71	67	78	78
SORGHUM PARTNERS	KS310	62	79	32	71	58	110	118	172	114	123
SORGHUM PARTNERS	251	60	55	11	58	42	106	81	57	93	89
SORGHUM PARTNERS	NK5418	55	60	21	58	45	97	90	111	93	96
SORGHUM PARTNERS	K35-Y5	53	72	25	63	50	94	108	132	101	106
SORGHUM PARTNERS	SP3303	47	60	10	54	39	84	89	52	86	83
TRUIMPH	TR424	--	76	32	--	--	--	114	172	--	--
TRUIMPH	TR452	54	66	--	60	--	96	98	--	97	--
Average		57	66	19	62	47					

Grain Yields were adjusted to 14.0% seed moisture content.

Dryland Grain Sorghum Hybrid Performance Trial at Walsh, 2011

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

PURPOSE: To identify high yielding hybrids under dryland conditions with 3700 sorghum heat units in a Silty Loam soil.

PLOT: Four rows with 30" row spacing, 50' long. SEEDING DENSITY: 43,600 seed/a. PLANTED: June 9. HARVESTED: November 4.

IRRIGATION: The trial was irrigated up with furrow irrigation for stand establishment then left rainfed for the remaining season.

WEED CONTROL: Preemergence Herbicides: Glyphosate, 28 oz/a; 2,4-D, 0.5 lb/a, Banvel 4 oz/a. Post Emergence Herbicides: Banvel 4.0 oz/a, Atrazine 1.0 lb/a, COC 32 oz/a. CULTIVATION: Twice. INSECTICIDES: None. FIELD HISTORY: Last Crop: Wheat. FIELD PREPARATION: No-till.

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

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------no. of days--------		
June	1.11	523	15	3	21
July	1.42	1021	30	20	52
August	0.75	973	29	10	83
September	0.32	539	8	2	113
October	1.01	237	1	0	132
Total	4.61	3696	69	10	132

\1 Growing season from June 9 (planting) to October 19 (first freeze, 30 F).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in dry soil moisture and irrigated up for stand establishment. Weed control was poor to fair due to excessive sandbur infestation. Much below normal precipitation for the growing season with dry and hot June to September. No greenbug infestation and only minor lodging. Yields and test weights were good despite the dry and hot season (trial was furrow irrigated up).

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

Summary: Soil Analysis of Plant Available Nutrients.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8"	7.6	0.9	1.9	10	4.3	425	0.7	4.0
8"-24"				9				
Comment	Alka	VLo	Hi	Mod	Lo	VHi	Lo	Marg

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: 43 bu/a.

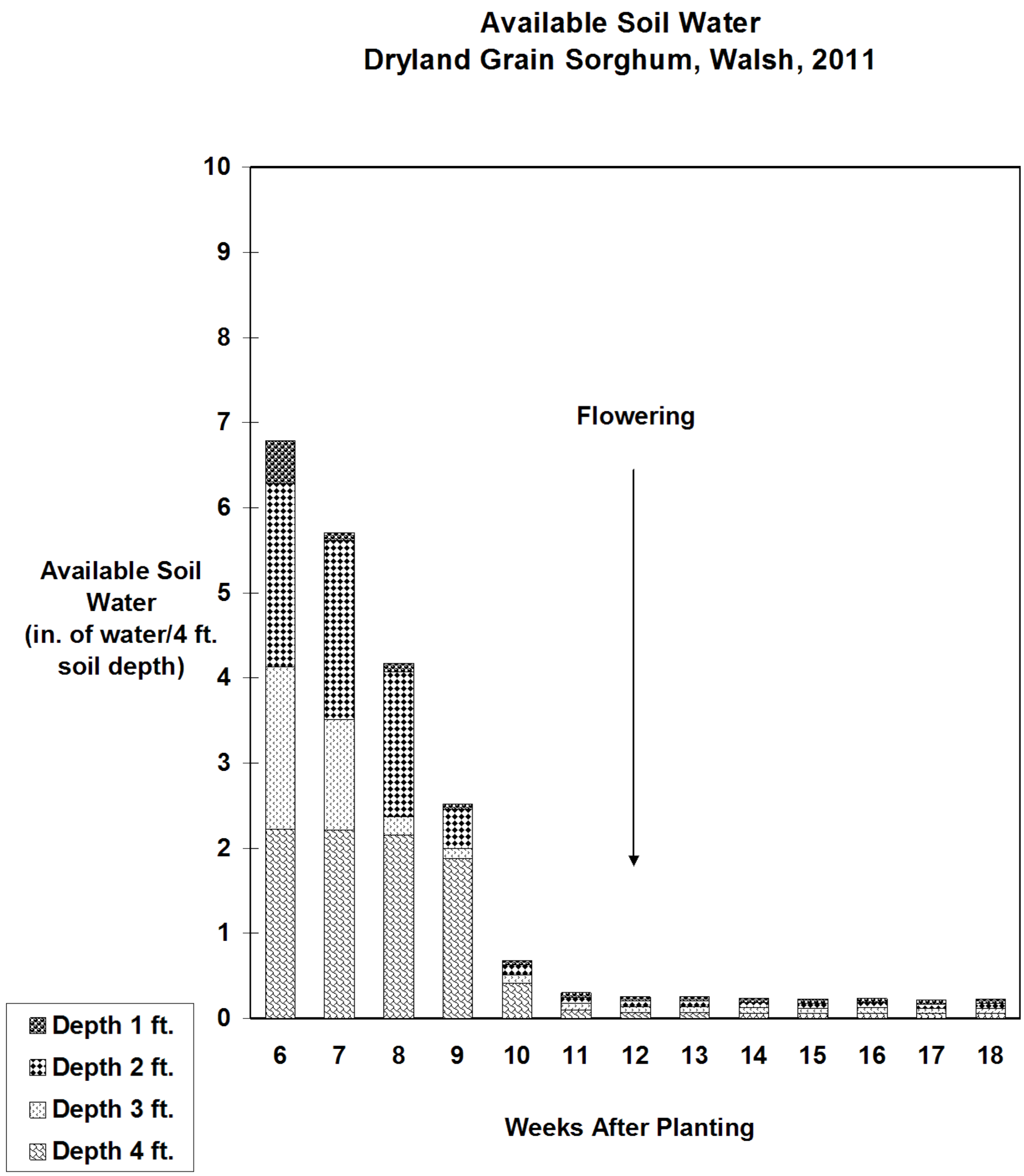


Fig. 2. Available soil water in dryland grain sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to first freeze was 4.61 in. Any increase in available soil water between weeks is from rain.

Table 6.--Dryland Grain Sorghum Hybrid Performance Test at Walsh, 2011. \1

Brand	Hybrid	Grain Yield	Yield % of Test Average	Test Wt.	Harvest Density	Plant Height	50% Bloom DAP	50% Bloom GDD	50% Mature DAP	50% Mature Group
		bu/a	%	lb/bu	plants/a (1000 X)	in				
MYCOGEN	1G557	49	113	60	27.5	36	67	2002	106	E
TRIUMPH	TR424	48	111	61	26.3	34	67	2002	107	E
TRIUMPH	TRX00464	46	105	58	25.6	34	68	2038	108	E
SORGHUM PARTNERS	SP3303	34	78	59	24.0	36	71	2133	114	E
SORGHUM PARTNERS	251	32	75	58	27.9	33	62	1862	101	E
SORGHUM PARTNERS	NK4420	61	140	61	24.8	38	77	2324	122	ME
DEKALB	DKS44-20	56	130	61	27.5	38	76	2291	120	ME
TRIUMPH	TR438	50	115	60	29.0	40	73	2196	110	ME
SORGHUM PARTNERS	K35-Y5	47	108	60	25.6	35	73	2196	113	ME
SORGHUM PARTNERS	KS310	43	99	59	25.9	37	72	2166	110	ME
SORGHUM PARTNERS	NK5418	63	144	60	25.6	34	81	2460	123	M
DEKALB	DKS37-07	48	111	56	23.7	37	82	2486	129	M
TRIUMPH	TRX03473	37	84	55	29.0	37	83	2516	128	M
SYNGENTA	SY5556	34	79	55	28.7	37	83	2516	127	M
MYCOGEN	M3838	31	72	57	21.7	38	81	2460	129	M
(Check)	399 X 2737	15	35	54	20.1	34	90	2682	HD	ML
Average		43		58	25.8	36	75	2271	116	ME
LSD 0.20		9.1								

\1 Planted: June 9; Harvested: November 4, 2011.
This study was irrigated after planting for stand establishment with furrow irrigation.
Yields are adjusted to 14.0% seed moisture content.
DAP: Days After Planting or maturation of seed at first freeze.
Seed Maturation: EM, early milk; MM, mid milk; LM, late milk; ED, early dough; SD, soft dough; HD, hard dough; mature (DAP).
GDD: Growing Degree Days for sorghum.
Maturity Group: E, early; ME, medium early; M, medium; ML, medium late; L, late.

Table 7.--Summary: Dryland Grain Sorghum Hybrid Performance Trials at Walsh, 2009-2011.

		Grain Yield					Yield as % of Test Average				
Brand	Hybrid	2009	2010	2011	2-Year Avg	3-Year Avg	2009	2010	2011	2-Year Avg	3-Year Avg
		------------------bu/a---------------------					----------------------%----------------------				
ASGROW	Pulsar	56	88	--	72	--	104	98	--	101	--
DEKALB	DKS37-07	65	91	48	78	52	121	102	111	110	111
DEKALB	DKS29-28	60	80	--	70	--	130	89	--	99	--
DEKALB	DKS28-05	61	80	--	71	--	115	97	--	99	--
MYCOGEN	M3838	--	88	31	--	--	--	99	72	--	--
SORGHUM PARTNERS	KS310	72	79	43	76	50	135	89	99	106	107
SORGHUM PARTNERS	251	45	57	32	51	34	83	63	75	72	72
SORGHUM PARTNERS	NK5418	65	112	63	89	59	122	126	144	125	126
SORGHUM PARTNERS	K35-Y5	55	95	47	75	50	103	107	108	106	106
SORGHUM PARTNERS	SP3303	46	64	34	55	37	86	72	78	77	78
										0	
TRUIMPH	TR424	--	83	48	--	--	--	93	111	--	--
TRUIMPH	TR438	62	100	50	81	54	116	112	115	114	115
TRUIMPH	TR448	64	93	--	79	--	119	104	--	111	--
TRUIMPH	TR452	62	108	--	85	--	116	121	--	120	--
TRUIMPH	TRX84732	63	89	--	76	--	117	100	--	107	--
(Check)	399 X 2737	38	101	15	70	46	72	113	35	98	99
Average		53	89	43	71	47					

Grain Yields were adjusted to 14.0% seed moisture content.

The site was pre-irrigated with furrow irrigation in 2011.

Dryland Forage Sorghum Hybrid Performance Trial at Walsh, 2011

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: June 9. HARVESTED: October 11.

IRRIGATION: The trial was irrigated up with furrow irrigation for stand establishment then left rainfed for the remaining season.

WEED CONTROL: Preemergence Herbicides: Glyphsate 28 oz/a, 2,4-D 0.5 lb/a, Banvel 4 oz/a. Post Emergence Herbicides: Atrazine 1.0 lb/a, Banvel 4 oz/a, COC 32 oz/a. CULTIVATION: Twice. INSECTICIDES: None. FIELD HISTORY: Last Crop: Wheat. FIELD PREPARATION: No-till.

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

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------no. of days--------		
June	1.11	523	15	3	21
July	1.42	1021	30	20	52
August	0.75	973	29	10	83
September	0.32	539	8	2	113
October	1.01	160	1	0	124
Total	4.61	3216	83	35	124

\1 Growing season from June 9 (planting) to October 11 (harvest).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in dry soil moisture and irrigated up for stand establishment. Weed control was only fair due to sandbur infestation. Much below normal precipitation for the growing season with dry and hot June to September. No greenbug infestation. Lodging was minor, except for one hybrid that had 20% lodging. Forage yields were good despite the dry and hot season (trial was furrow irrigated up).

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

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8"	7.6	0.9	1.9	10	4.3	425	0.7	4.0
8"-24"				9				
Comment	Alka	VLo	Hi	Mod	Lo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------lb/a------------------			
Recommended	0	20	2	0
Applied	50	20	0	0

Yield Goal: 8 ton/a.
Actual Yield: 10.9 ton/a @ 70% MC.

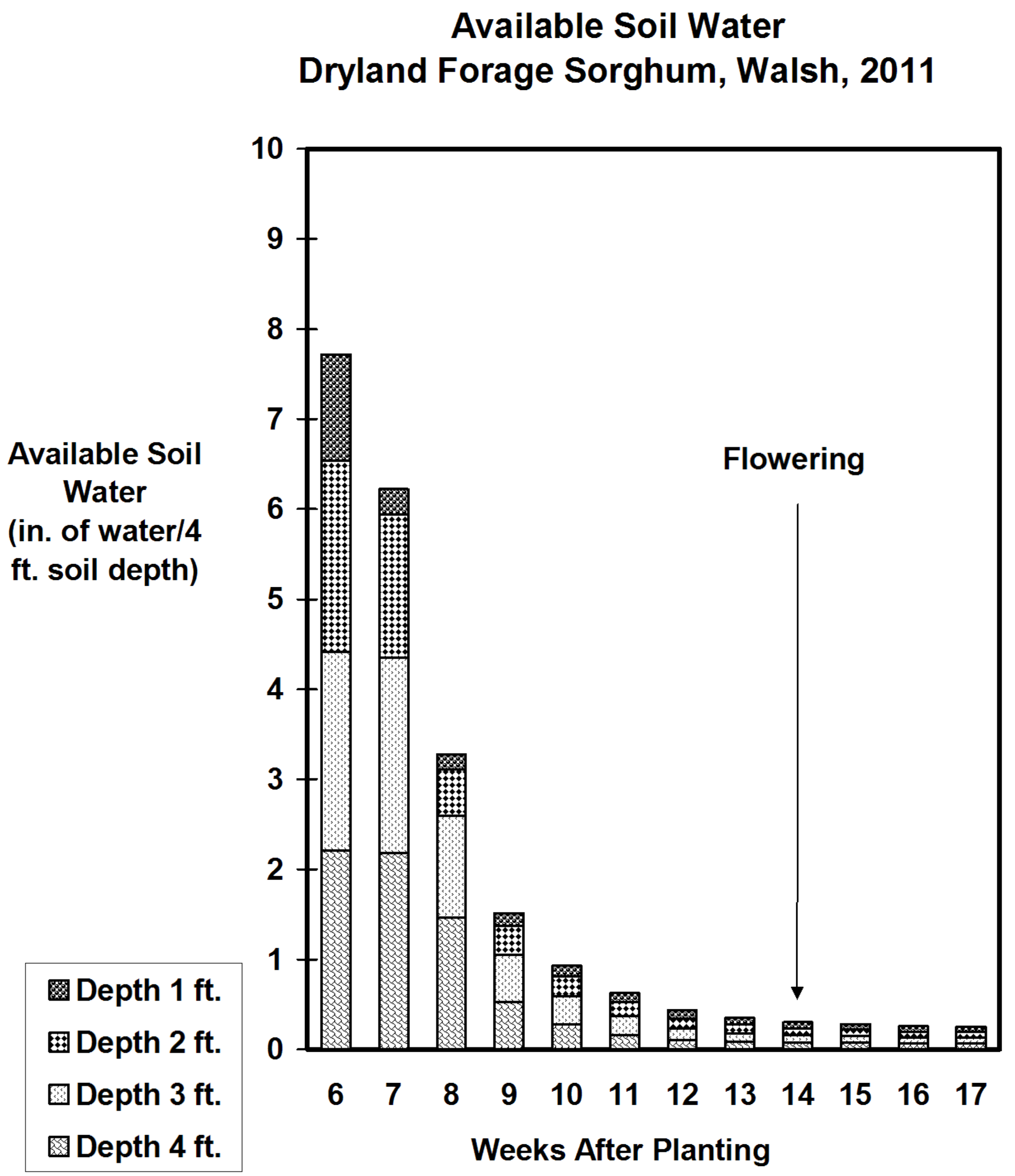


Fig. 3. Available soil water in dryland forage sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 4.61 in. Any increase in available soil water between weeks is from rain.

Table 8.--Dryland Forage Sorghum Hybrid Performance Trial at Walsh, 2011. \1

Brand	Hybrid	Forage Yield	Yield % of Test Avg.	Stage \2 at Harvest	Stem Sugar	Plant Lodging	Harvest Density	Plant Ht.	Days to 50% Bloom	Forage Type \3
		tons/a	%		%	%	plants/a (1000 X)	in		
SORGHUM PARTNERS	SS304	12.8	118	BT	16	0	35.6	59	BT	FS
SORGHUM PARTNERS	NK300	12.7	117	PM	19	0	35.5	45	106	FS
SORGHUM PARTNERS	HIKANE II	12.3	113	HD	19	6	37.6	71	80	FS
SORGHUM PARTNERS	SS405	11.1	103	PM	17	20	39.3	96	113	FS
(Check)	NB 305F	8.5	78	EM	21	6	15.0	72	102	FS
MYCOGEN	2T806	7.7	71	SD	13	2	21.7	75	73	Corn
Average		10.9		LM	17	6	30.8	70	94	FS
LSD 0.20		1.72								

\1 Planted: June 9; Harvested: October 11.

This study was irrigated after planting for stand establishment with furrow irrigation.

\2 Harvest Stage: Veg, vegetative; BT, boot; FL, flowering; PM, premilk; EM, early milk; MM, midmilk; LM, late milk; ED, early dough; SD, soft dough; HD, hard dough; MT, mature.

\3 Forage Type: FS, Forage Sorghum; SS, Sorghum Sudangrass; HS, Hybrid Sudangrass; SW, Sweet Sorghum.

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

Table 9.--Summary: Dryland Forage Sorghum Hybrid Performance Tests at Walsh, 2008, 2009 and 2011.

		Forage Yield					Yield as % of Test Average				
					2-Year	3-Year				2-Year	3-Year
Brand	Hybrid	2008	2009	2011	Avg	Avg	2008	2009	2011	Avg	Avg
		--------------tons/a--------------					-----------------%----------------				
MISS. STATE UNIV.	Topper 76-6	15.9	13.9	--	14.9	--	100	102	--	101	--
SORGHUM PARTNERS	NK 300	19.0	15.1	12.7	17.1	15.6	120	112	117	116	116
SORGHUM PARTNERS	HIKANE II	15.5	16.1	12.3	15.8	14.6	98	119	113	107	109
SORGHUM PARTNERS	Sordan 79	15.1	13.7	--	14.4	--	96	101	--	98	--
SORGHUM PARTNERS	Sordan Headless	19.0	15.4	--	17.2	--	120	114	--	117	--
SORGHUM PARTNERS	Trudan Headless	19.0	14.0	--	16.5	--	120	103	--	112	--
(Check)	NB 305F	16.2	13.6	8.5	14.9	12.8	103	101	78	101	95
(Check)	Corn	15.9	11.1	7.7	13.5	11.6	101	82	71	92	86
Average		15.8	13.5	10.9	14.7	13.4					

Forage Yields were adjusted to 70% moisture content based on oven-dried sample.
The site was pre-irrigated with furrow irrigation in 2008 and 2011.
There was no forage trial in 2010.

Table 10.--Dryland Forage Sorghum Hybrid Dry Matter Analysis at Walsh, 2011.

Brand	Hybrid	Forage Type \1	RFV	CP	TDN	Net Energy Main.	Net Energy Gain	Net Energy Lact.	ADF	NDF	Boot Plant Ht	Days to Boot
				-------%-------		-----MCal/lb-----			----%----		in	
SORGHUM PARTNERS	SS304	FS	128	4.7	66.4	0.69	0.42	0.69	31.7	46.5	58	118
SORGHUM PARTNERS	NK300	FS	122	7.9	65.5	0.68	0.41	0.68	32.5	48.3	40	97
(Check)	NB 305F	FS	115	7.7	64.0	0.66	0.39	0.66	33.8	50.7	63	89
SORGHUM PARTNERS	HIKANE II	FS	104	6.3	61.6	0.62	0.36	0.63	35.9	54.7	55	71
SORGHUM PARTNERS	SS405	FS	95	6.7	61.3	0.62	0.35	0.63	36.1	59.8	82	101
MYCOGEN	2T806	Corn	89	9.9	57.4	0.56	0.30	0.59	39.6	60.6	66	67
Sorghum Average		FS	109	7.2	62.7	0.64	0.37	0.65	34.9	53.4	61	91

\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;
RFV, Relative Feed Value; Net Energy: Maintenance, Gain, Lactation..

Irrigated Forage Sorghum Hybrid Performance Trial at Walsh, 2011

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: June 9. HARVESTED: October 11 and 12.

IRRIGATION: Three furrow irrigations: June 10, August 10, and September 14, total applied 20 a-in./a.

WEED CONTROL: Preemergence Herbicides: Glyphosate 28 oz/a, 2,4-D 0.5 lb/a, Banvel 4 oz/a. Post Emergence Herbicides: Atrazine 1.0 lb/a, Banvel 4 oz/a, COC 32 oz/a. CULTIVATION: Twiec. INSECTICIDES: None.
FIELD HISTORY: Last Crop: Wheat. FIELD PREPARATION: No-till.

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

Month	Rainfall	GDD \2	>90 F	>100 F	DAP \3
	In		--------no. of days--------		
June	1.11	523	15	3	21
July	1.42	1021	30	20	52
August	0.75	973	29	10	83
September	0.32	539	8	2	113
October	1.01	173	1	0	125
Total	4.61	3229	83	35	125

\1 Growing season from June 9 (planting) to October 12 (harvest).
\2 GDD: Growing Degree Days for sorghum.
\3 DAP: Days After Planting.

COMMENTS: Planted in dry soil moisture and irrigated up. Weed control was only fair due to sandbur infestation. Much below normal precipitation for the growing season with dry and hot June to September. No greenbug infestation. Lodging was minor, except for two hybrids that had 15% to 30% lodging. Forage yields were good despite the dry and hot season.

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

Summary: Soil Analysis.

Depth	pH	Salts	OM	N	P	K	Zn	Fe
		mmhos/cm	%	----------------ppm----------------				
0-8”	7.6	0.9	1.9	15	3.1	418	0.7	3.9
8”-24”				19				
Comment	Alka	VLo	Hi	Hi	VLo	VHi	Lo	Marg

Manganese and Copper levels were adequate.

Summary: Fertilization.

Fertilizer	N	P_2O_5	Zn	Fe
	--------------------lb/a------------------			
Recommended	0	40	0	0
Applied	50	20	0	0

Yield Goal: 18 ton/a.
Actual Yield: 18.7 ton/a @ 70% MC.

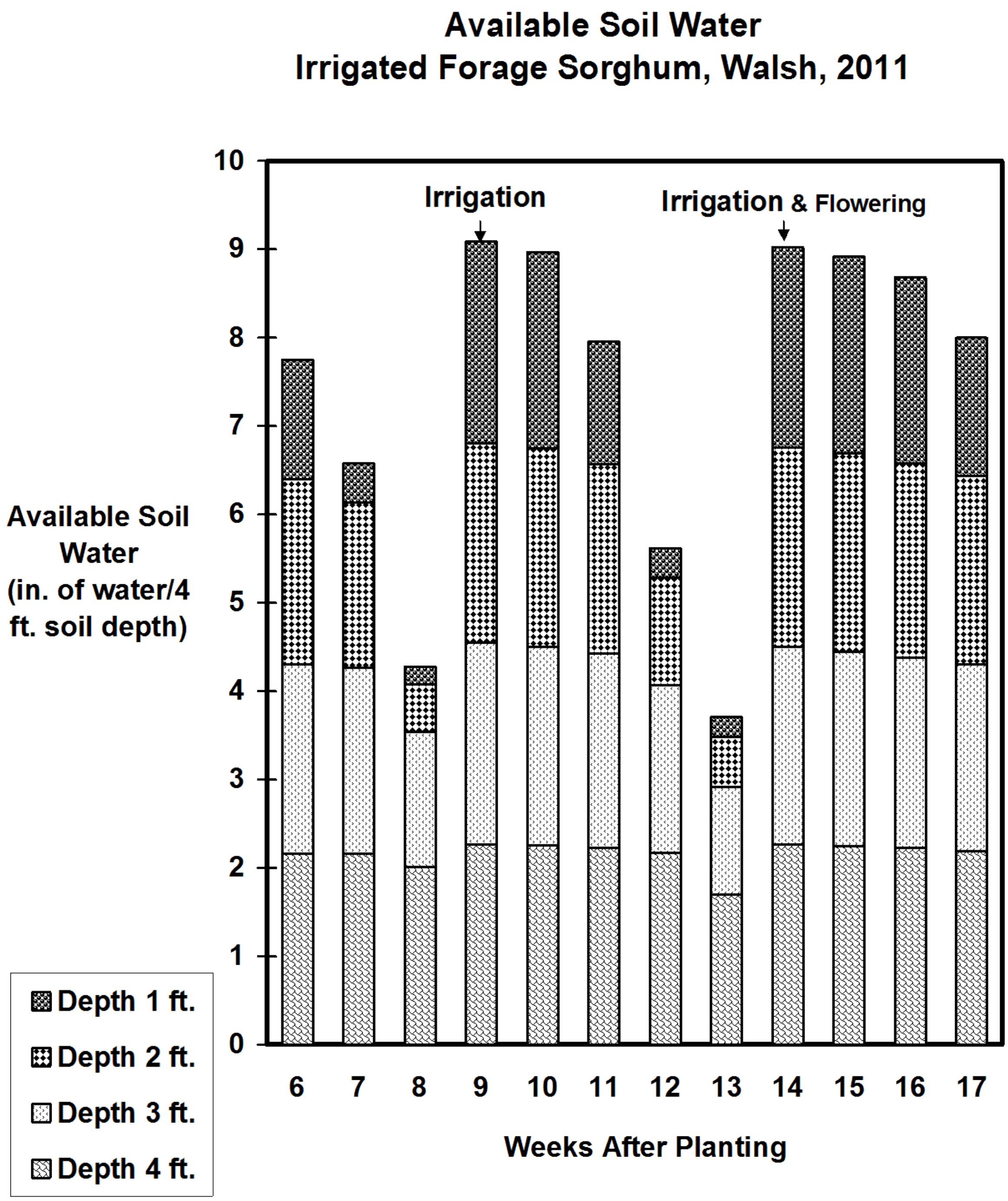


Fig. 4. Available soil water in irrigated forage sorghum at Walsh. Gypsum block measurements taken to 4 ft. with 1 ft. increments. Total rainfall at Walsh from planting to harvest was 4.61 in. Any increase in available soil water between weeks not attributed to applied irrigation of 20 a-in./a is from rain.

Table 11.--Irrigated Forage Sorghum Hybrid Performance Trial at Walsh, 2011. \1

Brand	Hybrid	Forage Yield	Yield % of Test Avg.	Stage \2 at Harvest	Stem Sugar	Plant Lodging	Harvest Density	Plant Ht.	Days to 50% Bloom	Forage Type \3
		tons/a	%		%	%	plants/a (1000 X)	in		
SORGHUM PARTNERS	SS405	22.3	119	EM	14	2	61.2	127	111	FS
SORGHUM PARTNERS	NK300	21.9	117	PM	15	0	56.4	74	104	FS
HIGH PLAINS BRAND	HP1010 BMR	20.5	110	MM	17	2	47.8	90	97	FS
HIGH PLAINS BRAND	HP120 BMR	19.9	107	FL	16	0	58.1	68	115	FS
HIGH PLAINS BRAND	HP95 BMR	19.9	107	HD	13	1	57.1	94	86	FS
(Check)	NB 305F	18.1	97	MM	18	0	25.7	103	102	FS
SORGHUM PARTNERS	HIKANE II	17.4	93	HD	18	30	50.6	105	81	FS
SORGHUM PARTNERS	SS304	16.6	89	FL	15	15	54.8	110	111	FS
MISS. STATE UNIV.	Topper 76-6	13.7	73	MM	21	6	29.7	86	100	SW
MYCOGEN	2T806	16.7	89	SD	12	1	32.5	80	74	Corn
Average		18.7		LM	16	6	47.4	94	98	FS
LSD 0.20		1.26								

\1 Planted: June 9; Harvested: October 11 and 12.

\2 Harvest Stage: Veg, vegetative; BT, boot; FL, flowering; PM, premilk; EM, early milk; MM, midmilk; LM, late milk; ED, early dough; SD, soft dough; HD, hard dough; MT, mature.

\3 Forage Type: FS, Forage Sorghum; SS, Sorghum Sudangrass; HS, Hybrid Sudangrass; SW, Sweet Sorghum.

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

Table 12.--Summary: Irrigated Forage Sorghum Hybrid Performance Tests at Walsh, 2008, 2009, and 2011.

		Forage Yield					Yield as % of Test Average				
Brand	Hybrid	2008	2009	2011	2-Year Avg	3-Year Avg	2008	2009	2011	2-Year Avg	3-Year Avg
		----------------tons/a------------------					--------------------%--------------------				
MISS. STATE UNIV.	Topper 76-6	17.4	--	13.7	--	--	103	--	73	--	--
SORGHUM PARTNERS	NK 300	19.4	21.5	21.9	20.5	20.9	115	107	117	111	113
SORGHUM PARTNERS	HIKANE II	16.6	--	17.4	--	--	98	--	93	--	--
SORGHUM PARTNERS	Sordan Headless	19.4	21.4	--	20.4	--	115	107	--	110	--
SORGHUM PARTNERS	Trudan Headless	19.4	22.0	--	20.7	--	115	110	--	112	--
(Check)	NB 305F	16.4	19.4	18.1	17.9	18.0	97	97	97	97	97
(Check)	Corn	18.4	18.5	16.7	18.5	17.9	109	92	89	100	97
Average		16.9	20.0	18.7	18.5	18.5					

Forage Yields were adjusted to 70% moisture content based on oven-dried sample.
There was no forage trial in 2010.

Table 13.--Irrigated Forage Sorghum Hybrid Dry Matter Analysis at Walsh, 2011.

Brand	Hybrid	Forage Type \1	RFV	CP	TDN	Net Energy Main.	Net Energy Gain	Net Energy Lact.	ADF	NDF	Boot Plant Ht	Days to Boot
				-------%-------		-----MCal/lb-----			----%----		in	
HIGH PLAINS BRAND	HP120 BMR	FS	108	6.5	61.0	0.61	0.35	0.63	36.4	52.0	53	105
SORGHUM PARTNERS	NK300	FS	95	5.6	60.5	0.60	0.34	0.62	36.8	58.9	58	94
(Check)	NB 305F	FS	95	8.7	59.9	0.59	0.33	0.61	37.4	58.4	85	90
SORGHUM PARTNERS	SS304	FS	95	5.5	57.4	0.56	0.30	0.59	39.6	57.1	95	101
MYCOGEN	2T806	Corn	94	10.6	58.9	0.58	0.32	0.60	38.3	58.2	76	70
SORGHUM PARTNERS	HIKANE II	FS	94	10.0	58.5	0.57	0.31	0.60	38.7	58.4	69	72
MISS. STATE UNIV.	Topper 76-6	SW	94	11.3	58.1	0.57	0.31	0.59	39.0	57.9	80	88
HIGH PLAINS BRAND	HP1010 BMR	FS	90	8.0	56.5	0.54	0.29	0.58	40.4	59.5	81	86
HIGH PLAINS BRAND	HP95 BMR	FS	90	10.5	56.4	0.54	0.29	0.57	40.5	59.2	73	78
SORGHUM PARTNERS	SS405	FS	88	6.7	55.4	0.53	0.27	0.56	41.4	60.0	110	99
Sorghum Average		FS	94	8.3	58.3	0.57	0.31	0.60	38.9	58.0	78	88

\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; RFV, Relative Feed Value; Net Energy: Maintenance, Gain, Lactation..

Forage Yield of Forage Sorghum and Field Pea Mixes, Walsh, 2011

W. Trujillo, K. Larson, D. Thompson, D. Harn, and B. Pettinger

Purpose: To study if forage yield and quality are increased by planting mixes of grasses (forage sorghum) and broadleaf forage (field pea) together.

Materials and Methods: We tested six forage sorghum and field pea mixes. The mix percentages were 100/0, 90/10, 80/20, 70/30, and 60/40 of forage sorghum at 6 lb/a and field pea at 50 lb/a. The forage sorghum hybrid was ASI AS781 and the field pea variety was Arvika. The forage sorghum and field pea mixes were planted on June 9, 2011 in the same 30 in. seedrows. Because of dry planting conditions, we furrow irrigated the forage sorghum and field pea mixes for seed germination and stand establishment. No other irrigations were applied. For weed control, we applied pre-emergence Glystar Plus at 28 oz/a and cultivated twice. We harvested four replications of the 2.5 ft. by 44 ft. forage mix plots on October 24 with a single row silage cutter. At harvest, a representative sample of fresh silage was taken for each treatment and oven-dried to determine harvested field moisture. Based on the moisture of these samples, forage yields were adjusted to 70% moisture content.

Results and Discussion: The 80/20 (80% of 6 lb seed/a forage sorghum and 20% of 50 lb seed/a field pea) mix produced the highest forage yield of 7.52 tons/a at 70% moisture content. Although, the forage yield of the 80/20 mix was not significantly higher than any of the forage sorghum and field pea mixes. The average forage yield of the 80/20 and 100/0 mixes was 7.41 tons/a at 70% moisture, and the average forage yield of the 90/10, 70/30, and 60/40 mixes was 6.54 tons/a at 70% moisture.

The forage yield of an adjacent dryland (also furrow irrigated for stand) forage sorghum hybrid trial was 10.9 tons/a at 70% moisture and the average forage yield of the forage sorghum and field pea mixes study was 7.0 tons/a at 70% moisture. The lack of weed control for the forage sorghum and field peas mix study compared to the forage sorghum hybrid trial contributed to the yield difference between these studies. Having the forage sorghum and field pea mixed together made it difficult to spray in-crop herbicides for weed control. For in-season weed control in the forage sorghum and field pea mixes study, our only option was cultivation.

Since there was no significant forage yield difference between the forage sorghum and field pea mixes and the 100% forage sorghum treatment, grass and broadleaf forage mixes may prove to be better than grass forage alone.

In this study, the field pea performed poorly. Field pea is a cool-season forage; therefore, it is not surprising that it did not perform well with the warm-season forage sorghum when planted in June. Using warm-season forage mixes of grasses and broadleaves may result in higher yielding forage production. One such warm season mix may be forage sorghum and cowpea.

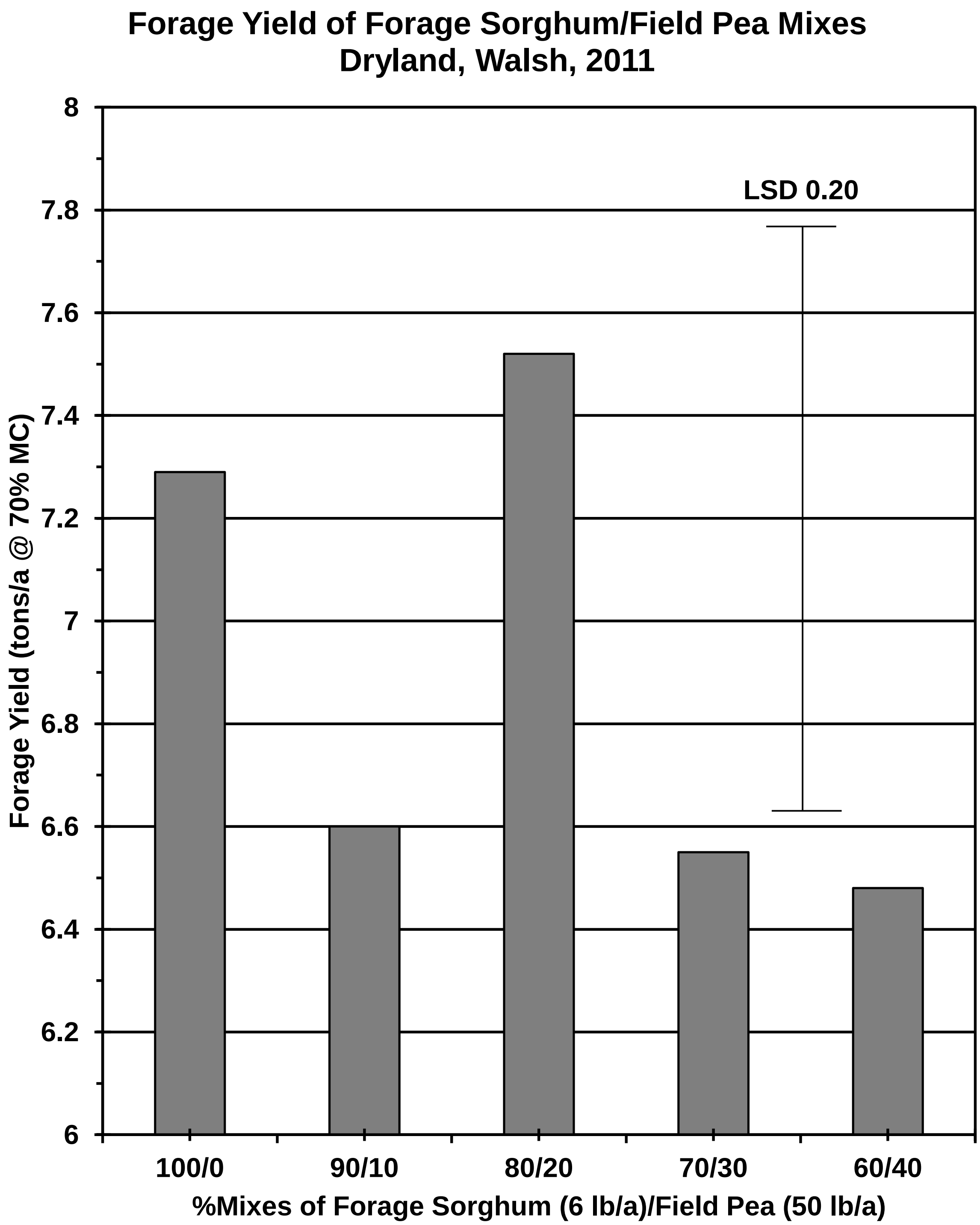


Fig. .Forage yield of dryland forage sorghum/field pea mixes study at Walsh. Mix percentages were 100/0, 90/10, 80/20, 70/30, and 60/40 of forage sorghum at 6 lb/a and field pea at 50 lb/a. The forage sorghum was ASI AS781 and the field pea was Arvika planted June 9, 2011 in 30 in. row spacings. The site was furrow irrigated for stand establishment.

Expanding Production Area and Alternative Energy Crop Market of Proso Millet for Water Deficient Lands
Final Report for the Sun Grant Initiative, South Central Region

Kevin Larson, Rick Kochenower, and Jeffrey Tranel

Proso millet (*Panicum miliaceum* L.) is reported to produce well under dry, low input conditions (Baltensperger, 1996) (Blumenthal and Baltensperger, 2002) (Lyon et. al, 2008) (Witt, 1983). In 2007 three states, Colorado, Nebraska, and South Dakota, produced 99% of the nation's total proso millet production (16.9 million bushels) (NASS, USDA, 2009). Colorado is the leading state for proso millet production; however, proso millet production is limited to the northeastern part of the state, where evaporative demand is lower than the southeastern part of Colorado. Proso millet appears to be an ideal crop for the water-deficient Southern High Plains region with focus on southeastern Colorado, northwestern Oklahoma, southwestern Kansas, northwestern Texas, and northeastern New Mexico. Expansion of proso millet into the drier Southern High Plains would require adapted agronomic production practices and market growth.

Currently, proso millet is primarily marketed as birdseed. The birdseed market is thin and easily oversupplied. If expansion of this low-water and low-fertilizer crop is to proceed, a new market for proso millet needs to be developed. One feed grain market that has been linearly growing is the ethanol market. According to the US Energy Information Administration, corn used for ethanol production increased from 174.3 million bushels in January 2007 to 398.3 million bushels in August 2010 (O'Brien, 2010). If proso millet could capture even a small portion of this ethanol market, there would be fewer consumer complaints about rising food cost, allegedly due to ethanol production from corn. In addition, the ethanol market for proso millet would increase demand and price, providing the impetus for production expansion into drier, nontraditional areas.

Reports of ethanol production from proso millet are nearly nonexistent. In fact, we could find only one report of ethanol production from proso millet (Santra, Ratnayake, and Burgener, 2010). Santra, Ratnayake, and Burgener reported that the proso millet cultivars, Huntsman and Plateau, averaged 147.44 ml/lb (2.18 gal/bu) of ethanol yield. This is similar to the 2.15 gal/bu for Huntsman that we initially obtained and reported for our Sun Grant proposal in 2009.

To determine if proso millet is an economically viable ethanol crop for the Southern High Plains, we evaluated four cultivars (to see which cultivars are adapted to this drier region), we tested multiple planting dates (to determine the optimum planting window), and we developed crop enterprise budgets (as production decision tools for proso millet as a birdseed crop compared to proso millet as an ethanol crop).

Materials and Methods for 2009

We planted proso millet at two sites, the Plainsman Research Center at Walsh, Colorado and the Oklahoma Panhandle Research and Extension Center at Goodwell, Oklahoma. We planted four proso millet cultivars at four incremental planting dates throughout July 2009. Three of the cultivars were standard starch cultivars: Huntsman, Sunrise, and Horizon. The fourth cultivar was a waxy starch cultivar, Plateau. The four planting dates at Walsh were: PD1, July 1; PD2, July 10; PD3, July 20; and PD4, July 31, 2009. The four planting dates at Goodwell were: PD1, July 7; PD2, July 14; PD3, July 21; and PD4, July 28, 2009.

The experimental designs were split-plots with planting dates as the main plot and cultivars as the subplots with four replications. The plot size at Walsh was 10 ft. by 50 ft. (harvested 10 ft. by 44 ft.). The plot size at Goodwell was 5 ft. by 35 ft. (harvested 5 ft. by 30 ft.). Both sites were irrigated to assure seed germination. All cultivars and planting dates were seeded at 15 lb/a. Nitrogen was the only fertilizer applied, 50 lb/a at Walsh and 100 lb/a at Goodwell. For weed control at Walsh, the entire site had a preplant application of glyphosate 24 oz/a and 2,4-D ester 0.5 lb/a, and a post emergence application of dicamba 4 oz/a and 2,4-D amine 0.38 lb/a. For weed control at Goodwell, the entire site had a preplant application of atrazine 1.0 lb/a, and no post emergence herbicides were applied. Both sites were harvested with a self-propelled combines equipped with conventional grain heads.

For both sites at harvest, we recorded grain yield, test weight, and seed moisture. The harvest dates at Walsh were: PD1, September 29; PD2, October 16; PD3 and PD4, October 17. The harvest dates at Goodwell were: PD1, September 14 and PD3 October 19. At Goodwell, the July 14 planting date (PD2) did not establish an adequate stand and was eliminated from the study, and the July 28 planting date (PD4) was not harvested because of excessive rainfall.

To determine ethanol production, grain samples (7.00 lb of cleaned seed) were milled three times with a grain mill set at 0.008 in. The milled grain was diluted with water (20 gal/bu). The mash was boiled and alpha amylase was added to liquefy it. The mash was cooled and alpha amylase was again added to breakdown the starches into dextrins. The mash was further cooled and gluco amylase was added to convert the dextrins into sugars. The temperature of the mash was further lowered, yeast was added, and the mash was allowed to ferment for five days in air-locked containers. After fermentation was completed, the beer in the mash was pressed out with a fruit press. To extract the remaining beer, water was added and the dilute beer was pressed (this step was repeated twice). The alcohol in the beer was distilled in a stainless steel still with a refraction column. Ethanol production is reported at 100% ethanol. After alcohol extraction, the wet distiller’s grain was oven dried; however no analysis was performed on the dry distiller’s grain.

Materials and Methods for 2010

All cultural practices in 2010 were similar to the cultural practices we used in 2009, except we planted the proso millet cultivars at four monthly planting dates from May to August. The four planting dates at Walsh were: PD1, May 12; PD2, June 3; PD3, July 2; and PD4, August 2, 2010. The four planting dates at Goodwell were in early May, June, July, and the August planting date was not planted due to bird damage in the previous planting dates. The location of the study at Goodwell was near urban dwellings with trees. Birds used the trees for roosting, which provided easy feeding access and subsequent damage to the millet study. The Goodwell site was not harvested because of severe bird damage. Grain yield, test weight, seed moisture, plant height, and seed shattering measurements were recorded at harvest for Walsh. The harvest dates at Walsh were: PD1, August 30; PD2, August 30; PD3, September 21; and PD4, November 5.

The procedure for ethanol determinations were the same in 2010 as outlined in 2009.

Crop enterprise budgets were generated from the optimum planting date in 2010 (June 3) at Walsh. Data for proso millet as a birdseed crop and as an ethanol crop are based on the average grain production, ethanol yield (gal/bu), and ethanol production (gal/a) of the four cultivars tested for the June 3, 2010 planting date. In our area, proso millet as an ethanol crop would compete with grain sorghum as an ethanol crop. Therefore, as a comparison, we included a crop enterprise budget based on a study of grain sorghum as an ethanol crop conducted at the Plainsman Research Center at Walsh during 2007 and 2008 (Larson, et. al, 2009).

Results for 2009

The first planting dates at both sites produced the highest average grain yield, 1645 lb/a at Walsh and 1450 lb/a at Goodwell (Tables 1 and 2). The planting date ranking for grain yield at Walsh was: PD1>>PD2>PD3=PD4 (Table 3). The planting date ranking at Goodwell was PD1>PD3 (Table 4). Huntsman produced the highest yield at all harvested planting dates at both sites, although Huntsman was not significantly different than Sunrise at Walsh, and Huntsman only significantly out yielded Plateau at Goodwell. Grain yield ranking of the four cultivars was consistent for all four planting dates at Walsh: Huntsman=Sunrise>Horizon>Plateau (Table 3 and Figure 1). The relative ranking of the four cultivars for the two harvested planting dates at Goodwell was: Huntsman>Sunrise=Horizon>Plateau, although the only significant difference was between Huntsman and Plateau (Table 4 and Figure 3).

At both sites, the first planting date produced the highest ethanol production, 59.5 gal/a for Walsh and 50.0 gal/a for Goodwell (Tables 3 and 4). The ethanol production rankings for the planting dates were: PD1>>PD2>PD3=PD4 at Walsh, and PD1>PD3 at Goodwell. These planting date ethanol production rankings have the same order and magnitude as the grain yield rankings. At both sites, Huntsman had the highest ethanol production at each planting date (Tables 1 and 2) and highest overall production, 36.6 gal/a for Walsh and 56.8 gal/a for Goodwell. Plateau produced the highest per bushel ethanol yield for each planting date at Walsh. Horizon had the highest overall ethanol yield at Goodwell with 1.98 gal/bu, and Plateau had the highest overall ethanol yield at Walsh with 2.11 gal/bu.

Test weights significantly decreased with later planting dates at Walsh (Table 3 and Figure 2), but increased, although not significantly, between the two harvested planting dates (PD1 and PD3) at Goodwell (Table 4 and Figure 3). Huntsman had the highest overall test weight at both sites, 56.9 lb/bu at Goodwell and 54.6 lb/bu at Walsh.

Plant height consistently decreased with later planting dates at Walsh (Table 1). The plant height ranking from tallest to shortest was: Huntsman, Sunrise, Horizon, and Plateau.

At Walsh, date to 50% heading averaged 33 days after planting (DAP) for all planting dates and cultivars (Table 1). With later planting dates, date of 50% heading became increasingly earlier for all cultivars, except Plateau. Plateau was the earliest maturing cultivar tested and its date to 50% heading remained at 30 to 31 DAP for the first three planting dates then dropped to 29 DAP at the last planting date. Date to 80% maturity, when the crop was ready for swathing, averaged 61 DAP for all planting dates and cultivars. Like heading, date to 80% maturity was earlier with later planting dates for all cultivars, except Plateau. Date of maturity of Plateau remained 58 to 59 DAP for all four planting dates.

Results for 2010

All the yield results for 2010 are from the Walsh site only, because the Goodwell site was lost to bird damage. The bird damage at Goodwell was due to the planting location (the study was too close to trees that the birds used for roosting) and is not indicative that the Goodwell area was a poor location for millet. At Walsh, the June planting date had the highest grain yield of 1891 lb/a, but it was not significantly higher than the May planting date with 1783 lb/a (Table 6 and Fig. 4). The May and June plantings dates were significantly higher than the July planting date, and the July planting date was significantly higher than the August planting date. The grain yield ranking for the planting dates was PD2=PD1>>PD3>>PD4. Huntsman had the single highest yield of 2170 lb/a with the June planting date, although it was not significantly different from Sunrise, which had the second highest yield of 2045 lb/a with the May planting date (Table 5). Huntsman and Sunrise produced significantly higher yield than Plateau and Horizon. The yield ranking for the cultivars was Huntsman=Sunrise>Plateau=Horizon.

The highest single ethanol production was 86.0 gal/a with Huntsman at the June 3 planting date, PD2 (Table 5). There was a tie for the second highest single ethanol production of 79 gal/a with Huntsman at May 12 (PD1) and Sunrise at June 3 (PD2). The June 3 planting date produced the highest average ethanol production, 74.0 gal/a, and the highest average ethanol yield, 2.19 gal/bu, compared to the average of all four cultivars in PD1 and PD3 (Table 6). There was insufficient plot yield of the August 2 (PD4) to conduct ethanol determinations; therefore, all ethanol analyses were performed with the first three planting dates only. Ethanol production ranking of the cultivars corresponded to the yield ranking with Huntsman=Sunrise>Plateau=Horizon. The highest single ethanol yield was 2.27 gal/bu with Horizon at the May 12 planting date (Table 5). Horizon is the only cultivar that did not increase ethanol yield with the June 3 planting date, but Horizon did increase ethanol production with the June 3 planting date. Plateau consistently had the lowest ethanol yield for the first three planting dates. Overall, Horizon had the highest average ethanol yield of 2.20 gal/bu for the first three planting dates. The ethanol yield ranking of the cultivars was Horizon>Huntsman=Sunrise>Plateau.

The average test weight for the July planting was significantly higher than May and August planting dates, but it was not significantly higher than the June planting date (Table 6 and Fig. 5). The test weight ranking for the planting dates was PD3=PD2>PD4>PD1. Test weight for PD4 was based solely on Huntsman because there was insufficient plot yield from the other three cultivars for test weight measurements. The highest test weight of 56.4 lb/bu occurred with Huntsman at the July planting date, and the lowest test weight was 50.9 lb/bu with Plateau at the May planting date (Table 5). Huntsman had the highest average test weight, 55.7 lb/bu. The test weight of Huntsman was significantly higher than Sunrise and Horizon, which were significantly higher than Plateau. The test weight ranking for the cultivars was Huntsman>Sunrise=Horizon>Plateau.

Plant height remained relatively constant at about 25 in. for the first three planting dates, but it was only half as high for the last planting date (Table 5). Huntsman was the tallest cultivar. Huntsman was an inch taller than the second tallest cultivar, Sunrise, in three of the four planting dates.

It took an average of 5 to 8 days longer for the cultivars planted in May to reach 50% heading and 80% maturity than the other three planting dates (Table 5). The cultivars in the July planting date had the fewest days to heading and maturity. Huntsman required an average of an extra day more than Sunrise to reach 50% heading and 80% maturity.

Crop enterprise budgets for proso millet as a birdseed crop and as an ethanol crop were developed using the average production of the optimum planting date, June 3 (PD2). The June 3 planting date produced an average of 74.0 gal/a from 33.8 bu/a seed yield with an ethanol yield of 2.19 gal/bu (Table 7). Proso millet as an ethanol feedstock in the Southern High Plains will be a direct replacement for grain sorghum as an ethanol feedstock. The average ethanol yield of the four proso millet cultivars at the optimum planting date was 2.19 gal/bu. The average ethanol yield of twelve grain sorghum hybrids from a previous study was 2.44 gal/bu (Larson et. al, 2009). We used 2.19/2.44 (2.19 gal/bu ethanol yield of proso millet divided by 2.44 gal/bu ethanol yield of grain sorghum), or 89.8% of the grain sorghum market price as the market price for proso millet as an ethanol crop. The 2010 market price for grain sorghum was $7.61/bu, therefore we used $6.83/bu ($7.61 * 0.898) as the market price for proso millet as an ethanol crop. For proso millet as a birdseed crop, we used the 2010 local market price of $4.48/bu. Using 2010 market prices, proso millet as an ethanol crop produced $137.41/a in net income compared to $57.50/a for proso millet as a birdseed crop (Table 8).

Discussion

In 2009, we evaluated only July planting dates for proso millet production. The first planting dates (July 1 for Walsh and July 7 for Goodwell) produced the highest grain yield and ethanol production (Tables 3 and 4). There was a significant yield decrease between the July 1 and July 10 planting dates at Walsh (990 lb/a yield drop), and the yield difference between the two harvested planting dates (July 7 and July 21) at Goodwell of 267 lb/a was also significant. This suggests that, when planting in July, early July planting is critical for high yields at Walsh and Goodwell, but with the small yield decrease, the planting window may be longer at Goodwell. Highest ethanol production corresponded with highest grain yield. Huntsman planted in early July had the highest grain yield and ethanol production at both Walsh and Goodland (Tables 1 and 2). Test weights decreased significantly with later planting dates at Walsh, but they actually increased at Goodwell, although the test weight increase was not significant. Moreover, at Walsh, Plateau consistently had the lowest test weight for all four planting dates; however, Plateau had the highest per bushel ethanol yield. Delayed planting, past early July, did not appear to have the severe yield and test weight penalty at Goodwell as it did at Walsh. Nonetheless, the highest grain yield and ethanol production averages were from the first planting dates (July 1 for Walsh and July 7 for Goodwell) at both sites.

The 2010 yield results were from the Walsh site only, and ethanol yield and production analyses were from the first three planting dates (plot yields were too small to perform ethanol analyses for the fourth planting date, August 2). Huntsman at the June 3 planting date had the single highest yield of 2170 lb/a (Table 5). The optimum planting date for Huntsman was late May (Fig. 4). There was no significant seed yield difference between the May 12 planting date and the June 3 planting date. Although not significantly higher, seed yield, ethanol yield, and ethanol production were highest for the June 3 planting date. Therefore we chose June 3 as the optimum planting date. Since there was no significant yield difference between the May 12 planting date and the June 3 planting date, but there was a significant yield decrease for the July 2 planting date, the optimum planting window for yield would encompass the first two planting dates. Obviously, the very low seed yields of the August 2 planting date indicate that August is too late for acceptable yields.

Overall in 2010, Huntsman produced slightly higher, but not significantly higher, seed yield and ethanol production than Sunrise. This suggests that Huntsman and Sunrise are well-adapted cultivars at Walsh. Horizon and Plateau produced significantly less seed yield than Huntsman and Sunrise. Horizon and Plateau are not as well adapted and would be on the second tier of cultivar choices compared to Huntsman and Sunrise. Plateau is a waxy type cultivar; whereas, Huntsman, Sunrise and Horizon are non-waxy type cultivars. Waxy type cultivars lack amylose (Graybosch and Baltensperger, 2009). This change in starch composition did not increase ethanol yield (gal/bu) or ethanol production (gal/a) of Plateau compared to the non-waxy type cultivars tested.

High grain production corresponded with high ethanol production. For the 2010 planting dates, ethanol yield ranged from 2.11 gal/bu to 2.19 gal/bu. This 0.08 gal/bu range was quantitatively too small to change the ethanol production rankings of the planting dates. The 1.9 bu/a seed yield difference between the first and second plantings was not significantly different. It would require an ethanol yield of 2.32 gal/bu (0.05 gal/bu higher than any single proso millet ethanol yield obtain) just to compensate for the 1.9 bu/a seed yield difference and make the first and second planting dates equal in ethanol production.

The highest test weights for the three planting dates and four cultivars tested did not produce the highest ethanol yields (Fig. 6). Conventional wisdom suggests that high test weights coincide with high ethanol yields; however, our results indicated that this was not the case. For both years of this study, 2009 with four July planting dates and 2010 with four monthly planting dates, highest test weights did not culminate in highest ethanol yields.

Crop enterprise budgets for proso millet as birdseed and proso millet as an ethanol feedstock were developed from the second planting date, June 3, 2010 at Walsh, which produced the highest grain and ethanol production. Proso millet when marketed as an ethanol crop (and priced as an ethanol feedstock replacement for grain sorghum) provided higher net income than proso millet as a birdseed crop. The ethanol yield of the four cultivars for the June 3 planting date averaged one quart less per bushel than the twelve grain sorghum hybrids from an earlier study (Larson et. al, 2009) and the proso millet produced 10 bu/a less than the grain sorghum. The net income of proso millet as an ethanol crop was much less than grain sorghum. However, the price differential of $2.35/bu between proso millet marketed as birdseed and proso marketed as an ethanol grain should provide economic incentive for ethanol production facilities to incorporate proso millet as part of their ethanol feedstock. If sufficient ethanol production facilities switch from grain sorghum to proso millet, the demand for proso millet would increase its price as an ethanol grain and as birdseed. These marketing scenarios are beyond the scope of this study; nonetheless, at some price point, proso millet would become competitive with grain sorghum as an ethanol crop.

Before the ethanol boom, which elevated grain prices, the price difference between proso millet and grain sorghum frequently favored proso millet. If the feed grain market reverts back to pre-ethanol production levels, the decision point for growing proso millet compared to grain sorghum would be $3.99/bu. With grain sorghum prices below $3.99/bu, it would be more advantageous to grow proso millet than grain sorghum, if the proso millet price remains at $4.48/bu (Tables 9 and 10).

Conclusion

Of the four proso millet cultivars studied, Huntsman and Sunrise provided higher grain and ethanol production than Horizon and Plateau. Therefore for the drier and warmer Southern High Plains region, Huntsman and Sunrise appear well adapted.

The June 3 planting date produced the highest grain production, ethanol production, and ethanol yield of the monthly May to August planting dates tested. The two earliest planting dates, May 12 and June 3, produced highest grain and ethanol production, then dropped precipitously for the two later planting dates, July 2 and August 2. From our results, the planting date window for proso millet in at Walsh is late May to mid June, which is similar to the planting date window reported for the Northern High Plains (Lyon et. al, 2008).

Proso millet is an undervalued crop. The price of proso millet is limited because it is almost entirely marketed as birdseed. From our analysis, proso millet marketed as an ethanol crop was worth $2.35/bu more than proso millet as a birdseed crop. It would be profitable for ethanol plants to include proso millet as part of their ethanol feedstock, even if they paid premiums up to $2.35/bu above the current proso millet price (birdseed price), the income advantage would be worth their effort. Furthermore, in 2010, Santra, Ratnayake, and Burgener reported that inclusion of proso millet as part of the ethanol feedstock had a synergetic increase on ethanol production. They found that 10% and 25% proso millet to corn mixtures produced 0.17 gal/bu more than when using corn alone. However, the ethanol yield of their 100% corn fermentation was 2.11 gal/bu, which is much lower than the standard commercial ethanol yield of 2.8 gal/bu (O'Brien, 2010).

Because of the price differential between the birdseed market and the ethanol market for proso millet, ethanol production facilities seeking the least cost grain would make profitable decisions by including proso millet as part of their fermentation feedstock. If ethanol plants include proso millet as a feedstock, then the demand and price would increase, and proso millet would expand into nontraditional production areas. This possible crop expansion of proso millet would offer more cropping options and more income stability to growers in the water-deficient lands of the Southern High Plains. Results from dryland sequence rotation studies conducted at Walsh showed that rotations with proso millet produced highest four-year variable net incomes (Larson, et. al, 2008). Ethanol production from proso millet will increase the income of producers and the economies of rural communities in the Southern High Plains will strengthen. According to the Department of Energy (DOE, 2001), ethanol production in rural communities stabilizes and even increases agriculturally based economies. Expanding ethanol production from proso millet will lessen our nation's dependence on foreign oil and will further our national goal of greater energy independence based on renewable feedstocks.

Literature Cited

Baltensperger, D.D. 1996. Foxtail and proso millet. p. 182-190. In: J. Janick (ed.), Progress in New Crops. ASHS Press, Alexandria, VA. http://www.hort.purdue.edu/newcrop/proceedings1996/v3-182.html. Accessed: February 9, 2009.

Blumenthal, J.M. and D.D. Baltensperger. 2002. Fertilizing proso millet. NebGuide G924. Institute of Agriculture and Natural Resources, Extension, Univ. of Neb., Lincoln, Nebraska.
http://www.ianrpubs.unl.edu/epublic/pages/publicationD.jsp?publicationId=151
Accessed: February 9, 2009.

Dept. of Energy. 2001. Rural economies benefit from bioenergy and biobased products. Biomass Research & Development Initiative Newsletter, Nov. 2001. USDA, Dept. of Energy.
http://www.bioproducts-bioenergy.gov/1101.html
Accessed: January 31, 2006.

Graybosch, R.A. and D.D. Baltensperger. 2009. Evaluating of the Waxy Endosperm Trait in Proso Millet (Panicum miliaceum). Plant Breeding 128, 70-73 (2009).
http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1367&context=agronomyfacpub&sei-redir=1#search="proso+millet+waxy"
Accessed: May 7, 2011.

Larson, K.J., D.L. Thompson, D. Harn, C. Thompson, C. Walker, J.J. Johnson, S. Haley, G.A. Peterson, D. Westfall, N. Hansen, M. Brick, and S. Brase. 2008. Plainsman Research Center 2007 research reports. Technical Report, TR08-05. Plainsman Research Center, Extension, Dept. of Soil and Crop Sci., AES, CSU, Fort Collins. 123p.

Larson, K., D. Thompson, D. Harn, T. Macklin, and J. Whittler. April, 2009. Expanding Bio-based Energy Crop Options for Dryland Systems. AES, CSU, Fort Collins, Colorado. Colorado Experiment Station web publication. 27p.
http://www.colostate.edu/depts/prc/pubs/CIGFinalRepNum09.pdf

Lyon, D.J., P.A. Burgener, K.L. DeBoer, R.M. Harveson, G.L. Hein, G.W. Hergert, T.L. Holman, J.J. Johnson, T. Nleya, J.M. Krall, D.C. Nielsen, and M.F. Vigil. 2008. Proso millet in the Great Plains. EC137 Producing and Marketing. SDSU, Univ. of Wyoming, CSU, USDA, ARS, Institute of Agriculture and Natural Resources, Extension, Univ. of Neb., Lincoln, Nebraska.

NASS, USDA. 2009. 2009 Agricultural Statistics Annual Report, Chapter 1: Feed and Grain. 46p.
http://www.nass.usda.gov/Publications/Ag_Statistics/2009/chp01.pdf
Accessed: May 7, 2011.

O'Brien, Daniel. September, 2010. Comparing Corn Ethanol Use data Sources from US Government Agencies. KSU. 6p.
http://www.agmanager.info/energy/DataSource_CornRefiningProcesses_09-24-10.pdf

Accessed: May 7, 2011.

Santra, D.K., W. Ratnayake, and P. Burgener. 2010. Increasing NE Wheat Productivity by Expanding Proso Millet Market. Progress Report for Nebraska Wheat Board, July 1, 2009 to June 30, 2010. Univ. of Neb. 2p. http://cropwatch.unl.edu/c/document_library/get_file?uuid=81a27f2c-7123-4210-ae64-5e6274e30f91&groupId=465948
Accessed: May 4, 2011.

Witt, M. 1983. Proso millet as a crop Alternative. SRL70. Keeping Up with Research. AES, KSU, Manhattan, Kansas. http://www.oznet.ksu.edu/library/crpsl2/SRL70.pdf
Accessed: February 9, 2009.

Final Report for the Sun Grant Initiative, South Central Region

Kevin Larson, Research Scientist, Plainsman Research Center, Colorado State University, Walsh, Colorado

Rick Kochenower, Area Research and Extension Specialist, Oklahoma Panhandle Research and Extension Center, Oklahoma State University, Goodwell, Oklahoma

Jeffrey Tranel, Extension Economist, Agriculture and Business Management, Colorado State University, Pueblo, Colorado

Corresponding Author: Kevin Larson
Email address: kevin.larson@colostate.edu

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Table 1.--Proso Millet: Planting Dates and Cultivars at Walsh, CO, 2009.

Cultivar	Seed Yield	Test Weight	Ethanol Yield	Total Ethanol Production	Plant Height	50% Heading	80% Maturity
	lb/a	lb/bu	gal/bu	gal/a	in	DAP	DAP
PD1 - July 1							
Huntsman	2137	56.5	2.04	77.8	27	39	66
Sunrise	1956	56.3	1.96	68.5	26	38	65
Horizon	1411	56.0	2.03	51.1	24	36	64
Plateau	1076	53.5	2.10	40.4	21	30	58
PD1 Average	**1645**	**55.6**	**2.03**	**59.5**	**25**	**36**	**63**
PD2 - July 10							
Huntsman	981	55.8	2.04	35.7	21	36	63
Sunrise	940	54.5	2.04	34.2	20	35	62
Horizon	490	54.4	2.07	18.1	19	34	61
Plateau	208	54.1	2.10	7.8	16	30	58
PD2 Average	**655**	**54.7**	**2.06**	**24.0**	**19**	**34**	**61**
PD3 - July 20							
Huntsman	429	54.1	2.08	15.9	18	34	62
Sunrise	399	53.9	2.01	14.3	16	34	62
Horizon	139	55.0	2.08	5.2	16	33	61
Plateau	151	53.5	2.18	5.9	13	31	59
PD3 Average	**280**	**54.1**	**2.09**	**10.3**	**16**	**33**	**61**
PD4 - July 31							
Huntsman	365	51.9	2.00	13.0	16	32	59
Sunrise	316	51.5	1.94	10.9	14	32	59
Horizon	229	51.3	2.06	8.4	15	30	58
Plateau	201	50.7	2.07	7.4	12	29	58
PD4 Average	**278**	**51.4**	**2.02**	**10.0**	**14**	**31**	**59**
Average	714	53.9			18	33	61
LSD 0.05	272.1	0.94					

Harvested: PD1, Sept. 29; PD2, Oct. 16; PD3, Oct. 17; PD3, Oct. 17, 2009.
DAP is days after planting.
Seed yields adjusted to 13% seed moisture content.
Ethanol Production is 100% ethanol.

Table 2.-Proso Millet Planting Dates and Cultivars, Seed Yield and Ethanol Yield at Goodwell, OK, 2009.

	-----------PD1 - July 7-----------				-----------PD3 - July 21----------			
Cultivar	Seed Yield	Test Weight	Ethanol Yield	Total Ethanol Prod.	Seed Yield	Test Weight	Ethanol Yield	Total Ethanol Prod.
	lb/a	lb/bu	gal/bu	gal/a	lb/a	lb/bu	gal/bu	gal/a
Huntsman	1686	56.4	1.95	58.7	1558	57.3	1.97	54.8
Sunrise	1498	54.8	1.88	50.3	1065	57.6	2.03	38.6
Horizon	1450	55.4	1.97	51.0	1234	55.5	1.98	43.6
Plateau	1168	52.4	1.91	39.8	873	54.7	1.98	30.9
Mean	1450	54.8	1.93	50.0	1183	56.3	1.99	42.0
LSD 0.05	NS	NS			NS	NS		
CV %	23	3			27	3		

Seed Yield is adjusted to 13.0% seed moisture content.
Ethanol Production is 100% ethanol.

Table 3.--Proso Millet Planting Dates and Cultivar Summary at Walsh, 2009.

	Total Ethanol Production	Seed Yield		Ethanol Yield	Test Weight		Seed Moisture	
	gal/a	lb/a		gal/bu	lb/bu		%	
Planting Date								
PD1 - July 1	59.5	1645	a	2.03	55.6	a	13.0	a
PD2 - July 10	24.0	655	b	2.06	54.7	b	14.4	b
PD3 - July 20	10.3	280	c	2.09	53.9	c	14.7	b
PD4 - July 31	10.0	278	c	2.02	51.3	d	17.0	c
PD LSD 0.05		160.8			0.44		0.35	
Cultivar								
Huntsman	35.6	978	a	2.04	54.6	a	14.8	a
Sunrise	32.0	903	a	1.99	54.0	b	14.8	a
Horizon	20.7	567	b	2.06	53.9	b	14.7	a
Plateau	15.4	409	c	2.11	53.0	c	14.8	a
Cultivar LSD 0.05		135.2			0.49		0.37	
Average	26.0	715		2.05	53.9		14.8	

Seed Yield is adjusted to 13% seed moisture content.
Ethanol is adjusted to 100% alcohol.

Table 4.--Proso Millet Planting Dates and Cultivar Summary at Goodwell, 2009

	Total Ethanol Production	Seed Yield		Ethanol Yield	Test Weight		Seed Moisture	
	gal/a	lb/a		gal/bu	lb/bu		%	
Planting Date								
PD1 - July 7	50.0	1450	a	1.93	54.7	b	13.8	a
PD3 - July 21	42.0	1183	b	1.99	56.3	a	12.9	a
PD LSD 0.05		91.2			2.31		2.33	
Cultivar								
Huntsman	56.8	1622	a	1.96	56.9	a	13.8	a
Sunrise	44.5	1282	ab	1.96	56.3	a	13.5	a
Horizon	47.3	1342	ab	1.98	55.4	ab	13.3	a
Plateau	35.4	1021	b	1.95	53.5	b	12.8	a
Cultivar LSD 0.05		354.0			1.97		1.88	
Average	46.0	1317		1.96	55.5		13.4	

Seed Yield is adjusted to 13% seed moisture content.
Ethanol is adjusted to 100% alcohol.

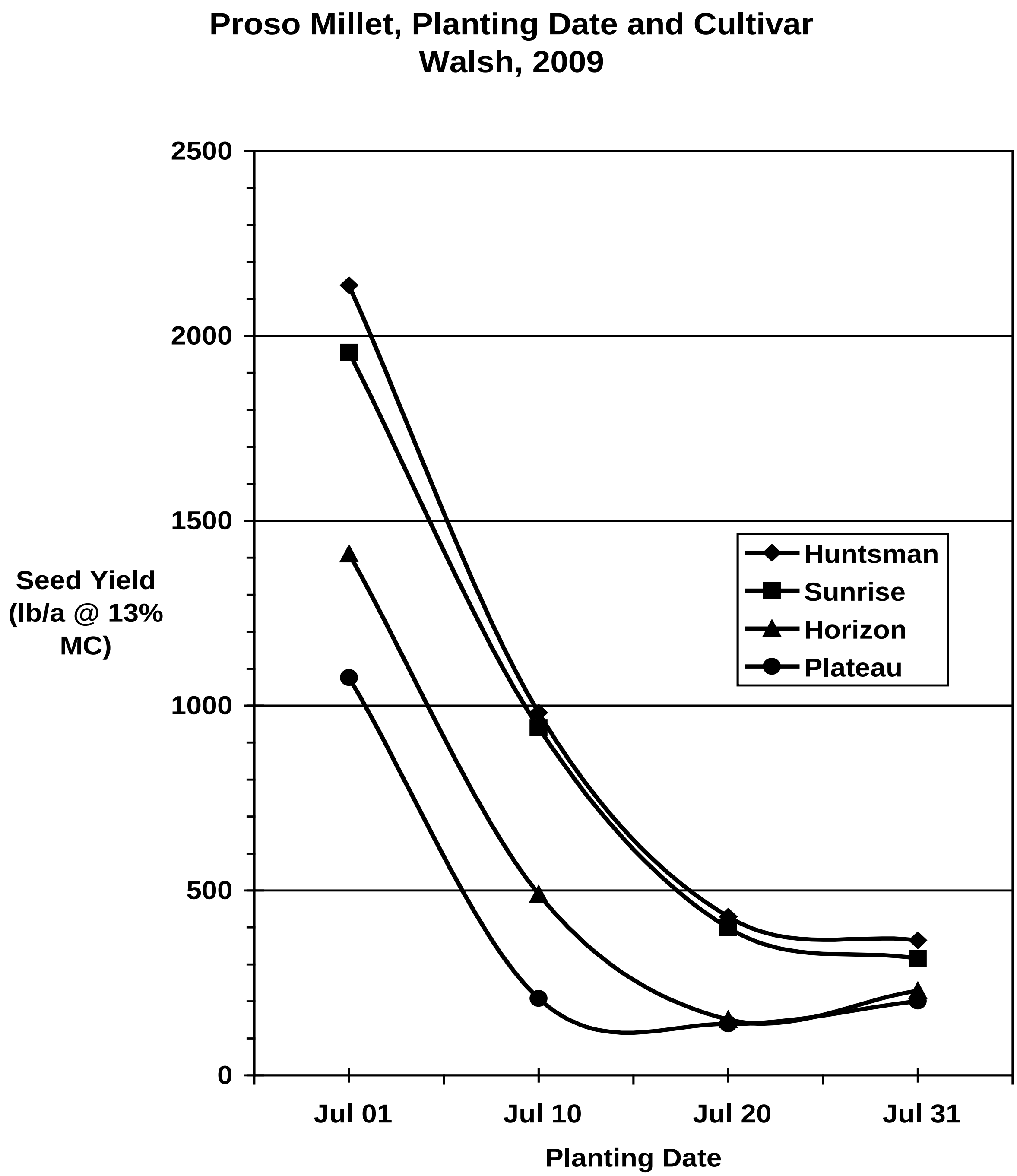

Fig. 1. Seed yield of proso millet planting dates and cultivars for ethanol production study at Walsh, CO, 2009. The planting dates were: PD1, July 1; PD2, July 10; PD3, July 20; and PD4, July 31. The cultivars were: Huntsman, Sunrise, Horizon, and Plateau. All planting dates and cultivars were seeded at 15 lb/a. Harvest dates were: PD1, September 29; PD2, October 16; PD3 and PD4, October 17.

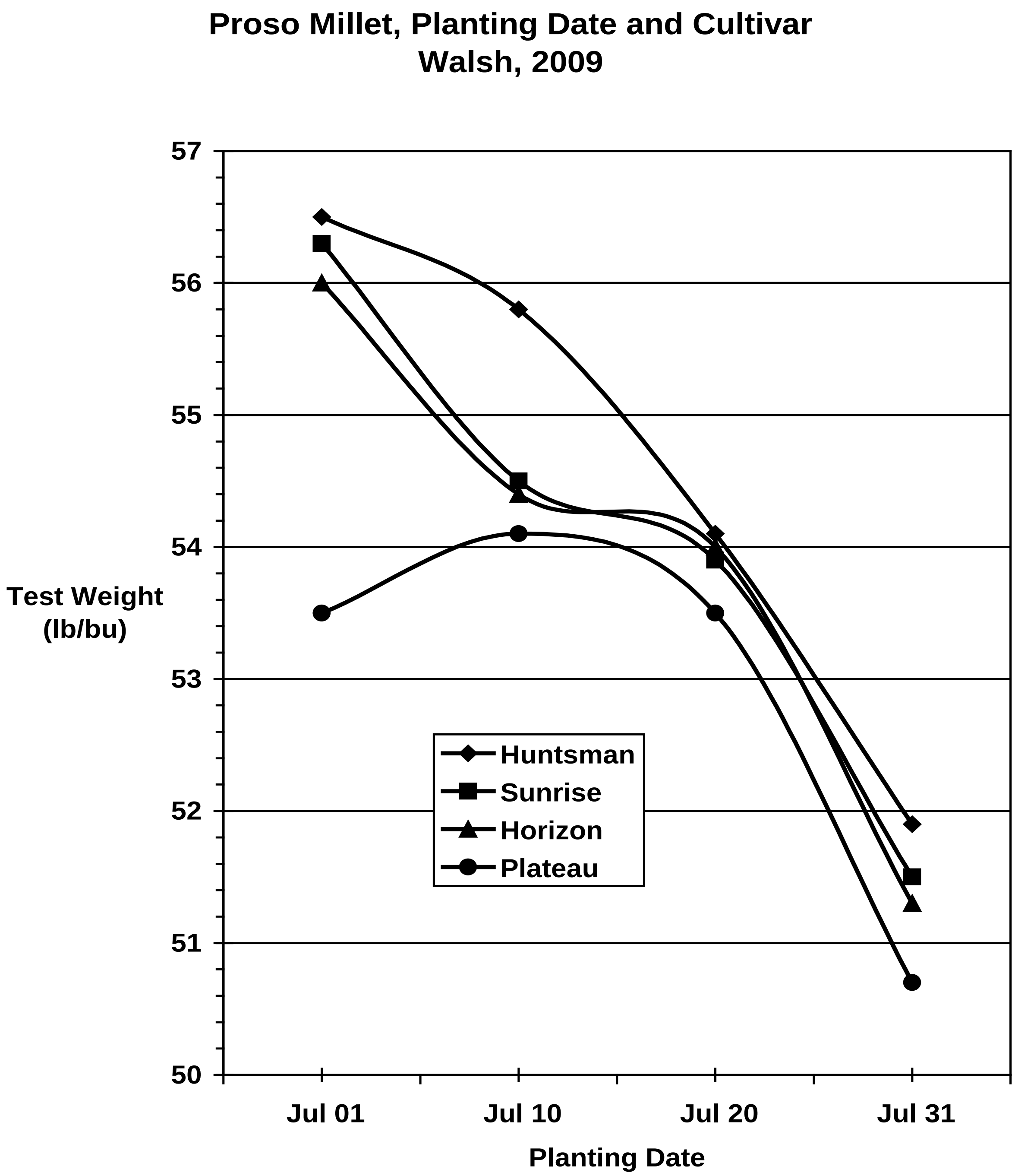

Fig. 2. Test weight of proso millet planting dates and cultivars for ethanol production study at Walsh, CO, 2009. The planting dates were: PD1, July 1; PD2, July 10; PD3, July 20; and PD4, July 31. The cultivars were: Huntsman, Sunrise, Horizon, and Plateau. All planting dates and cultivars were seeded at 15 lb/a. Harvest dates were: PD1, September 29; PD2, October 16; PD3 and PD4, October 17.

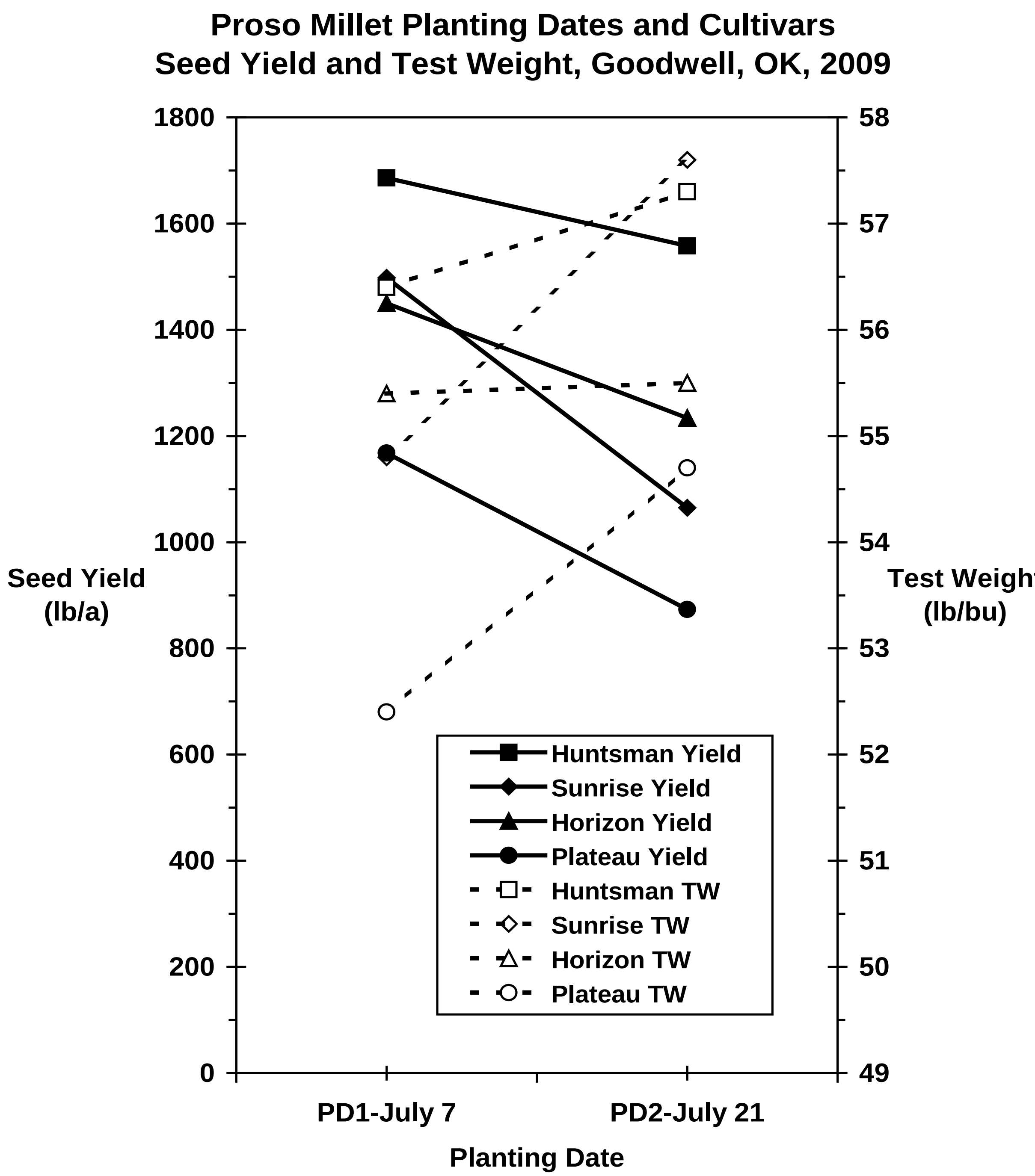

Fig. 3. Seed yield and test weight of proso millet planting dates and cultivars for ethanol production study at Goodwell, OK, 2009. The harvested planting dates were: PD1, July 7; and PD3, July 21, 2009. The cultivars were: Huntsman, Sunrise, Horizon, and Plateau. All planting dates and cultivars were seeded at 15 lb/a. Harvest dates were: PD1, September 14; and PD3, October 19. Seed yield is adjusted to 13.0% seed moisture content.

Table 5.--Proso Millet: Planting Dates and Cultivars at Walsh, CO, 2010.

Cultivar	Seed Yield	Test Weight	Ethanol Yield	Total Ethanol Production	Plant Height	50% Heading	80% Maturity
	lb/a	lb/bu	gal/bu	gal/a	in	DAP	DAP
PD1 - May 12							
Huntsman	2101	54.9	2.10	78.8	26	54	87
Sunrise	2045	54.4	2.11	77.1	25	53	86
Horizon	1466	53.7	2.27	59.4	22	51	84
Plateau	1519	50.9	2.06	55.9	22	47	80
PD1 Average	**1783**	**53.5**	**2.14**	**67.8**	**24**	**51**	**84**
PD2 - June 3							
Huntsman	2170	56.0	2.22	86.0	29	47	78
Sunrise	1985	55.1	2.22	78.7	28	46	77
Horizon	1717	55.5	2.20	67.5	25	44	75
Plateau	1692	51.9	2.12	64.1	23	40	73
PD2 Average	**1891**	**54.6**	**2.19**	**74.1**	**26**	**44**	**76**
PD3 - July 2							
Huntsman	1126	56.4	2.12	42.6	26	38	66
Sunrise	1143	55.4	2.12	43.3	25	38	65
Horizon	766	55.1	2.12	29.0	22	36	62
Plateau	926	53.5	2.06	34.1	21	32	62
PD3 Average	**990**	**55.1**	**2.11**	**37.2**	**24**	**36**	**64**
PD4 - Aug. 2							
Huntsman	79	54.3	--	--	12	49	77
Sunrise	40	--	--	--	13	48	76
Horizon	17	--	--	--	11	45	76
Plateau	30	--	--	--	11	43	75
PD4 Average	**42**	**54.3**	**--**	**--**	**12**	**46**	**76**
Average	1177	54.4	2.15	59.7	22	44	75
LSD 0.05	221.1	0.86					

Harvested: PD1, Aug. 30; PD2, Aug. 30; PD3, Sep. 21; PD4, Nov. 5, 2010.
DAP is days after planting.
Seed yields adjusted to 13% seed moisture content.
Ethanol Production is 100% ethanol.

Table 6.--Proso Millet Planting Dates and Cultivar Summary at Walsh, 2010.

	Total Ethanol Production	Seed Yield		Ethanol Yield	Test Weight		Seed Moisture	
	gal/a	lb/a		gal/bu	lb/bu		%	
Planting Date								
PD1 - May 12	68.1	1783	a	2.14	53.5	c	14.1	b
PD2 - June 3	74.0	1891	a	2.19	54.6	ab	15.6	a
PD3 - July 2	37.3	990	b	2.11	55.1	a	13.9	bc
PD4 - August 2	--	42	c	--	54.3	b	13.7	c
PD LSD 0.05		134.6			0.71		0.37	
Cultivar								
Huntsman	52.6	1369	a	2.15	55.7	a	14.7	a
Sunrise	50.0	1303	a	2.15	55.0	b	14.7	a
Horizon	38.9	991	b	2.20	54.8	b	14.5	ab
Plateau	38.7	1042	b	2.08	52.1	c	14.3	b
Cultivar LSD 0.05		113.5			0.45		0.23	
Average	59.8	1177		2.15	54.4		14.3	

Seed Yield is adjusted to 13% seed moisture content.
Ethanol is adjusted to 100% alcohol.
PD4 test weight and seed moisture of Huntsman only.

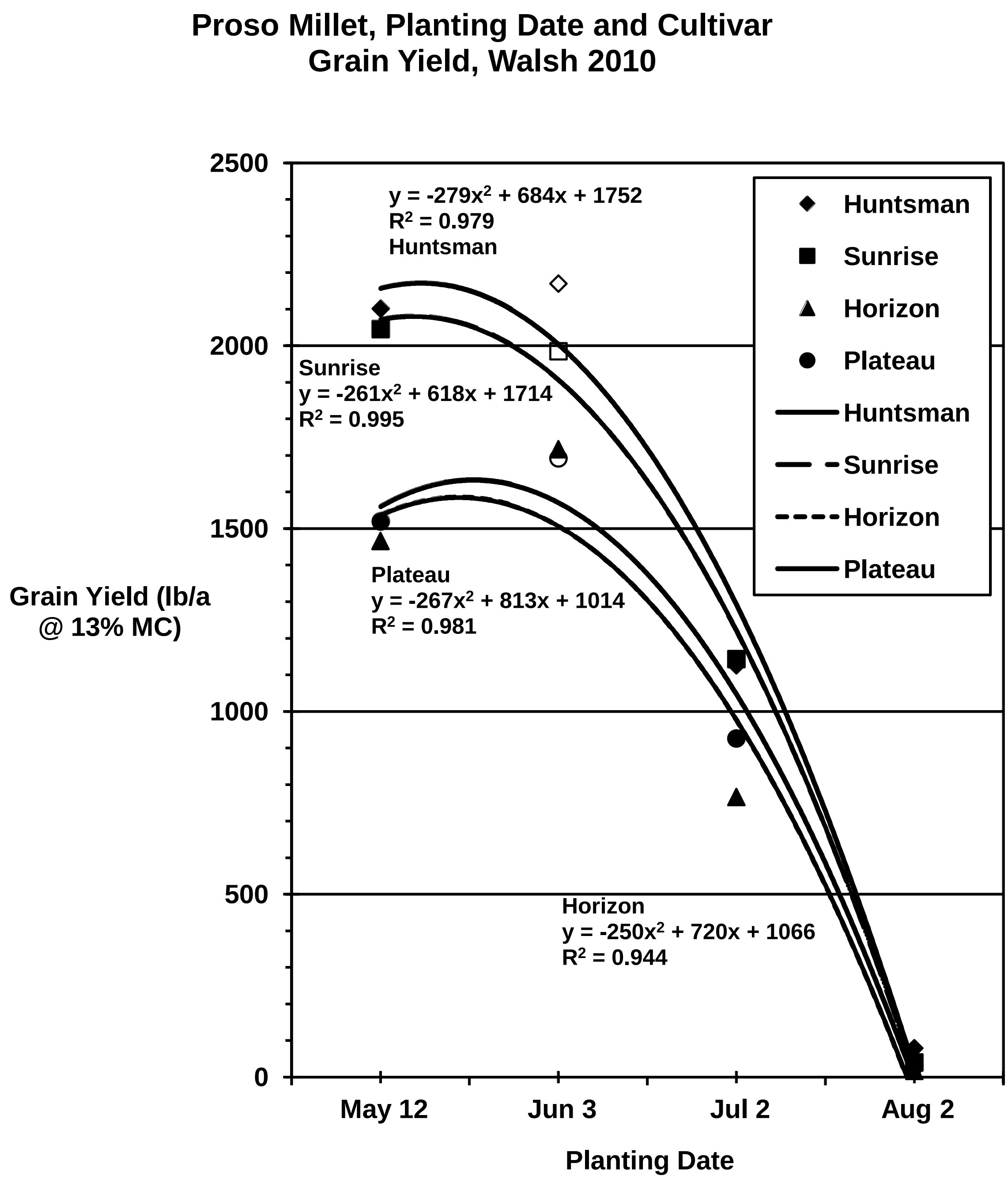

Fig. 4. Seed yield of proso millet planting dates and cultivars for ethanol production study at Walsh, CO, 2010. The planting dates were: PD1, May 12; PD2, June 3; PD3, July 2; and PD4, August 2. The cultivars were: Huntsman, Sunrise, Horizon, and Plateau. All planting dates and cultivars were seeded at 15 lb/a. Harvest dates were: PD1, August 30; PD2, August 30; PD3, September 21; and PD4, November 5.

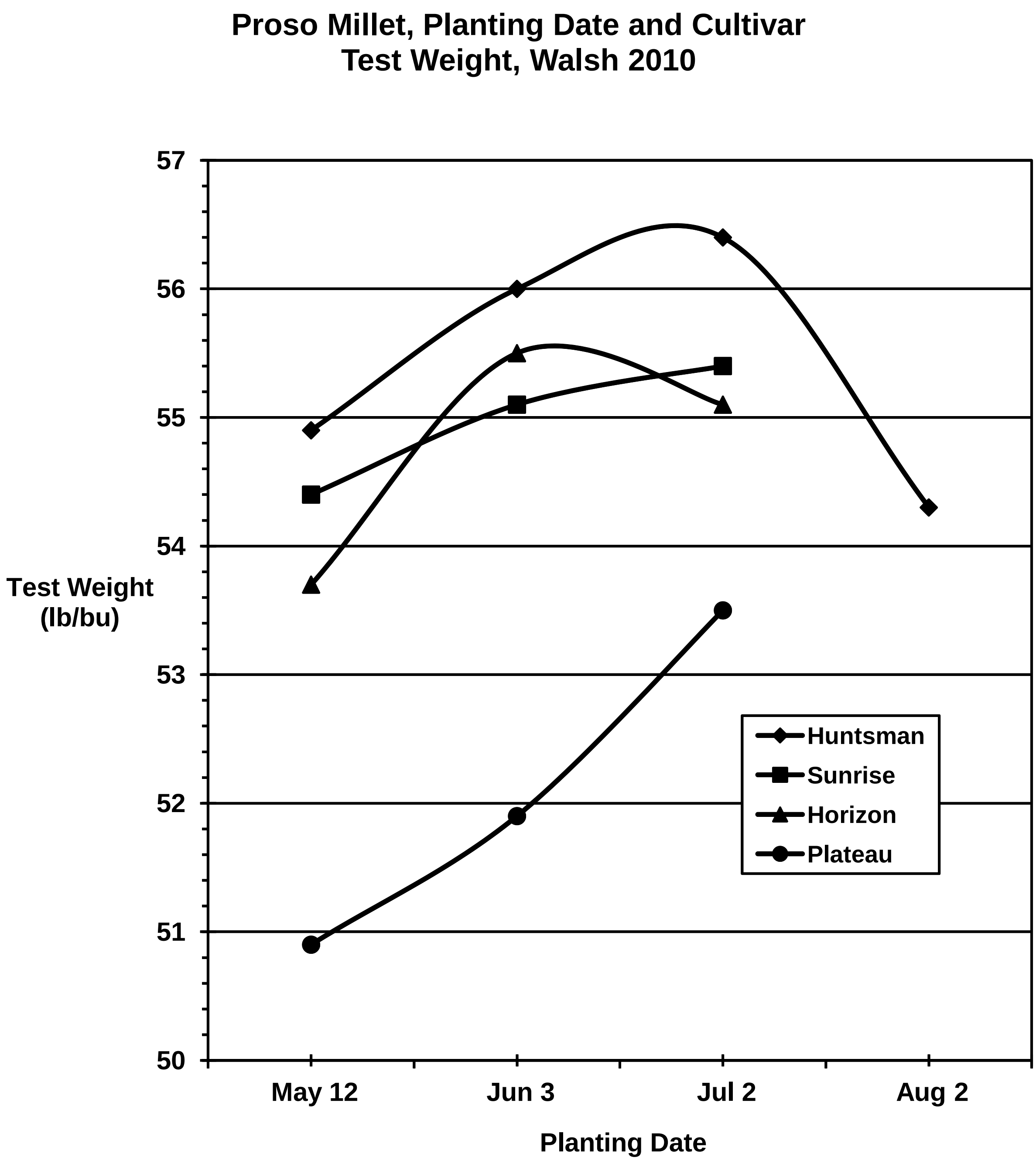

Fig. 5. Test weight of proso millet planting dates and cultivars for ethanol production study at Walsh, CO, 2010. The planting dates were: PD1, May 12; PD2, June 3; PD3, July 2; and PD4, August 2. The cultivars were: Huntsman, Sunrise, Horizon, and Plateau. All planting dates and cultivars were seeded at 15 lb/a. Harvest dates were: PD1, August 30; PD2, August 30; PD3, September 21; and PD4, November 5.

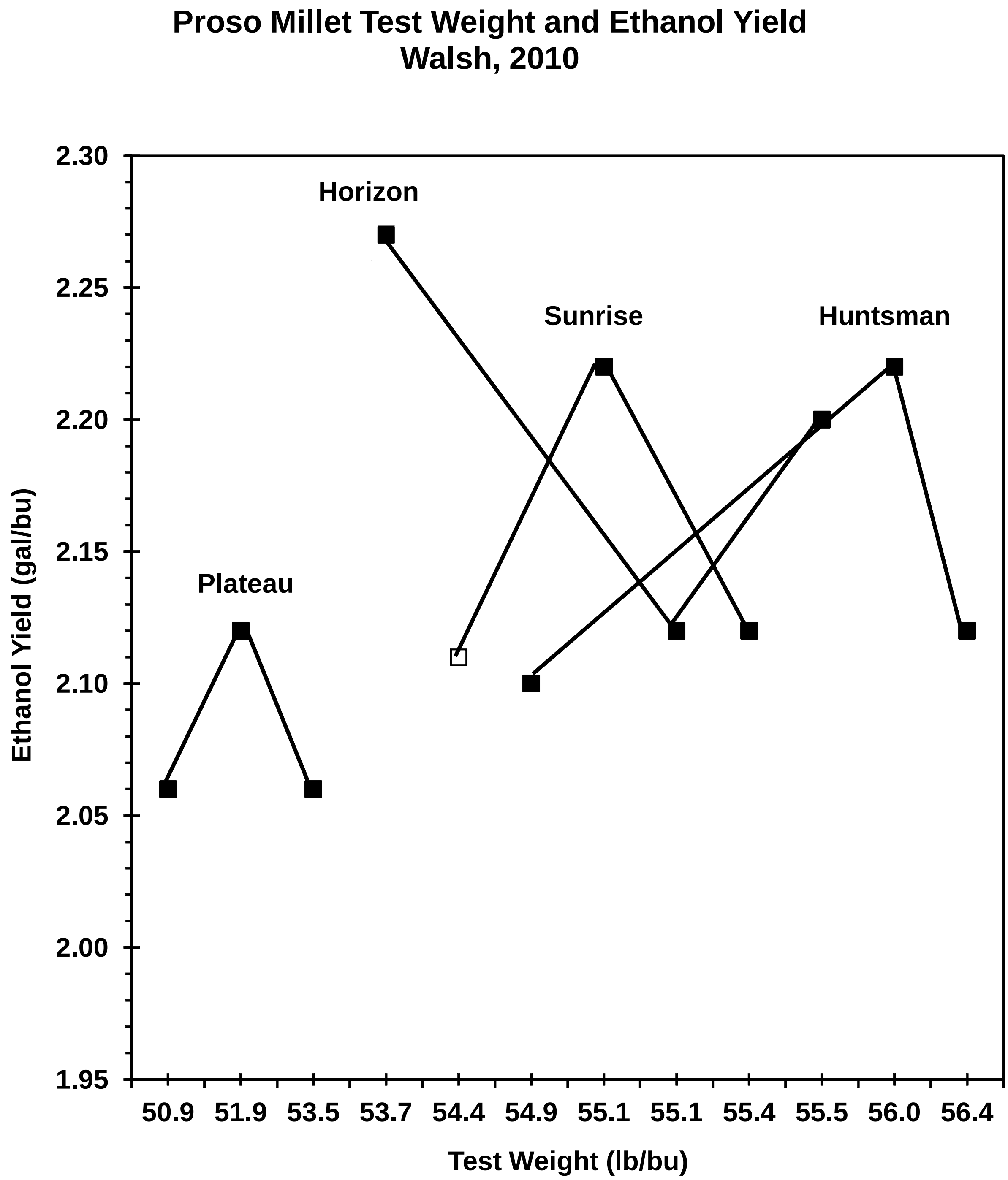

Fig. 6. Test weight and ethanol yield of proso millet planting dates and cultivars at Walsh, CO, 2010. The planting dates tested were: PD1, May 12; PD2, June 3; and PD3, July 2. The cultivars were: Huntsman, Sunrise, Horizon, and Plateau. All planting dates and cultivars were seeded at 15 lb/a. Harvest dates were: PD1, August 30; PD2, August 30; and PD3, September 21.

National Winter Canola Variety Performance and Great Plains Trials, Walsh 2011

Kevin Larson, Mike Stamm, and Dennis Thompson

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

Results and Discussion

The soil was dry at planting, therefore we furrow irrigated the site for seed germination. For our area, it is atypical to have adequate soil moisture for planting winter canola. This is because its small seed requires shallow planting depths and its narrow planting window (late August to mid-September) is frequently too short for sufficient rain to occur. This year the stands in both trials were good because we irrigated the trials up. The winter and spring were dry, yet winter survival rates were high. In past studies, this scenario of a dry and cold winter resulted in severe canola winterkill.

The stands and winter survivals were good for both the National and Great Plains trials. However, seed yields were quite poor for both trials. After the initial irrigation for stand establishment, no further irrigation was applied to the trial site. Seed yields were poor, because of the very dry conditions, particularly at seed filling. Comparing yields of these winter canola trials to adjacent winter wheat trials, the canola performed poorly and the wheat performed well under the dry conditions. It appears that canola is not as drought tolerant as wheat.

Materials and Methods

We planted 44 winter canola varieties and lines for the National Winter Canola Trial and 36 winter canola varieties and lines for the Great Plains Winter Canola Trial on September 10, 2109. The trial was planted at 5 lb seed/a with a 12 in. row-spaced drill to a depth of 1.5 inches in dry soil moisture. We stream-applied 50 lb N/a as 32-0-0 on 18 in. spacing. No other fertilizers were applied. For weed control, we applied Treflan 24 oz/a and incorporated the herbicide with a rotary hoe. Since there was insufficient planting moisture for seed germination, we furrow irrigated the site to establish a stand. We harvested the National Trial on July 11 and 12, and the Great Plains Trial on July 12 and 13 with a self-propelled combine and weighed them in a digital scale.

National Canola Variety Trial: Walsh, Colorado, 2011.

Variety (Line)	Stand (0-10)	Winter Survival (0-10)	Flowering Date	Plant Height in.	Seed Shattering %	Seed Yield lb/acre
Dynastie	9.8	9.2	24-Apr	26	2	336
Safran	7.9	9.9	28-Apr	26	2	324
Witchita	8.8	9.8	28-Apr	26	4	317
Flash	9.2	8.9	30-Apr	28	1	284
Hybrisurf	9.2	8.7	29-Apr	28	3	284
KS4428	9.4	9.7	23-Apr	27	6	271
Hornet	7.4	10.0	23-Apr	25	1	257
MH06E4	9.3	8.7	2-May	25	5	257
HPX-7341	9.5	9.6	27-Apr	27	8	257
Sitro	9.0	9.2	28-Apr	26	1	244
HPX-7228	9.1	9.2	25-Apr	26	5	238
Rossini	9.3	8.6	28-Apr	27	2	238
KS4426	9.3	8.8	1-May	23	5	224
MH06E10	9.0	7.0	6-May	25	1	218
Athena	8.7	9.0	29-Apr	24	2	218
HPX-501	8.0	9.2	3-May	27	3	218
Chrome	8.3	8.2	3-May	28	2	212
VSX-3	8.1	9.7	28-Apr	24	3	211
Dimension	6.7	8.3	30-Apr	26	4	205
MH06E11	9.1	7.4	3-May	26	0	205
Riley	8.0	9.7	24-Apr	28	5	205
Visby	8.7	8.7	26-Apr	26	2	198
Kadore	7.7	9.5	2-May	25	1	198
Virginia	7.8	9.8	28-Apr	26	1	198
KS4083	9.7	9.8	25-Apr	29	8	198
Hyclass 110W	7.8	8.4	28-Apr	23	7	185
DKW41-10	7.9	9.0	24-Apr	23	16	185
DKW47-15	7.7	9.2	30-Apr	28	1	185
AAMU3307	9.8	8.0	23-Apr	24	5	185
Hybrilux	8.5	7.0	5-May	25	4	178
Kiowa	8.3	8.8	26-Apr	30	4	178
Sumner	7.5	10.0	24-Apr	27	8	178
Durola	9.0	9.2	1-May	28	5	172
Baldur	8.6	9.1	26-Apr	29	5	165
Hyclass 125W	8.4	9.2	2-Mar	25	6	165
Hyclass 154W	9.6	8.7	3-May	29	1	165
DKW46-15	9.3	8.9	29-Apr	23	4	152
Amanda	9.4	9.8	2-May	23	9	139
DKW44-10	8.2	10.0	26-Apr	24	16	132
AAMU607	9.4	9.3	24-Apr	25	6	132
AAMU6207	9.4	6.3	28-Apr	24	7	125
AAMU6407	9.4	6.0	29-Apr	22	4	106
Hyclass 115W	8.8	9.5	25-Apr	25	7	99
Hybristar	9.4	6.5	30-Apr	23	3	73
Mean	8.7	8.9	28-Apr	26	4	203
LSD 0.05	1.59	1.11	3.2		4.8	124.0

Planted: September 10, 2010; Harvested: July 11 and 12, 2011

Great Plains Canola Variety Trial, Walsh, Colorado, 2011.

Variety (Line)	Stand (0-10)	Winter Survival (0-10)	Flowering Date	Plant Height in.	Seed Shattering %	Seed Yield lb/acre
KS4503	7.2	8.9	26-Apr	28	5	237
KS4480	8.5	8.7	30-Apr	32	3	231
KS4442	8.2	8.8	29-Apr	29	4	218
KS4469	7.6	8.7	27-Apr	27	3	218
KS4546	7.7	9.0	26-Apr	31	3	218
KS4543	8.0	9.3	26-Apr	30	4	211
Baldur	7.8	8.8	26-Apr	27	4	211
KS4496	6.3	8.9	30-Apr	33	3	205
KS4425	7.3	9.0	26-Apr	30	4	204
KS4429	7.6	8.9	27-Apr	30	4	198
KS4465	8.1	8.8	1-May	32	2	198
Riley	7.8	9.5	26-Apr	26	3	192
KS4470	6.2	8.7	27-Apr	32	3	191
KS4505	6.9	9.0	2-May	33	2	191
Wichita	7.5	9.2	1-May	30	3	191
KS4423	7.6	8.7	30-Apr	31	4	185
KS4476	7.5	8.8	3-May	30	3	185
KS4313	5.8	9.0	30-Apr	30	4	178
KS4486	6.4	9.3	29-Apr	33	3	178
KS4499	6.2	9.5	28-Apr	31	8	178
Sumner	7.2	9.7	25-Apr	32	10	178
KS4452	6.1	9.0	1-May	32	4	172
KS4391	7.2	9.3	30-Apr	29	1	158
KS4441	5.8	9.2	28-Apr	33	2	158
KS4528	6.3	8.9	1-May	31	3	152
KS4521	7.3	8.6	1-May	30	2	145
KS4548	7.0	9.8	1-May	32	6	145
KS4421	7.5	8.3	30-Apr	30	6	139
KS4481	7.7	8.3	4-May	29	3	138
KS4410	7.7	8.9	2-May	28	4	125
KS4477	6.0	8.4	4-May	33	2	125
KS4191	4.7	8.7	29-Apr	30	2	112
KS4417	6.9	9.0	29-Apr	27	6	106
KSUR21	5.5	9.1	3-May	27	4	99
KS4541	5.8	9.2	5-May	27	2	66
KSUR20	4.3	8.7	1-May	30	1	53
KAIIMA 4	7.3	0.8	27-Apr	22	5	13
KAIIMA 9	8.7	0.6	28-Apr	23	3	13
Mean	7.0	8.5	29-Apr	30	4	161
LSD 0.05	2.24	0.824	2.5		4.6	108.3

Planted: September 10, 2010; Harvested: July 12 and 13, 2011

Canola Winter Survival, Furrow and Surface Planting Comparison

Kevin Larson and Dennis Thompson

In the 2008-2009 season, the winter canola regional nursery and national variety performance trials at Walsh, Colorado completely winterkilled. This was the second time in the last five years that none of the 51 varieties/lines in the national variety performance trial survived the winter. Both of these winterkilling years occurred despite receiving pre-irrigation for stand establishment; however, the fall and winter seasons were very dry. We believed that there was a correlation between soil moisture and winter survival of winter canola. We conducted an irrigation study to see if we could improve the winter survival of canola. But we found that irrigation timing did not ameliorate winterkilling conditions in canola; therefore, we conducted a new study comparing furrow planting to surface planting to see if furrows protect the young plants from winterkilling. We tested four canola varieties with a range of winter survival levels to strengthen the results of this furrow and surface planting study.

Materials and Methods

We planted four winter canola varieties, Sitro, AAMU-33-07, Riley, and Kadore, which represented a range of winter survival, on September 10, 2010 in 10 ft. by 50 ft plots with six replications. The trial was planted at 5 lb seed/a with a 12 in. row-spaced drill in dry soil. For the furrow treatment, we used small shovels in front of the drill disks. These shovels made furrows about three inches deep. We planted 1 in. below the bottom of the furrow for the furrow planting treatment and 1 in. below the soil surface for the surface planting treatment. We fertilized the site with 50 lb N/a by surface banding 32-0-0. No other fertilizers were applied. The soil test results were: N, 19 ppm (two feet depth composite); P, 5.3 ppm; and K, 389 ppm. For weed control, we applied Treflan 24 oz/a and incorporated the herbicide with a rotary hoe. We furrow irrigated the site on 5 ft. beds until the moisture soaked across the beds. We recorded plant stand, winter survival, 50% flowering date, plant height, and seed yield. We harvested the study on July 14 with a self-propelled combine and weighed the plot seed with a digital scale.

Results and Discussion

Seeds yields were low. Dry conditions throughout the winter and spring depressed yields. The lack of rain during seed filling was particularly detrimental to the winter canola varieties in this study. With dry winter conditions, we expected low winter survival rates. However, winterkilling was not a contributing factor to the low yields. All four winter canola varieties had winter survival rates 90% and greater. Furrow planting produced significantly higher yield than surface planting. Furrow planting averaged 70 lb/a higher yield than surface planting, but the yield of furrow planting was still low, averaging only 227 lb/a. Yield and plant stand appeared to be correlated. The four winter canola varieties tested had low to moderate plant stands, ranging from 40% to 71% of solid stands for the planting treatments. The plant stands of Sitro and AAMU-

33-07 were significantly higher than Riley and Kadore. Plant stands for furrow planting were significantly higher than surface planting stands. Significantly higher plant stands produced significantly higher yields. Furrow planting had significantly higher yield and plant stand than surface planting. Varieties with average plant stands around 60%, Sitro and AAMU-33-07, produced significantly higher yield than varieties with average plant stands below 50%, Riley and Kadore.

In this study, furrowing planting did not appreciably increase winter survival compared to surface planting. However, furrowing planting did significantly increase plant stand and yield (although the yields were still low). Because stands and yields were increased with furrow planting, furrow planting would the preferred planting method compared to surface planting for winter canola production.

Table .-Canola Winter Survival, Furrow and Surface Planting, Walsh, 2011.

Planting	Variety	Seed Yield	Stand	Winter Survival	50% Bloom	Plant Height
		lb/a	%	%	date	in
Furrow	Sitro	281	71	92	26-Apr	30
Furrow	AAMU-33-07	254	67	94	22-Apr	26
Furrow	Riley	195	51	99	25-Apr	31
Furrow	Kadore	178	52	97	29-Apr	30
Furrow Average		**227**	**60**	**96**	**25-Apr**	**29**
Surface	Sitro	200	55	90	26-Apr	29
Surface	AAMU-33-07	172	59	91	23-Apr	26
Surface	Riley	142	47	96	25-Apr	31
Surface	Kadore	112	40	96	30-Apr	29
Surface Average		**157**	**50**	**93**	**26-Apr**	**29**
Average		192	55	94	25-Apr	29
LSD 0.05		56.5	12.3	2.9		

Planted: September 10, 2010; Harvested: July 14, 2011.
Furrow Planted: 1 in. below bottom of 3 in. deep furrows.
Surface Planted: 1 in. below soil surface.

Table .-Canola Winter Survival, Planting and Variety Summary, Walsh, 2011.

Planting	Variety	Seed Yield	Stand	Winter Survival	50% Bloom	Plant Height
		lb/a	%	%	date	in
Furrow		227	60	95	25-Apr	29
Surface		157	50	93	26-Apr	29
Planting Average		**192**	**55**	**94**	**25-Apr**	**29**
Planting LSD 0.05		**33.4**	**8.1**	**2.1**		
	Sitro	220	59	91	26-Apr	30
	AAMU-33-07	193	61	92	22-Apr	26
	Riley	155	48	97	25-Apr	31
	Kadore	129	43	96	29-Apr	30
Variety Average		**192**	**55**	**94**	**25-Apr**	**29**
Variety LSD 0.05		**37.5**	**7.7**	**1.7**		

Planted: September 10, 2010; Harvested: July 14, 2011.
Furrow Planted: 1 in. below bottom of 3 in. deep furrows.
Surface Planted: 1 in. below soil surface.