2016 Agricultural Research Update

MSU Eastern Agricultural Research Center

Sidney, MT

****

NDSU Williston Research Extension Center

Williston, ND

Serving the Mon-Dak Region

MONTANA STATE UNIVERSITY
MONTANA AGRICULTURAL EXPERIMENT STATION

Regional Report No. 22 – December 2016

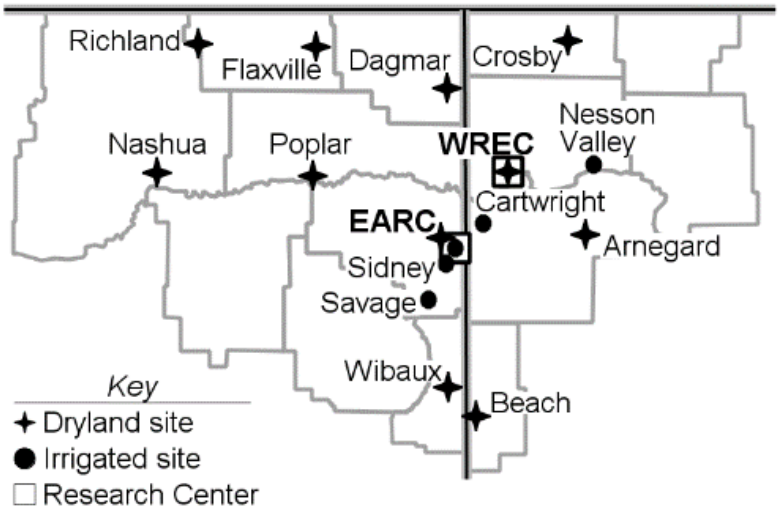
NDSU North Dakota State University ND Agricultural Experiment Station

Off-Station Cooperators – Producers – CES Agents

MONTANA
SMALL GRAIN--PULSES:
Dagmar—Brian Kaae—Agent Colleen Buck
Flaxville – Dave Roos – Agent Bobbie Roos
Nashua – Bill Lauckner – Agent Shelley Mills
Poplar – Mark Swank – Agent Jeff Chilson
Richland – Richard Fulton – Agent Shelley Mills
Wibaux – Rick Miske – Agent Danielle Harper
SUGARBEET:
Cartwright, ND – Ronnie L. Berry
East Fairview – Ty Hurley
Savage – Conradsen Bros., Inc.
Sidney – VS, Inc.

NORTH DAKOTA
SMALL GRAIN--PULSES--OIL SEEDS:
Crosby – Harlan Johnson – Agent Brandon Biwer
Arnegard—Phil Moen—Agent Morgan Myers
Beach—Tim Oech—Agent Ashley Krause

Location of Test Sites



We would like to take this opportunity to thank the County Agents, the County Ag Improvement Associations and especially the farm operators who permit the location of off-station plots on their land. ***All are to be commended for their cooperative efforts in helping determine crops and variety performance in the MonDak region.***

Results from tillage, chemical fallow, and field scale no-till trials, as well as other management trials on dryland and irrigated crops can be obtained by visiting with Center personnel.

Disclaimer: The information given herein is for educational purposes only. Any reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement is implied by the Williston Research Extension Center or the Eastern Agricultural Research Center.

Table of Contents

Weather Information

Weather Summary Williston, ND

Month	Precipitation 2016	Precipitation Avg	Temperature 2016	Temperature Avg	*
	- inches -		- degrees F -		
Oct-Dec. 2015	2.18	1.75			
January-March	0.40	1.19			
April	2.26	1.18	46	46	0
May	2.06	2.27	58	57	2
June	1.84	2.69	67	65	2
July	2.65	2.25	71	72	9
August	0.51	1.54	71	71	16
September	3.73	1.36	61	60	3
April-July	8.81	8.39			
April-Sept	13.05	11.29			
Total-Oct 15-Sept 16	15.63	14.23			

*Number of Days over 89° F

Last Spring Frost – May 15, 2016 (32° F)

First Fall Frost – September 13, 2016 (31° F)

Weather Summary Sidney, MT

Month	Precipitation 2016	Precipitation Avg	Temperature 2016	Temperature Avg	*
	- inches -		- degrees F -		
Oct-Dec. 2015	0.73	1.89			
January-March	0.84	1.30			
April	0.25	1.14	46.4	44.6	0
May	1.27	2.17	53.7	56.0	0
June	4.04	2.78	66.7	64.5	5
July	1.93	2.09	71.1	70.1	10
August	1.28	1.48	69.3	68.8	13
September	2.38	1.25	61.9	58.0	4
April-July	7.49	8.18			
April-Sept	11.15	10.91			
Total- Oct 15-Sept 16	12.72	14.10			

*Number of Days over 89° F

Last Spring Frost – May 15, 2016 (30.9° F)

First Fall Frost – September 13, 2016 (29.3° F)

Off-Station Precipitation* North Dakota

Site	April	May	June	July	Aug	Total
Arnegard	2.50	1.99	0.87	1.82	0.78	7.96
Beach	2.09	1.52	1.44	3.83	1.00	9.88
Crosby	0.94	3.45	4.72	2.10	0.60	11.81
Nesson Valley	1.58	2.89	2.60	1.66	0.31	9.04

*Actual rainfall received at plot location may have been more or less.

Off-Station Precipitation* Montana

Site	April	May	June	July	Aug	Total
Cartwright, ND	2.50	1.99	0.87	1.82	0.78	7.96
Flaxville	1.48	2.73	2.96	3.46	0.34	10.97
Nashua	2.88	5.04	2.47	2.66	0.42	13.47
Poplar	2.88	3.15	3.44	2.40	0.54	12.41
Richland	1.59	3.90	3.33	4.27	1.62	14.71
Savage	3.17	1.53	1.23	3.78	1.20	10.91
Wibaux	2.81	1.96	2.71	3.07	1.85	12.40

*Actual rainfall received at plot location may have been more or less.

North Dakota State University
Williston Research Extension Center
14120 Hwy 2
Williston, ND 58801

Tel. (701) 774-4315
Fax. (701) 774-4307
E-mail: NDSU.Williston.REC@ndsu.edu
http://www.ag.ndsu.edu/WillistonREC/

Montana State University
Eastern Agricultural Research Center
1501 North Central Avenue
Sidney, MT 59270

Tel. (406) 433-2208
Fax. (406) 433-7336
E-mail: cchen@montana.edu
http://agresearch.montana.edu/earc/

HARD SPRING WHEAT VARIETY DESCRIPTIONS

Variety	Origin[1]	Year released	Height	Maturity	Resistance to[2]						Quality Factors	
					Lodging	Stem Rust	Leaf Rust	Foliar Disease	Head Scab	Sawfly	Test Weight	Grain Protein
Advance	SDSU	2012	M SHORT	M EARLY	MS	MR	MR	NA	MS	NA	M HIGH	M HIGH
Alsen	NDSU	2000	MEDIUM	M EARLY	MR	R	MR/MS	S	MR	S	MEDIUM	M HIGH
AP 604 CL*	AgriPro	2006	MEDIUM	M EARLY	MS	R	MS	MS	NA	S	HIGH	MEDIUM
Barlow	NDSU	2009	MEDIUM	M EARLY	M	R	MR/MS	MR	M	S	M HIGH	M HIGH
Bolles	MN	2015	SHORT	M LATE	MR	NA	MR	MR	MR	NA	MEDIUM	HIGH
Breaker	WB	2007	MEDIUM	MEDIUM	MR	R	MR	MS	M	S	M HIGH	M HIGH
Brennan	AgriPro	2009	SHORT	M EARLY	MR	R	MR	M	MS	S	MEDIUM	MEDIUM
Briggs	SDSU	2002	M TALL	M EARLY	MS	R/MR	MR/MS	MS	M	S	MEDIUM	MEDIUM
Choteau	MSU	2004	M SHORT	M LATE	MS	R	MR/MS	MR	S	R	MEDIUM	MEDIUM
Corbin	WB	2006	MEDIUM	MEDIUM	M	NA	NA	NA	NA	MR	MEDIUM	MEDIUM
Dapps	NDSU	2003	MEDIUM	MEDIUM	MR	R	M	NA	S	NA	MEDIUM	HIGH
Duclair	MSU	2011	MEDIUM	MEDIUM	R	R	NA	NA	NA	R	MEDIUM	MEDIUM
Egan[3]	MSU	2014	MEDIUM	M LATE	R	NA	NA	NA	NA	S	HIGH	M HIGH
Elgin-ND	NDSU	2012	TALL	MEDIUM	M	R	MS	NA	M	S	M LOW	LOW
Faller	NDSU	2007	M TALL	MEDIUM	M	R	S	MR	M	S	MEDIUM	LOW
Forefront	SDSU	2012	TALL	EARLY	M	MR	MR	NA	MR	S	M LOW	HIGH
Freyr	AgriPro	2004	MEDIUM	MEDIUM	M	R	MR/MS	MS	MR	S	MEDIUM	M LOW
Glenn	NDSU	2005	M TALL	M EARLY	MR	R	MR/MS	M	MR	S	HIGH	M HIGH
Howard	NDSU	2006	M TALL	MEDIUM	MS	R	MS	M	M	S	M LOW	M LOW
HRS 3419	Croplan	2014	M SHORT	LATE	MR	NA	MR	MR	MR	NA	M HIGH	MEDIUM
HRS 3530	Croplan	2015	TALL	LATE	MR	NA	NA	NA	NA	NA	M HIGH	HIGH
HRS 3616	Croplan	2016	Medium	MEDIUM	MR	NA	NA	NA	NA	NA	NA	NA
Jedd*	WB	2008	M SHORT	EARLY	R	NA	NA	NA	NA	S	HIGH	LOW
Jenna	AgriPro	2009	M SHORT	M LATE	MR	R	MR/MS	M	M	S	M LOW	M LOW
Kelby	AgriPro	2006	SHORT	MEDIUM	MR	MR	MR/MS	M	M	S	M HIGH	MEDIUM
LCS Albany	Limagrain	2008	M SHORT	LATE	M	MR	MR	MS	M	S	M HIGH	M LOW
LCS Anchor	Limagrain	2016	M SHORT	MEDIUM	MR	NA	NA	NA	NA	NA	NA	NA
LCS Breakaway	Limagrain	2011	M SHORT	M EARLY	M	NA	R	MS	M	S	M HIGH	MEDIUM
LCS Iguacu	Limagrain	2014	SHORT	LATE	R	NA	NA	MR	MR	S	M HIGH	M LOW
LCS Nitro	limagrain	2015	SHORT	MEDIUM	MR	NA	NA	NA	NA	NA	M HIGH	MEDIUM
LCS Powerplay	Limagrain	2011	MEDIUM	MEDIUM	M	NA	MR	MS	M	S	LOW	M LOW
Linkert	MN	2013	M SHORT	M EARLY	R	R	MR	NA	M	NA	MEDIUM	HIGH
Mott	NDSU	2009	TALL	M LATE	M	MR	S	MS	MS	R	MEDIUM	MEDIUM
ND901CL Plus*	NDSU	2010	TALL	MEDIUM	M	R/MR	MR	NA	M	S	M HIGH	HIGH
Norden	MN	2012	M SHORT	M LATE	MR	R	R/MR	M	M	NA	LOW	M HIGH
ONeal	WB	2008	MEDIUM	M LATE	R	NA	MS	MR	S	S	MEDIUM	M LOW
Prestige	Pulse USA	2015	MEDIUM	M EARLY	MR	NA	NA	NA	NA	S	MEDIUM	MEDIUM
Prevail	SDSU	2014	M SHORT	EARLY	M	NA	NA	NA	M	NA	HIGH	M HIGH
Prosper	NDSU	2011	MEDIUM	MEDIUM	MR	R	S	M	M	S	MEDIUM	M HIGH
RB07	MN	2007	M SHORT	M EARLY	M	R	R	MS	MR	S	M HIGH	MEDIUM
Redstone	Pulse USA	2015	SHORT	M LATE	R	NA	R	NA	MR	MA	M LOW	MEDIUM
Reeder	NDSU	1999	MEDIUM	MEDIUM	MR	R	MS	S	S	S	MEDIUM	MEDIUM
Rollag	MN	2011	MEDIUM	MEDIUM	MR	R	MS	MR	MR	NA	M HIGH	M LOW
Sabin	MN	2009	MEDIUM	MEDIUM	M	R	MR	MS	M	NA	M HIGH	MEDIUM
Samson	WB	2007	SHORT	MEDIUM	R	R	MR/MS	MS	S	S	LOW	LOW
Select	SDSU	2010	MEDIUM	M EARLY	M	R/MR	R/MR	R/MR	MR	NA	MEDIUM	MEDIUM
Shelly	MN	2016	MEDIUM	MEDIUM	MR	NA	MR/MS	NA	M	NA	NA	NA
Steele-ND	NDSU	2004	MEDIUM	MEDIUM	MS	R	R	MS	M	S	MEDIUM	MEDIUM
Surpass	SDSU	2016	M SHORT	EARLY	MR	NA	MR/MS	NA	MR	NA	NA	NA
SY Ingmar	Syngenta	2014	MEDIUM	MEDIUM	R	MR	MR	MS	MR	S	M HIGH	M HIGH
SY Rowyn	Syngenta	2013	M SHORT	M EARLY	R	MR	MR	NA	MR	S	M HIGH	M LOW
SY Soren	Syngenta	2011	M SHORT	M EARLY	R	R	MR	M	M	S	M HIGH	MEDIUM
SY Tyra	Syngenta	2011	M SHORT	MEDIUM	R	R	MR	MS	S	R	MEDIUM	M LOW
SY605CL*	Syngenta	2011	MEDIUM	M EARLY	MS	R/MR	MR/MS	MS	S	S	M LOW	HIGH
Vantage	WB	2007	M SHORT	LATE	R	MR	MR/MS	MS	MS	S	HIGH	HIGH
Velva	NDSU	2011	M SHORT	M LATE	R	R	MR/MS	M	MS	S	MEDIUM	MEDIUM
Vida	MSU	1998	MEDIUM	MEDIUM	MR	MS	MS	MR	S	MR	MEDIUM	MEDIUM
Volt	WB	2008	MEDIUM	M LATE	R	NA	MR	MR	MS	S	HIGH	LOW
WB9312	WB	2016	M SHORT	MEDIUM	R	NA	MR	NA	NA	NA	NA	NA
WB9879CLP*	WB	2012	MEDIUM	MEDIUM	R	S	S	MR	MS	R	MEDIUM	HIGH
WB-Digger	WB	2009	MEDIUM	MEDIUM	M	MR	MR/MS	NA	MS	S	M LOW	LOW
WB Gunnison	WB	2013	MEDIUM	M EARLY	R	NA	S	S	S	T	M HIGH	MEDIUM
WB Mayville	WB	2011	SHORT	M EARLY	R	R	MR/MS	MS	S	S	M HIGH	M HIGH

[1] Refers to developer: MN = University of Minnesota**;** MSU = Montana State University; NDSU = North Dakota State University; SD = South Dakota State University; TS = Tigren Seed; WB = WestBred.

[2] R = resistant; MR = moderately resistant; M = intermediate; MS = moderately susceptible; S = susceptible; VS = very susceptible; NA = data not available.

[3] Resistant to orange wheat blossom midge.

***** Clearfield wheat with imidazolinone tolerance.

Spring Wheat Dryland Variety Trial **WREC, Williston, ND**

Variety	Plant Height	Heading Date	Protein†	Test weight‡	Yield#		
					2016	2-Yr Avg	3-Yr Avg*
	(in)	DAP*	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Velva	26	50	13.8	58.2	58.9	46.8	46.5
Prevail	26	48	13.6	57.7	57.9	46.6	45.4
LCS Pro	30	49	13.5	57.6	57.1	46.3	45.3
Elgin-ND	28	49	14.1	57.8	57.2	44.0	43.0
SY Ingmar	23	51	14.5	57.7	51.9	42.1	42.9
Mott	28	51	15.1	57.5	53.3	44.5	42.7
SY Tyra	22	49	13.6	58.6	53.8	42.8	42.6
WB-Mayville	23	48	14.6	57.7	52.6	43.4	42.5
LCS Nitro	24	53	13.5	56.1	52.5	42.3	42.4
WB9507	26	49	14.1	55.1	52.8	41.9	42.2
Linkert	24	48	14.6	58.1	51.3	42.1	41.8
SY605CL	26	47	14.2	59.1	55.2	43.5	41.6
Duclair	25	48	13.9	56.6	53.0	43.0	41.6
LCS Iguacu	25	52	13.1	58.7	50.7	42.3	41.6
Rollag	25	49	14.7	57.6	53.7	41.5	41.1
Prosper	25	50	13.9	57.3	51.2	41.4	41.1
Boost	27	51	15.2	57.5	48.5	40.8	40.8
SY Soren	24	49	14.6	58.4	54.4	42.4	40.7
ND 901CL+	29	49	15.5	58.6	53.0	42.4	40.6
SY Rowyn	24	49	14.0	57.1	50.8	40.7	39.5
Faller	26	51	13.4	56.5	53.5	39.0	39.5
Glenn	28	48	13.9	60.7	52.7	40.5	38.7
Barlow	27	47	14.2	59.3	52.8	39.6	38.6
LCS Breakaway	23	47	14.9	59.4	49.8	38.3	38.2
LCS Prime	26	48	12.8	59.4	55.9	50.8	-
WB9653	24	49	13.7	57.6	56.3	47.4	-
MS Chevelle	25	48	13.2	58.3	57.8	46.5	-
SY Valda	24	50	13.6	57.9	55.4	46.5	-
Surpass	27	47	13.5	57.8	54.8	45.6	-
MS Stingray	25	54	12.3	56.9	55.4	44.9	-
Croplan HRSW 3530	29	50	14.0	56.8	54.0	44.7	-
Focus	28	46	13.9	59.8	54.7	43.8	-
Redstone	25	47	13.7	58.1	56.9	43.3	-
Croplan HRSW 3419	26	54	14.0	55.1	56.9	42.9	-
Croplan HRSW 3361	24	50	13.8	56.6	51.8	42.3	-
Prestige	24	54	14.1	56.1	51.4	41.8	-
Bolles	25	51	16.0	56.5	45.6	39.6	-
HRS 3504	23	50	13.3	56.9	59.8	-	-
LCS Anchor	23	47	14.6	59.1	55.2	-	-
TCG Spitfire	26	52	14.0	57.2	55.0	-	-
TCG Wildfire	25	49	14.1	58.3	53.4	-	-
HRS 3616	24	48	14.7	57.4	52.2	-	-
Shelly	23	52	13.4	58.3	51.6	-	-
WB9312	24	47	13.2	57.8	48.9	-	-
Egan	26	49	15.7	55.9	48.4	-	-
TCG Cornerstone	22	49	15.4	57.5	47.5	-	-
Mean	25.3	49.3	14.1	57.7	53.4	-	-
CV (%)	6.0	1.7	3.4	0.6	7.1	-	-
LSD (5%)	2.2	1.2	0.7	0.5	5.3	-	-
LSD (10%)	1.8	1.0	0.6	0.4	4.4	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft Previous crop: Safflower
Planted: 5-3-2016 Harvested: 8-16-2016
Soil test (0-6"): P=17 ppm; K=266 ppm; pH=6.2; OM=2.4%; Soil type: Williams-Bowbells loam
(0-24"): NO3-N=4 lb/a
Applied fertilizers in lb/a: N=67; P_2O_5=18; K_2O=0; S=5

DAP* = Days after planting

†Protein adjusted to 12.0% moisture

‡Test Weight = Reported on a 13.5% moisture basis

#Yield = Reported on a 13.5% moisture basis

Chemical Applications: Brox-M/Axial Star @ 1.5 pt/ac and 16 oz/ac (6-6-16)

Spring Wheat Divide Variety Trial - WREC **Divide County, ND**

Variety	Protein†	Test weight	Yield		
			2016	2-Yr Avg	3-Yr Avg*
	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Barlow	13.3	61.1	80.2	57.3	64.1
Glenn	13.6	60.6	81.4	58.7	63.3
Mott	12.8	62.4	82.4	58.8	61.4
Jenna	13.6	60.9	71.6	56.4	60.9
Velva	12.7	59.2	74.8	53.3	59.0
SY Soren	14.1	60.2	71.9	53.5	58.7
Brennan	15.0	60.9	69.1	49.5	58.0
Prosper	14.7	61.1	70.1	52.6	57.3
SY Rowyn	15.0	60.9	65.0	51.2	56.7
Kelby	15.2	63.0	61.4	47.4	55.5
Elgin-ND	14.6	59.7	61.2	49.0	53.8
LCS Nitro	14.3	58.5	75.6	-	-
Faller	15.0	60.3	74.7	-	-
LCS Prime	14.8	60.3	72.5	-	-
LCS Pro	15.0	61.2	68.2	-	-
LCS Iguacu	14.5	57.2	63.0	-	-
Reeder	14.4	58.1	59.8	-	-
Egan	15.3	57.8	58.7	-	-
Rollag	15.5	59.6	56.8	-	-
SY Ingmar	16.2	54.3	56.5	-	-
Mean	14.5	59.9	71.7	-	-
CV (%)	3.5	1.1	10.1	-	-
LSD (5%)	0.8	1.1	11.5	-	-
LSD (10%)	0.9	0.7	9.5	-	-

Location: Latitude 48° 48'N; Longitude 103° 18'W; Elevation 2044 ft
Previous crop: Soybean
Planted: 4-28-2016
Harvested: 8-29-2016
Soil test (0-6"): P=19.5 ppm; K=380 ppm; pH=7.1; OM=4.2%
Soil type: Farnuf-Alkabo
(0-24"): NO3-N=25.5 lb/a
Applied fertilizers in lb/a: N=55; P_2O_5=18; K_2O=0; S=5
Chemical Applications: Brox-M/Axial Star @ 1.5 pt/ac and 16 oz/ac
†Protein adjusted to 12% moisture
*Average of years 2013, 2014, and 2016

Let the farmer forevermore be honored in his calling; for they who labor in the earth are the chosen people of God.

Thomas Jefferson

Spring Wheat Golden Valley Dryland Variety Trial - WREC **Golden Valley County, ND**

Variety	Protein†	Test weight	Yield		
			2016	2-Yr Avg	3-Yr Avg*
	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Velva	13.0	61.2	50.2	50.0	56.4
Elgin-ND	13.2	61.1	46.0	50.6	54.9
Mott	12.3	61.1	48.7	50.0	53.9
Prosper	11.7	61.1	46.6	47.1	53.9
Jenna	12.1	59.5	43.5	43.5	50.9
SY Soren	13.7	61.3	43.0	42.1	48.4
SY Rowyn	12.9	60.2	45.1	37.4	46.9
Barlow	14.0	62.8	45.5	37.7	46.6
Brennan	14.1	61.6	43.1	37.4	44.5
Glenn	13.0	63.9	41.1	35.1	41.3
Kelby	15.1	60.9	40.2	33.3	41.0
LCS Prime	11.5	62.8	51.0	-	-
Reeder	13.3	61.6	50.8	-	-
Faller	12.7	60.5	50.7	-	-
LCS Pro	13.1	62.6	50.3	-	-
LCS Iguacu	12.6	60.7	44.5	-	-
Egan	14.2	58.8	44.1	-	-
Rollag	13.3	61.7	42.6	-	-
LCS Nitro	13.6	59.3	42.1	-	-
SY Ingmar	14.8	61.6	40.1	-	-
Mean	13.2	61.2	45.5	-	-
CV (%)	6.0	0.4	5.8	-	-
LSD (5%)	1.3	0.4	4.4	-	-
LSD (10%)	1.1	0.4	3.7	-	-

Location: Latitude 46° 50'N; Longitude 103° 59'W; Elevation 2890 ft Previous crop: lentil Harvested: 8-31-2016
Planted: 5-17-2016
Soil test (0-6"): P=7 ppm; K=202 ppm; pH=7.9; OM=2.5% Soil type: Grail-Grassna complex
(0-24"): NO3-N=35 lb/a
Applied fertilizers in lb/a: N=29; P_2O_5=18; K_2O=0: S=5
Chemical Applications: Brox-M/Axial Star @ 1.5 pt/ac and 16 oz/ac
†Protein adjusted to 12% moisture
*Average of years 2013, 2014, and 2016

Spring Wheat McKenzie Dryland Variety Trial - WREC **McKenzie County, ND**

Variety	Protein†	Test weight ‡	Yield#	
			2016	2-Yr Avg
	(%)	(lb/bu)	(bu/a)	(bu/a)
Brennan	13.3	61.9	59.2	47.3
Reeder	12.7	61.6	56.1	46.1
Elgin-ND (ND818)	12.4	61.0	59.8	45.3
Glenn	13.1	63.9	58.4	42.9
Mott	12.2	60.4	53.0	42.4
Barlow	12.8	62.6	50.8	42.0
SY Soren	13.2	61.2	49.3	41.3
Jenna	11.9	59.9	50.4	41.0
Velva	11.8	59.6	44.8	39.3
Prosper	11.6	60.0	52.1	38.8
LCS Pro	11.4	61.7	63.4	-
Faller	11.1	59.9	61.8	-
LCS Prime	11.2	62.2	61.1	-
Egan	13.2	59.5	56.9	-
SY Ingmar	13.1	61.9	56.6	-
SY Rowyn (03S253-7)	12.3	60.4	53.7	-
LCS Iguacu	12.0	60.8	52.3	-
LCS Nitro	12.0	59.0	51.8	-
Rollag	13.8	61.2	49.0	-
Kelby	14.3	61.1	40.8	-
Mean	12.3	61.0	55.1	-
CV (%)	2.7	0.6	8.6	-
LSD (5%)	0.6	0.6	7.7	-
LSD (10%)	0.5	0.5	6.4	-

Location: Arnegard, ND; Latitude 47° 47'N; Longitude 103° 25'W; Elevation 2250 ft Previous crop: Lentil
Planted: 5/9/2016 Harvested: 8/23/2016
Soil test (0-6"): P=7 ppm; K=235 ppm; pH=7.1; OM=4.2% Soil type: Williams-Belfield-Grail
(0-24"): NO3-N=4 lb/a
Applied fertilizers in lb/a: N=96; P_2O_5=21; K_2O=0; S=5

†Protein adjusted to 12% moisture

‡Test Weight = Reported on a 13.5% moisture basis

#Yield = Reported on a 13.5% moisture basis

*Moisture stress caused low yields in 2015, contributing to a low 2 yr. avg.

The farmer has to be an optimist or he wouldn't still be a farmer.

Will Rogers

Hard Red Spring Wheat Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Year of release	Plant height	Days to head	Lodging	Protein†	Test weight	Yield		
								2016	2-Yr Avg	3-Yr Avg
			(in)	(DAP+)	(0-9*)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Velva	ND	2011	33.9	62	0	15.4	61.5	82.1	90.2	94.3
LCS Iguacu	Limagrain	2014	30.5	60	0	14.0	61.8	81.7	88.9	93.3
Jenna	AgriPro	2009	30.5	63	0	15.5	61.2	84.0	86.9	90.9
Freyr	AgriPro	2004	33.2	61	0	16.3	61.6	75.9	86.6	89.2
Elgin-ND	ND	2012	35.7	61	0	16.0	61.8	89.9	88.0	88.2
Reeder	ND	1999	32.7	61	0	16.0	61.6	80.6	85.8	87.4
Prosper	ND	2011	31.9	63	0	15.4	61.4	83.4	84.4	87.1
Barlow	ND	2009	34.2	60	0	16.3	62.8	76.6	81.2	87.1
SY Soren	Syngenta	2011	29.6	61	1	15.3	61.6	77.4	82.4	86.6
Mott	ND	2009	35.5	62	1	15.2	62.1	79.7	81.7	86.6
Vida	MT	1998	31.7	61	0	16.1	59.3	82.9	85.3	85.8
Faller	ND	2007	32.2	62	0	14.6	61.0	79.0	79.3	85.3
Steele-ND	ND	2004	33.9	61	0	16.2	62.6	75.9	76.2	84.5
Briggs	SD	2002	31.1	61	0	16.6	61.9	73.1	78.8	83.5
RB07	MN	2007	31.3	62	0	16.3	60.8	78.4	79.7	82.8
Glenn	ND	2005	33.3	60	0	16.2	63.5	69.7	75.5	81.8
Linkert (MN06028)	MN	2013	28.4	61	0	16.6	61.7	71.8	74.9	81.6
Rollag	MN	2011	30.0	61	1	16.2	62.1	74.3	78.0	81.4
Vantage	WB	2007	30.5	62	0	16.3	62.9	82.8	81.9	80.0
Brennan	AgriPro	2009	29.2	60	0	15.5	61.4	73.0	73.2	79.1
Kelby	AgriPro	2006	28.2	60	0	16.3	60.8	62.2	68.7	76.2
Croplan HRSW 3530	Croplan	2015	34.9	62	1	13.9	61.7	89.5	94.2	-
Croplan HRS 3419	Croplan	2014	31.3	63	1	13.4	60.3	102.1	89.6	-
Bolles (MN00186-8)	MN	2015	30.9	61	0	17.5	61.2	79.4	79.7	-
Prevail (SD4178)	SD	2014	31.8	61	1	15.4	61.1	74.1	78.7	-
WB-Mayville	WB	2011	26.1	60	0	16.6	60.5	68.4	75.4	-
Forefront	SD	2012	31.7	61	0	15.4	61.8	78.8	72.8	-
Prestige	Pulse USA	2015	31.8	64	0	13.6	61.1	104.3	-	-
Advance	SD	2012	31.7	61	0	14.9	62.9	87.6	-	-
LCS Nitro (LNR10125)	Limagrain	2015	27.6	62	1	14.1	61.1	87.4	-	-
MS Chevelle	Meridian	-	30.7	60	0	14.1	62.1	86.5	-	-
SY Ingmar	Syngenta	2014	30.6	60	0	15.6	62.9	84.7	-	-
Egan	MSU	2014	32.7	62	0	16.9	59.3	80.7	-	-
WB-Digger	WB	2009	32.0	60	0	16.0	60.7	77.8	-	-
LCS Prime	Limagrain	2015	31.3	62	0	15.1	62.5	77.6	-	-
Croplan HRS 3616	Croplan	-	31.2	61	0	16.0	61.0	77.0	-	-
WB9653	WB	-	28.2	62	0	15.3	61.0	76.2	-	-
SY Valda	Syngenta	-	28.0	61	0	15.7	62.2	70.2	-	-
WB9507	WB	-	32.5	61	0	15.4	59.4	69.5	-	-
Redstone	Pulse USA	2015	28.6	60	1	15.9	60.3	69.5	-	-
Focus (SD4362)	SD	-	31.3	60	0	16.6	62.4	66.8	-	-
LCS Anchor (LNR 12-0283)	Limagrain	2016	27.4	61	1	16.0	61.2	64.8	-	-
Mean			31.2	61.1	0.2	15.6	61.5	78.7	81.4	85.4
C.V.			5.1	2.2	188.5	4.3	0.8	9.7	-	-
LSD 5%			2.2	1.9	NS	0.9	0.7	10.7	-	-
LSD 10%			1.9	1.6	NS	0.8	0.6	9.0	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: Potato
Planted: 4/21/2016 — Harvested: 8/9/2016
Residue status at planting: Conventional Till — Soil type: Lihen Loamy Fine Sand
Plot size: 91.875 ft^2
Applied fertilizer in lbs/a broadcast: 420 lbs/a of 46-0-0
Soil test to 6": 13-ppm P, 152-ppm K, OM-1.8, pH-7.7
Soil test to 2' : 7 lbs of N
Yield goal: 90 bu/a
Planting population: 1.25 million seeds/a
Herbicides applied: Starane 10 oz/a + Tacoma 1EC 10 oz/a + Bison 1.5 pt/a (5/17/2016)
Fungicides applied: Priaxor D 8 oz/a (6/22/2016)
Rainfall: 8.21 in (4/21/2016 - 8/9/2016)
Irrigation: 6.8 in (4/21/2016 - 8/9/2016)
+ Days after planting
* 0: no lodging - 9: plants lying flat on ground
† Protein content adjusted to a 12% moisture

Dryland Spring Wheat Advanced Yield Trial **EARC, Sidney, MT**

Entry	Heading date DAP	Plant Height cm	Yield bu/ac	Protein %	Test W lb/bu
CI 10003	**172**	91	55.2	13.5	62.0
CI 13596	166	**93**	61.1	13.6	63.5
PI574642	165	72	70.3	13.7	62.6
ND 695	166	82	79.9	12.9	64.0
PI633974	165	73	72.7	12.5	63.1
PI642366	165	72	71.3	13.8	61.7
PI660981	165	75	72.1	12.2	63.5
PI671855	166	76	59.1	14.0	62.9
BZ996434	165	67	68.0	12.3	64.1
BZ92413R	165	72	57.0	12.1	64.4
WB9879CLP	165	64	62.5	12.0	64.2
AGRIPR10	165	73	70.1	13.8	64.8
AGRIPR12	165	72	72.1	12.1	64.5
AGRIPR14	165	66	65.5	12.9	64.4
WSCIA	165	75	75.1	12.3	65.1
WB 161	165	64	68.2	13.0	64.4
WB 162	165	72	69.5	11.1	63.8
WB 163	165	71	72.1	11.5	64.4
AGRIPR161	166	73	75.0	12.0	62.5
AGRIPR151	165	70	73.3	12.2	64.1
AGRIPR141	165	73	69.6	13.2	64.7
LIMAGR143	165	80	68.9	11.7	64.3
LIMAGR161	165	73	68.5	12.1	64.3
LIMAGR162	165	69	70.0	12.8	64.2
WF161	166	75	73.4	13.4	63.5
WF162	165	72	80.5	12.7	62.9
WF163	166	74	70.2	12.7	63.4
AVG	166	73	69.3	12.7	63.8
CV (%)	0.37	7.04	9.99	6.32	0.85
LSD (0.05)	1	8	11.4	1.3	0.9

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Safflower
Residual soil N: 143.5 lb N/ac
Planted: April 11, 2016
Harvested: August, 3, 2016
Applied fertilizer: No fertilizer

Herbicide: Full Deck; Discover
Fungicide: Avaris
Precipitation April – August 2016: 9.74 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2015 – August 2016: 14.55 in
Ave (65 yr) precipitation September – August: 14.09 in

Comments: Soil N was high thus no fertilizer was applied.

Old Farmers never die, they just go to seed.

Irrigated Spring Wheat Advanced Yield Trial **EARC, Sidney, MT**

Entry	Heading Date DAP	Plant Height cm	Yield bu/ac	Protein %	Test W lb/bu
CI 10003	172	**101**	71.4	15.1	59.2
CI 13596	171	88	75.2	14.9	60.4
PI574642	171	97	93.5	14.5	60.4
ND 695	169	95	99.4	15.4	61.7
PI633974	169	90	99.8	14.8	59.9
PI642366	171	94	83.9	15.3	58.8
PI660981	169	93	99.8	14.4	60.7
PI671855	171	94	92.7	**16.1**	59.4
BZ996434	169	92	84.2	14.7	60.7
BZ92413R	170	81	85.4	13.9	62.0
WB9879CLP	170	94	96.1	14.6	60.5
AGRIPR10	169	83	92.7	15.2	61.3
AGRIPR12	170	87	100.9	13.4	60.2
AGRIPR14	170	84	102.2	14.6	61.4
WSCIA	169	89	90.6	14.8	59.5
WB 162	169	90	**112.3**	12.6	62.6
WB 163	169	84	102.9	12.9	61.5
AGRIPR161	172	90	94.5	14.4	57.8
AGRIPR151	169	90	110.3	14.0	62.1
AGRIPR141	170	88	98.3	14.7	61.8
LIMAGR143	169	93	94.7	14.9	62.6
LIMAGR161	169	92	106.7	13.5	62.6
LIMAGR162	169	83	99.7	15.0	62.1
WF161	169	88	99.6	15.2	60.3
WF162	170	88	102.5	14.2	59.5
WF163	171	95	106.5	14.7	62.4
AVG	**170**	**91**	**95.0**	**14.5**	**60.9**
CV (%)	0.45	3.47	5.79	2.22	1.32
LSD (0.05)	1	5	9.4	0.6	1.4

Location: EARC irrigated farm
Soil type: Savage Silty Clay
Previous crop: Safflower
Residual soil N: 78 lb N/ac
Planted: April 21, 2016
Harvested: August 8, 2016
Applied fertilizer: 200 lb/ac 46-0-0

Herbicide: Full Deck; Discover
Fungicide: Avaris
Precipitation April – August 2016: 9.74 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2015 – August 2016: 14.55 in
Ave (65 yr) precipitation September – August: 14.09 in

"It is only the farmer who faithfully plants seeds in the Spring, who reaps a harvest in the Autumn."

B. C. Forbes

Dryland Spring Wheat Evaluation - EARC **Daniels County, MT**

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
MCNEAL	77	25.3	11.5	60.5
REEDER	75	35.5	11.1	62.1
CHOTEAU	74	34.2	12.3	61.2
VIDA	76	36.7	11.4	61.7
DUCLAIR	73	36.0	11.7	61.5
MOTT	**92**	29.3	11.7	63.0
WB9879CLP	71	37.4	12.1	62.7
BRENNAN	68	34.5	11.9	63.1
SY TYRA	76	36.3	10.4	63.3
SY SOREN	72	39.0	12.6	62.8
EGAN	74	38.9	**12.8**	61.7
ELGIN	84	35.8	10.9	62.5
AVG	76	34.9	11.7	62.2
CV	6.7	13.7	5.5	1.4
LSD (0.05)	8	7.7	1.0	1.4

Dryland Spring Wheat Evaluation - EARC **Roosevelt County, MT**

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
MCNEAL	89	26.8	15.8	60.0
REEDER	88	42.0	14.9	60.7
CHOTEAU	83	37.7	15.6	59.1
VIDA	91	37.0	15.4	59.6
DUCLAIR	84	41.1	15.6	59.6
MOTT	96	25.7	15.2	60.7
BRENNAN	80	53.6	15.1	**63.6**
SY TYRA	79	30.2	14.5	60.6
SY SOREN	80	**56.5**	15.7	62.3
EGAN	89	36.8	**17.4**	60.5
BARLOW	95	39.4	15.1	62.8
ELGIN	**101**	34.7	15.2	60.4
AVG	**88**	**38.5**	**15.5**	**60.8**
CV	3.9	13.6	2.2	1.2
LSD (0.05)	6	9.0	0.6	1.2

Dryland Spring Wheat Evaluation - EARC **Sheridan County, MT**

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
MCNEAL	**79**	31.7	14.4	59.7
REEDER	75	41.1	14.7	61.5
CHOTEAU	63	33.0	14.1	60.7
VIDA	76	44.8	14.1	61.1
DUCLAIR	64	28.8	14.4	59.6
MOTT	76	35.1	14.0	61.3
BRENNAN	60	44.1	15.0	62.6
SY TYRA	62	37.6	14.0	62.6
SY SOREN	62	42.1	15.3	62.9
EGAN	71	33.3	**15.7**	58.7
BARLOW	75	41.6	14.8	**63.6**
ELGIN	72	43.2	14.2	62.0
AVG	**70**	**38.0**	**14.6**	**61.4**
CV	7.9	11.0	2.6	0.8
LSD (0.05)	9	7.0	0.6	0.8

Dryland Spring Wheat Evaluation - EARC **Valley County, MT**

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
MCNEAL	74	30.2	15.3	60.8
REEDER	77	**40.1**	15.1	63.3
CHOTEAU	65	34.9	15.6	61.6
VIDA	74	38.1	14.8	62.3
DUCLAIR	70	34.7	15.1	61.8
MOTT	79	30.5	15.1	62.1
BRENNAN	65	34.6	16.0	64.8
SY TYRA	63	33.0	14.2	63.5
SY SOREN	62	34.9	15.6	64.0
EGAN	73	39.3	**16.9**	61.1
BARLOW	77	33.5	14.6	64.8
ELGIN	**82**	36.5	14.3	63.4
AVG	**72**	**35.0**	**15.2**	**62.8**
CV	6.7	8.8	3.1	1.0
LSD (0.05)	8	5.0	0.8	1.1

Dryland Spring Wheat Evaluation - EARC **Wibaux County, MT**

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
MCNEAL	71	33.9	13.6	63.4
REEDER	65	35.3	14.2	64.9
CHOTEAU	65	28.7	13.7	64.6
VIDA	65	34.3	12.5	65.4
DUCLAIR	66	34.4	12.5	64.7
MOTT	**74**	34.1	13.9	65.4
BRENNAN	62	39.9	13.8	66.6
SY TYRA	63	**48.2**	13.2	66.7
SY SOREN	63	46.7	14.2	66.0
EGAN	66	30.0	**16.7**	62.3
BARLOW	73	39.2	13.3	**66.9**
ELGIN	73	47.6	13.2	65.4
AVG	**67**	**37.7**	**13.7**	**65.2**
CV	5.6	27.6	8.0	0.7
LSD (0.05)	6	18.0	1.8	0.8

Recrop Spring Wheat Variety Yield Evaluation **EARC, Sidney, MT**

Entry	Height cm	Heading Date DAP	Yield bu/ac	Protein %	TW lb/bu
MCNEAL	70	167	62.8	14.4	62.2
REEDER	67	167	62.2	**14.8**	63.2
CHOTEAU	62	165	53.3	13.6	62.1
VIDA	69	165	**69.5**	13.3	62.5
DUCLAIR	68	163	58.6	14.2	61.2
MOTT	72	167	57.5	13.8	62.9
BRENNAN	60	160	52.9	12.9	63.2
SY TYRA	63	165	60.8	10.6	64.0
SY SOREN	61	166	60.0	13.4	63.3
EGAN	68	167	55.0	13.8	61.8
BARLOW	72	163	52.7	14.0	**64.7**
ELGIN	**74**	167	63.0	14.5	63.5
AVG	**67**	**165**	**59.0**	**13.6**	**62.9**
CV	6.0	0.9	13.9	8.7	0.8
LSD (0.05)	7	2	13.4	1.9	0.9

Wheat Variety Comparisons, Williston, ND

The gross return per acre was calculated by multiplying 3 year average yield from dryland varietal trials and the market price obtained on 11/22/2016 from different grain elevators in and around Williston. The market price of each spring wheat variety was adjusted for protein premium by using a linear equation obtained by plotting wheat market prices against percent proteins. In case of durum, the terminal rate was used.

Spring Wheat

Variety	3 Yr Avg. (2014–2016) Yield bu/a	Protein %	Gross Return $/a	+ or - Barlow $/a
Mott	42.7	15.1	199.49	30.73
Velva	46.5	13.8	196.49	27.73
ND 901CL+	40.6	15.5	195.11	26.36
Boost	40.8	15.2	191.92	23.16
SY Ingmar	42.9	14.5	191.74	22.98
WB-Mayville	42.5	14.6	191.49	22.73
Prevail	45.4	13.6	189.44	20.69
Linkert	41.8	14.6	188.00	19.24
LCS Pro	45.3	13.5	186.90	18.15
Elgin-ND	43.0	14.1	186.86	18.11
Rollag	41.1	14.7	186.25	17.50
WB9507	42.2	14.1	183.28	14.53
SY Soren	40.7	14.6	182.98	14.22
SY605CL	41.6	14.2	181.75	12.99
Duclair	41.6	13.9	178.35	9.60
SY Tyra	42.6	13.6	177.87	9.11
LCS Nitro	42.4	13.5	175.62	6.86
Prosper	41.1	13.9	175.42	6.66
LCS Breakaway	38.2	14.9	175.24	6.48
SY Rowyn	39.5	14.0	169.85	1.09
Barlow	38.6	14.2	168.76	0.00
LCS Iguacu	41.6	13.1	166.41	-2.35
Glenn	38.7	13.9	164.66	-4.09
Faller	39.5	13.4	162.42	-6.34

Durum

Variety	3 Yr Avg. (2014–2016) Yield bu/a	Protein %	Gross Return $/a	+ or - Ben $/a
Tioga	34.2	17.7	230.85	15.94
Divide	34.3	19.5	231.53	16.61
VT Peak	34.2	19.4	230.85	15.94
Grenora	32.5	17.9	219.38	4.46
AC Navigator	34.0	18.7	229.38	14.47
AC Commander	33.8	18.7	228.41	13.50
Carpio	32.2	19.0	217.35	2.44
Alkabo	33.7	19.3	227.48	12.56
Alzada	32.8	18.7	221.40	6.49
Normanno	32.4	18.8	218.48	3.57
Joppa	33.2	18.9	224.10	9.19
Lebsock	32.2	18.0	217.18	2.27
Mountrail	32.0	19.7	216.00	1.09
Ben	31.8	19.4	214.91	0.00
Strongfield	31.5	20.1	212.57	-2.35
CDC Verona	31.4	21.0	211.64	-3.27
Pierce	31.0	18.9	208.93	-5.99
Rugby	30.2	18.2	203.78	-11.14
Silver	30.2	19.2	203.85	-11.06

DURUM VARIETY DESCRIPTIONS

VARIETY	ORIGIN[1]	YEAR RELEASED	HEIGHT	MATURITY	Resistance To[2]					Quality Factors			
					LODGING	LEAF RUST	FOLIAR DISEASE	ROOT ROT	SCAB	TEST WEIGHT	KERNEL SIZE[3]	GRAIN PROTEIN	OVERALL QUALITY
AC AVONLEA	CANADA	1997	MEDIUM	M EARLY	MS	R	MS	S	VS	MEDIUM	LARGE	M HIGH	GOOD
AC COMMANDER	CANADA	2002	M SHORT	LATE	M	R	MS	M	VS	MEDIUM	LARGE	M HIGH	GOOD
AC NAVIGATOR	CANADA	1999	M SHORT	M LATE	M	R	M	S	S	MEDIUM	V LARGE	MEDIUM	GOOD
ALKABO	NDSU	2005	MEDIUM	MEDIUM	R	R	M	M	MS	HIGH	LARGE	M LOW	GOOD
ALZADA	WB	2004	SHORT	EARLY	M	R	S	M	VS	MEDIUM	LARGE	MEDIUM	EXCELLENT
BEN	NDSU	1996	TALL	MEDIUM	MR	R	MR	M	S*	V HIGH	V LARGE	M HIGH	AVERAGE
CARPIO	NDSU	2012	TALL	M LATE	MS	R	M	NA	M	MEDIUM	LARGE	M HIGH	EXCELLENT
CDC VERONA	CANADA	2010	M TALL	M LATE	M	R	MR	NA	S	MEDIUM	LARGE	M HIGH	GOOD
DG MAX	DGP	2008	M TALL	MEDIUM	M	MR	MR	NA	MS	HIGH	MEDIUM	M HIGH	GOOD
DG STAR	DGP	2007	M TALL	M EARLY	M	R	M	NA	NA	MEDIUM	M SMALL	MEDIUM	GOOD
DILSE	NDSU	2002	M TALL	LATE	M	R	M	M	MS	HIGH	MEDIUM	HIGH	EXCELLENT
DIVIDE	NDSU	2005	M TALL	M LATE	M	R	M	M	MR	MEDIUM	MEDIUM	M HIGH	EXCELLENT
GRANDE D'ORO	WB/DGP	2005	M TALL	MEDIUM	MR	R	M	MS	NA	HIGH	M SMALL	MEDIUM	AVERAGE
GRENORA	NDSU	2005	MEDIUM	M EARLY	M	R	M	MR	MS	MEDIUM	MEDIUM	MEDIUM	GOOD
JOPPA	NDSU	2013	MEDIUM	MEDIUM	R	R	M	NA	M	MEDIUM	LARGE	MEDIUM	GOOD
KYLE	CANADA	1984	TALL	MEDIUM	S	MR	M	S	NA	MEDIUM	M LARGE	MEDIUM	GOOD
LEBSOCK	NDSU	1999	M TALL	MEDIUM	R	R	M	MS	MS	HIGH	LARGE	MEDIUM	AVERAGE
MAIER	NDSU	1998	M TALL	M LATE	M	R	M	M	S*	HIGH	MEDIUM	HIGH	AVERAGE
MONROE	NDSU	1985	TALL	EARLY	M	R	M	S	VS	MEDIUM	LARGE	M HIGH	GOOD
MOUNTRAIL	NDSU	1998	M TALL	M LATE	M	R	M	M	S*	MEDIUM	MEDIUM	MEDIUM	AVERAGE
PIERCE	NDSU	2001	M TALL	MEDIUM	M	R	MS	MR	S	V HIGH	MEDIUM	MEDIUM	EXCELLENT
RUGBY	NDSU	1973	TALL	M EARLY	R	R	MR	M	S	MEDIUM	MEDIUM	MEDIUM	POOR
SILVER	MSU	2012	SHORT	EARLY	R	NA	M	NA	S	M HIGH	SMALL	M HIGH	GOOD
STRONGFIELD**	CANADA	2004	M TALL	M LATE	M	R	MS	NA	S	MEDIUM	M LARGE	V HIGH	GOOD
TIOGA	NDSU	2010	TALL	M LATE	MR	R	M	NA	MS	M HIGH	MEDIUM	M HIGH	EXCELLENT
WESTHOPE	WB	2009	M TALL	MEDIUM	M	R	M	NA	S	M HIGH	M LARGE	MEDIUM	GOOD
VT PEAK	VITERRA	2010	M TALL	MEDIUM	MS	NA	NA	NA	NA	MEDIUM	M SMALL	M HIGH	GOOD

[1] Refers to developer: DGP = Dakota Growers Pasta; MSU = Montana State University; NDSU = North Dakota State University.

[2] R = resistant; MR = moderately resistant; M = intermediate; MS = moderately susceptible; S = susceptible; VS = very susceptible; NA = data not available. All varieties are resistant to current stem rust races. Foliar Disease = reaction to tan spot and septoria leaf spot complex.

[3] Number seeds/lb: small = less than 11,000; medium = 11,000-12,000; large = more than 12,000.

* Indicates yield and/or quality have been higher than would be expected based on visual head blight symptoms alone.

** Indicates low cadmium variety.

MT Statewide Durum Trial - NDSU **WREC, Williston, ND**

Variety	Plant Height	Heading Date	Protein†		Test weight‡	Yield#	
			2016	3-Yr Avg		2016	3-Yr Avg
	(in)	DAP*	(%)	(%)	(lb/bu)	(bu/a)	(bu/a)
Alkabo	24	53	18.9	16.9	56.1	37.6	33.7
Alzada	23	51	18.1	16.8	54.9	42.4	32.8
Carpio	26	55	18.4	16.8	56.0	42.6	32.2
Divide	24	53	18.1	16.6	55.6	42.9	34.3
Grenora	24	52	18.4	16.6	55.5	38.7	32.5
Joppa	26	53	18.8	16.9	55.6	39.3	33.2
Mountrail	24	53	18.2	16.4	54.2	36.9	32.0
Silver	21	50	18.2	17.1	56.0	39.5	30.2
Tioga	24	52	18.0	16.6	59.7	38.5	34.2
Mean	24.0	52.5	18.4		55.9	39.8	
CV (%)	6.9	1.1	5.4		2.4	11.8	
LSD (5%)	2.8	0.9	NS		2.3	NS	
LSD (10%)	2.3	0.8	NS		1.9	NS	

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft Previous crop: Safflower
Planted: 5-2-2016 Harvested: 8-5-2017
Soil test (0-6"): P=17 ppm; K=266 ppm; pH=6.2; OM=2.4%; Soil type: Williams-Bowbells loam
(0-24"): NO3-N=4 lb/a
Applied fertilizers in lb/a: N=67; P_2O_5=18; K_2O=0; S=5

DAP* = Days after planting

†Protein adjusted to 12.0% moisture

‡Test Weight = Reported on a 13.5% moisture basis

#Yield = Reported on a 13.5% moisture basis

Chemical Applications: Brox-M/Discover NG @ 1.5 pt/ac and 16 oz/ac (6-6-16)

Durum Divide Variety Trial - WREC **Divide County, ND**

Variety	Protein†	Test weight	Yield		
			2016	2-Yr Avg	3-Yr Avg*
	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Joppa	15.6	58.8	63.7	49.3	53.9
Mountrail	14.5	58.6	67.8	53.8	53.8
Lebsock	15.0	59.6	69.1	49.9	49.9
Carpio	15.4	58.4	58.5	45.5	49.6
Tioga	14.7	58.3	58.9	44.2	49.5
Divide	15.7	58.1	62.6	45.9	48.8
Alkabo	14.7	58.5	58.0	44.8	46.3
Mean	15.1	58.6	62.6	-	-
CV (%)	3.9	1.2	8.8	-	-
LSD (5%)	1.0	1.2	9.5	-	-
LSD (10%)	0.8	1.0	7.8	-	-

Location: Latitude 48° 48'N; Longitude 103° 18'W; Elevation 2044 ft Previous crop: Soybean
Planted: 4-28-2016 Harvested: 8-29-2016
Soil test (0-6"): P=19.5 ppm; K=380 ppm; pH=7.1; OM=4.2% Soil type: Farnuf-Alkabo
(0-24"): NO3-N=25.5 lb/a
Applied fertilizers in lb/a: N=55; P_2O_5=18; K_2O=0; S=5

Chemical Applications: Brox-M/Discover NG @ 1.5 pt/ac and 16 oz/ac

†Protein adjusted to 12% moisture

*Average of years 2013, 2014, and 2016

Durum Golden Valley Dryland Variety Trial - WREC **Golden Valley County, ND**

Variety	Protein†	Test weight	Yield		
			2016	2-Yr Avg	3-Yr Avg*
	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Joppa	13.5	61.8	55.1	65.5	62.2
Mountrail	12.8	61.4	50.0	61.0	61.5
Tioga	13.8	62.0	54.1	65.9	58.5
Carpio	13.2	61.8	52.3	56.8	56.3
Lebsock	12.9	61.7	48.3	63.0	56.0
Alkabo	12.9	61.3	45.1	58.2	55.1
Divide	13.1	61.8	46.1	56.2	54.9
Mean	13.2	61.7	50.1	-	-
CV (%)	5.6	0.4	8.5	-	-
LSD (5%)	1.3	0.5	7.4	-	-
LSD (10%)	1.1	0.4	6.1	-	-

Location: Latitude 46° 50'N; Longitude 103° 59'W; Elevation 2890 ft Previous crop: lentil
Planted: 5-17-2016 Harvested: 08-31-2016
Soil test (0-6"): P=7 ppm; K=202 ppm; pH=7.9; OM=2.5% Soil type: Grail-Grassna complex
(0-24"): NO3-N=35 lb/a
Applied fertilizers in lb/a: N=29; P_2O_5=18; K_2O=0: S=5
Chemical Applications: Brox-M/Discover NG @ 1.5 pt/ac and 16 oz/ac
†Protein adjusted to 12% moisture
*Average of years 2013, 2014, and 2016

Durum McKenzie Dryland Variety Trial - WREC **McKenzie County, ND**

Variety	Protein†	Test weight†	Yield#	
			2016	2-Yr Avg
	(%)	(lb/bu)	(bu/a)	(bu/a)
Joppa	12.8	61.7	61.5	45.5
Tioga	13.0	61.5	59.3	44.8
Alkabo	12.8	61.1	49.1	39.9
Lebsock	13.7	61.6	47.1	39.6
Mountrail	13.1	61.0	57.3	39.0
Carpio	13.5	61.1	55.3	38.7
Divide	14.0	60.9	48.1	34.8
Mean	13.3	61.3	54.0	-
CV (%)	4.8	0.4	8.8	-
LSD (5%)	1.1	0.4	8.5	-
LSD (10%)	0.9	0.3	7.0	-

Location: Arnegard, ND; Latitude 47° 47'N; Longitude 103° 25'W; Elevation 2250 ft Previous crop: Lentil
Planted: 5/9/2016 Harvested: 8/23/2016
Soil test (0-6"): P=7 ppm; K=235 ppm; pH=7.1; OM=4.2% Soil type: Williams-Belfield-Grail
(0-24"): NO3-N=4 lb/a
Applied fertilizers in lb/a: N=96; P_2O_5=21; K_2O=0; S=5
†Protein adjusted to 12% moisture
‡Test Weight = Reported on a 13.5% moisture basis
#Yield = Reported on a 13.5% moisture basis
*Moisture stress caused low yields in 2015, contributing to a low 2 yr. avg.

Durum Irrigated Wheat Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Year of release	Plant height	Days to head	Protein†	Test weight	Yield		
							2016	2-Yr Avg	3-Yr Avg
			(in)	(DAP+)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Tioga	ND	2010	30.9	61	15.1	62.3	78.0	91.2	86.8
Mountrail	ND	1998	29.8	62	16.0	61.4	78.0	89.5	85.7
Pierce	ND	2001	30.8	60	15.5	62.4	74.3	90.0	84.7
Grenora	ND	2005	28.1	60	15.7	62.0	75.1	89.4	84.6
Joppa	ND	2013	30.2	62	15.2	62.3	67.7	90.5	82.9
Carpio	ND	2012	30.4	64	14.9	62.3	72.5	87.3	82.4
CDC Verona	Canada	2010	29.6	61	15.3	61.5	66.4	89.9	82.0
Strongfield	Canada	2004	30.6	60	16.2	60.8	70.9	87.4	81.9
DG Max	DGP	2008	29.7	59	16.1	61.6	68.9	87.9	81.6
VT Peak	Viterra	2010	24.7	60	16.8	62.8	79.0	80.6	80.0
Alkabo	ND	2005	27.5	60	14.9	62.1	61.9	86.8	78.5
Divide	ND	2005	28.7	62	15.3	61.5	67.6	84.0	78.5
Lebsock	ND	1999	27.2	60	14.6	62.6	68.3	82.4	77.7
Ben	ND	1996	30.4	60	16.5	61.9	65.5	82.8	77.0
AC Commander	Canada	2002	26.3	60	15.2	60.6	63.9	83.1	76.7
AC Navigator	Canada	1999	28.5	61	15.9	61.1	62.0	81.8	75.2
Maier	ND	1998	28.1	61	15.6	61.7	61.1	80.1	73.7
Rugby	ND	1973	30.2	62	14.8	61.4	55.7	78.6	70.9
Silver	MSU	2012	27.8	59	16.8	60.3	59.7	75.5	70.2
Alzada	WB	2004	26.0	58	16.5	59.8	55.4	77.1	69.9
Normanno	-	-	25.5	59	15.7	59.0	60.1	70.5	67.0
Westhope	WB	2009	28.3	62	15.7	61.4	73.0	-	-
Wales	-	-	28.3	62	15.3	61.3	70.5	-	-
DG Star	DGP	2007	30.3	59	16.1	61.0	65.8	-	-
WB Belfield	WB	-	24.0	58	16.7	60.0	47.4	-	-
Mean			28.5	60.3	15.7	61.4	66.7	84.1	78.5
C.V.			10.6	1.8	4.7	0.6	13.6	-	-
LSD 5%			4.3	1.5	1.1	0.5	12.8	-	-
LSD 10%			3.6	1.2	0.9	0.4	10.7	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft Previous crop: Potato

Planted: 4/21/2016 Harvested: 8/9/2016

Residue status at planting: Conventional Till Soil type: Lihen Loamy Fine Sand

Plot size: 91.875 ft^2

Applied fertilizer in lbs/a broadcast: 420 lbs/a of 46-0-0

Soil test to 6": 13-ppm P, 152-ppm K, OM-1.8, pH-7.7

Soil test to 2' : 7 lbs of N

Yield goal: 90 bu/a

Planting population: 1.25 million seeds/a

Herbicides applied: Starane 10 oz/a + Tacoma 1EC 10 oz/a + Bison 1.5 pt/a (5/17/2016)

Fungicides applied: Priaxor D 8 oz/a (6/22/2016)

Rainfall: 8.21 in (4/21/2016 - 8/9/2016)

Irrigation: 6.8 in (4/21/2016 - 8/9/2016)

+ Days after planting

† Protein content adjusted to a 12% moisture

Dryland Uniform Regional Durum Yield Trial **EARC, Sidney, MT**

Variety	Lodging %	Height cm	Grain Yld bu/ac	Protein %	TW lb/bu
Mountrail	0	76	69.4	12.8	64.6
Alkabo	0	84	65.9	12.5	64.9
Divide	0	84	68.9	12.6	64.2
Tioga	0	84	69.2	12.2	64.4
Carpio	0	81	67.4	12.3	64.1
Joppa	0	78	67.2	11.9	64.6
Strongfield	0	81	67.2	12.6	64.7
AVG	**0**	**81**	**67.9**	**12.4**	**64.5**
CV (%)		4.08	6.4	3.9	0.7
LSD (0.05)		5.5	7.2	0.8	0.8

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Safflower
Residual soil N: 143.5 lb. N/ac
Planted: April 12, 2016
Harvested: August 4, 2016
Applied fertilizer: No fertilizer

Herbicide: Full Deck; Discover
Fungicide: Avaris
Precipitation April – August 2016: 9.74 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2015 – August 2016: 14.55 in
Ave (65 y.) precipitation September – August: 14.09 in

Comments: Soil N was high thus no fertilizer was applied.

Irrigated Statewide Durum Study **EARC, Sidney, MT**

Variety	Heading Date DAP	Plant Height cm	Lodging %	Grain Yield bu/ac	Protein %	TW lb/bu
Mountrail	171	94.7	40	88.2	14.1	62.7
Divide	171	99.0	47	78.0	14.8	61.6
Alkabo	170	93.7	0	77.1	13.8	62.9
Grenora	170	93.7	33	92.5	13.5	61.5
Tioga	171	94.7	23	75.2	14.7	61.8
Carpio	172	98.0	17	77.1	14.3	63.0
Joppa	172	95.7	0	86.3	13.8	62.3
Silver	169	90.0	13	83.3	14.5	61.0
Alzada	169	81.7	87	71.5	**15.6**	60.7
AVG	**171**	**93.5**	**29**	**81.0**	**14.3**	**61.9**
CV (%)	0.49	3.04	49.12	7.52	1.30	1.15
LSD (0.05)	1	5	29	8.9	0.3	1.2

Location: EARC irrigated farm
Soil type: Savage Silty Clay
Previous crop: Safflower
Residual soil N: 78 lb N/ac
Planted: April 22, 2016
Harvested: August 16, 2016
Applied fertilizer: 200 lb/ac 46-0-0

Herbicide: Full Deck; Discover
Fungicide: Avaris
Precipitation April – August 2016: 9.74 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2015 – August 2016: 14.55 in
Ave (65 yr) precipitation September – August: 14.09 in

Dryland Durum Evaluation - EARC **Daniels County, MT**

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Mountrail	85	45.9	10.3	60.4
Divide	89	52.7	10.3	62.6
Alabo	87	43.5	9.6	61.7
Grenora	85	45.7	10.9	61.5
Tioga	82	38.9	10.0	61.6
Carpio	88	**56.5**	10.0	**62.7**
Joppa	80	43.1	11.3	60.9
Alzada	84	42.9	11.2	61.4
Silver	65	24.0	**12.8**	58.9
Strongfield	**90**	44.2	11.0	61.9
AVG	84	43.7	10.7	61.4
CV	14.5	19.4	6.8	1.5
LSD (0.05)	19	12.7	1.3	1.5

Dryland Durum Evaluation - EARC **Roosevelt County, MT**

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Mountrail	98	40.1	15.4	60.8
Divide	**106**	45.5	16.3	62.0
Alabo	98	38.9	14.3	**63.6**
Grenora	101	45.6	14.9	61.1
Tioga	105	46.8	16.0	61.8
Carpio	99	**50.2**	15.5	62.6
Joppa	101	48.6	15.1	61.4
Alzada	81	42.7	14.9	60.8
Silver	81	42.0	15.2	60.3
Strongfield	103	36.6	**16.8**	61.8
AVG	97	43.7	15.4	61.6
CV	4.5	12.2	1.9	1.3
LSD (0.05)	7	8.5	0.5	1.3

Dryland Durum Evaluation - EARC **Sheridan County, MT**

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Mountrail	74	40.1	13.6	60.9
Divide	74	38.8	14.1	**62.0**
Alabo	72	35.5	13.0	61.6
Grenora	73	38.4	13.0	60.9
Tioga	78	**43.1**	13.8	61.6
Carpio	**87**	38.9	13.6	61.4
Joppa	78	40.9	13.1	61.3
Alzada	73	24.4	13.8	58.9
Silver	65	18.7	14.2	58.8
Strongfield	80	37.1	15.0	61.7
AVG	75	35.6	13.7	60.9
CV	11.8	8.3	2.3	0.6
LSD (0.05)	14	4.5	0.5	0.6

Dryland Durum Evaluation - EARC **Valley County, MT**

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Mountrail	75	30.4	15.4	62.5
Divide	75	33.9	16.0	63.6
Alabo	73	24.9	14.3	63.5
Grenora	68	32.4	14.9	62.7
Tioga	84	37.5	15.2	64.0
Carpio	**85**	**41.2**	15.7	63.2
Joppa	76	34.1	14.8	63.7
Alzada	66	29.0	15.7	63.3
Silver	62	27.9	16.2	60.9
Strongfield	74	32.0	**16.3**	64.0
AVG	74	32.3	15.5	63.1
CV	6.7	11.5	2.1	0.8
LSD (0.05)	8	6.0	0.5	0.9

Dryland Durum Evaluation - EARC **Wibaux County, MT**

Entry	Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Mountrail	74	46.6	12.8	64.3
Divide	71	41.0	12.2	65.1
Alabo	68	43.4	12.7	65.5
Grenora	68	44.4	13.1	64.5
Tioga	76	36.9	**14.4**	63.6
Carpio	77	43.9	13.4	64.6
Joppa	65	29.6	12.7	64.6
Alzada	63	29.9	13.9	64.4
Silver	61	39.2	13.8	63.6
Strongfield	**79**	43.0	12.8	65.1
AVG	70	39.8	13.2	64.5
CV	6.4	22.3	5.8	1.1
LSD (0.05)	7	15.2	1.3	1.2

Recrop Durum Variety Yield Evaluation **EARC, Sidney, MT**

Entry	Height cm	Heading Date DAP	Yield bu/ac	Protein %	TW lb/bu
Mountrail	71	169	59.8	13.5	63.7
Divide	**74**	169	56.4	12.8	63.5
Alabo	70	167	57.3	15.1	63.5
Grenora	73	167	60.2	13.4	62.7
Tioga	72	168	55.0	14.7	63.6
Carpio	71	**169**	**63.9**	13.4	63.0
Joppa	72	169	57.6	12.8	63.5
Alzada	66	166	59.8	12.8	63.6
Silver	60	166	52.9	13.5	63.2
Strongfield	73	169	62.0	**15.3**	63.7
AVG	**70**	**168**	**58.5**	**13.7**	**63.4**
CV (%)	5.7	0.6	5.8	8.7	0.7
LSD (0.05)	6.4	1.6	5.6	2.0	0.7

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Pea and Safflower
Residual soil N: 100 lb N/ac
Planted: April 12, 2016
Harvested: August 3, 2016

Applied fertilizer: No fertilizer
Herbicide: Full Deck; Axial
Precipitation April – August 2016: 9.74 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2015 – August 2016: 14.55 in
Ave (65 yr) precipitation September – August: 14.09 in

Hard Red Winter Wheat Variety Descriptions

Variety	Origin[1]	Year Released	Height	Maturity	Winter Hardiness[3]	Resistance To[2]				Quality Factors	
						Lodging	Stem Rust	Leaf Rust	Foliar Disease	Test Weight	Grain Protein
AC Broadview	Canada	2009	medium	medium	good	R	R	R	NA	medium	medium
Art	AgriPro	2008	m short	m early	fair	R	R	R	MS	high	m high
Boomer	WB	2009	medium	medium	good	R	R	MR	S	high	medium
CDC Accipiter	Canada	2008	short	medium	good	R	R	MS	S	medium	medium
CDC Falcon	Canada	2000	m short	medium	good	M	R	MS	MS	medium	m low
Colter	MSU	2013	medium	medium	good	MR	R	S	NA	medium	medium
Darrell	SDSU	2006	medium	medium	good	R	R	S	MR	m high	medium
Decade	MSU/NDSU	2010	medium	m early	good	R	R	S	M	medium	medium
Expedition	SDSU	2002	medium	medium	fair	R	R	MS	MS	low	medium
Flourish	Canada	2010	short	early	good	R	MR	R	NA	medium	m low
Genou*	MSU	2004	medium	medium	poor	MS	MS	S	NA	m low	medium
Ideal	SDSU	2011	short	medium	good	R	MR	MR	MS	medium	medium
Jerry	NDSU	2001	medium	medium	good	MR	R	MR	M	medium	m high
Judy*	MSU	2011	medium	medium	fair	R	S	S	NA	medium	m high
Lyman	SDSU	2008	medium	medium	fair	M	R	R	MR	m high	m high
McGill	NE	2010	m tall	m early	v good	MS	NA	MR	NA	medium	m low
Moats	Canada	2010	medium	medium	good	MS	R	MR	NA	m high	medium
Overland	NE	2006	m tall	medium	fair	MS	MS	MR	NA	m high	medium
Peregrine	Canada	2008	medium	m late	v good	MR	R	MR	NA	m high	m low
Radiant	Canada	2001	tall	late	good	R	S	S	NA	medium	m low
Rampart*	MSU	1996	medium	m late	fair	R	R	S	MR	medium	high
Robidoux	NE	2010	m short	m early	poor	MR	NA	MS	NA	medium	m low
Sunrise	Canada	2008	medium	medium	good	MS	MR	MS	R	medium	low
SY Wolf	AgriPro	2010	m short	medium	poor	R	R	MR	MR	high	m low
Warhorse	MSU	2013	short	m late	fair	MR	R	S	NA	medium	medium
WB-Grainfield	WB	2013	short	m late	good	MR	NA	MR	MS	m low	medium
WB-Matlock	WB	2010	medium	medium	good	MR	R	MS	MS	medium	medium
WB-Quake*	WB	2011	medium	late	fair	MR	NA	MR	NA	m low	m low
Wesley	NE	2000	short	early	v good	R	R	MR	MR	high	medium
Yellowstone	MSU	2005	medium	medium	good	M	S	MS	M	low	m high

[1] Refers to developer: MSU = Montana State University; NDSU = North Dakota State University; NE = University of Nebraska; SDSU = South Dakota State University; WB = WestBred.

[2] R = resistant, MR = moderately resistant; M = intermediate; MS = moderately susceptible; S = susceptible; NA = data not available.

[3] Varieties with fair to poor winter hardiness should not be seeded on bare soil.

* Sawfly resistant.

Hard White Winter Wheat Variety Descriptions

Variety	Origin[1]	Year Released	Height	Maturity	Winter Hardiness[3]	Resistance To[2]				Quality Factors	
						Lodging	Stem Rust	Leaf Rust	Foliar Disease	Test Weight	Grain Protein
Alice	SDSU	2006	short	early	fair	MR	MR	S	NA	m high	m low
Gary	ID	2001	med	m late	fair	MR	NA	NA	NA	med	low
Hyalite*	MSU/WB	2005	m short	m early	fair	MR	R	S	NA	med	med
NuDakota	AgriPro	2007	short	m	poor	R	MR	MR	NA	med	med
NuFrontier	GM/AgriPro	NA	m short	early	fair	R	NA	NA	NA	m high	low
NuHorizon	GM/AgriPro	NA	short	early	poor	R	NA	NA	NA	high	m low
NuSky	MSU	2001	med	m late	good	R	MR	S	MR	med	med
NuWest	MSU/GM	1994	med	m	good	R	MR	S	MR	m low	med
Wendy	SDSU	2004	short	early	good	NA	NA	NA	NA	med	med

[1]Refers to developer: GM = General Mills; ID = University of Idaho; MSU = Montana State University; SDSU = South Dakota State University; WB = WestBred.

[2]R = resistant, MR = moderately resistant; S = susceptible; NA = data not available.

[3]Varieties with fair to poor winter hardiness should not be seeded on bare soil.

* Clearfield wheat with imidazolinone tolerance.

Winter Wheat Dryland Variety Trial **WREC, Williston, ND**

Variety	Origin	Year of release	Days to heading	Plant height	Fall stand	Spring stand	Protein†	Test weight	Yield		
									2016	2-Yr Avg	3-Yr Avg*
			(julian)	(in)	(%)	(%)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Jerry	ND	2001	149	23.7	95	95	12.8	56.3	42.0	48.7	48.7
AC Broadview	Canada	2008	149	18.7	96	96	12.6	57.2	43.0	48.7	48.6
Moats	Canada	2010	151	24.3	91	90	12.7	57.9	43.8	44.9	48.4
Accipiter	CDC	2008	151	21.9	92	91	12.5	58.1	43.2	46.8	44.3
Peregrine	CDC	2008	150	25.8	91	90	10.6	59.2	48.7	47.3	44.1
WB Matlock	WB	2010	149	22.9	97	97	12.9	57.2	42.2	47.1	42.8
Lyman	SD	2008	147	21.1	96	95	13.4	58.0	46.2	48.0	42.2
Decade	MT/ND	2010	147	21.7	95	94	12.9	58.2	47.8	47.7	41.6
Ideal	SD	2011	148	19.0	95	94	13.4	57.8	42.6	44.3	40.9
Overland	NE	2006	147	22.1	90	90	12.8	57.6	45.4	45.6	40.2
SY Wolf	Agripro	2010	147	20.9	98	97	11.6	58.9	50.8	44.6	38.1
Flourish	Canada	2010	147	18.9	95	93	13.4	57.5	40.1	36.3	33.9
Colter	MT	2013	149	25.3	94	88	12.3	57.1	50.3	50.4	-
Northern	MT	2015	151	21.0	97	97	12.9	58.2	42.7	47.6	-
Redfield	SD	2013	147	21.8	93	93	11.9	58.9	46.2	46.3	-
WB4614	WB	2013	147	20.1	99	98	13.1	55.7	40.0	46.2	-
CDC Chase	CDC	2013	148	24.6	97	97	13.0	59.5	45.4	46.0	-
Emerson	Canada	2011	150	19.4	96	96	14.1	58.9	37.8	42.5	-
AAC Gateway	Canada	2012	148	19.4	93	93	13.3	59.1	39.6	41.5	-
SY Monument	Agripro	2014	147	20.1	94	94	10.9	57.2	50.3	-	-
SY Sunrise	Agripro	2015	147	15.6	94	94	13.8	57.9	43.4	-	-
Mean			148	21.8	94	93	12.6	57.8	44.6	-	-
CV (%)			0.3	11.4	3.6	3.7	9.2	0.6	11.2	-	-
LSD (5%)			0.7	8.6	4.8	4.8	1.7	0.5	6.7	-	-
LSD (10%)			0.6	7.2	4.0	4.0	1.4	0.4	5.6	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft Previous crop: Lentil
Planted: 9-18-2015 Harvested: 07-24-2016
Soil test (0-6"): P=27 ppm; K=226 ppm; pH=6.6; OM=2.5% Soil type: Williams-Bowbells loam
(0-24"): NO3-N=24 lb/a
Applied fertilizers in lb/a: N=36; P_2O_5=26; K_2O=0

†Protein adjusted to 12% moisture
*Average of years 2013, 2015, and 2016

I won't be impressed with technology until I can download food.

Winter Wheat Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Year of release	Winter survival	Days to heading	Plant height	Lodging	Protein[†]	Test Weight	Yield	
									2016	2-Yr Avg
			(%)	(julian)	(in)	(0-9*)	(%)	(lb/bu)	(bu/a)	(bu/a)
Decade	MSU/NDSU	2010	98.1	152	32.8	1	13.2	56.9	98.9	97.9
Jerry	NDSU	2001	97.5	151	34.4	3	13.3	55.6	93.4	96.8
Radiant	Canada	2001	97.5	151	33.2	1	12.6	60.0	113.4	-
CDC Falcon	Canada	2000	96.2	152	32.9	2	12.3	58.5	113.0	-
Peregrine	Canada	2008	100.0	152	33.5	2	12.7	58.7	110.6	-
Boomer	WB	2009	98.1	153	34.2	2	13.1	56.3	109.8	-
WB Matlock	WB	2010	98.8	152	33.4	1	12.6	59.5	106.1	-
CDC Accipiter	Canada	2008	98.8	155	32.4	1	12.7	58.2	102.8	-
Northern	MSU	2015	98.1	153	32.4	3	13.3	56.3	102.7	-
Overland	NE	2006	96.8	149	35.8	2	13.2	57.6	101.6	-
Mean			98.0	151.8	33.5	1.7	12.9	57.8	105.2	97.3
C.V.			1.4	0.7	8.5	59.5	4.1	3.0	7.5	-
LSD 5%			2.1	1.6	NS	1.4	0.9	3.0	13.8	-
LSD 10%			1.7	1.3	3.4	1.2	1.1	3.6	16.6	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: Soybean
Planted: 8/28/2015 — Harvested: 7/19/2016
Residue status at planting: 0" soybean stubble — Soil type: Lihen Loamy Fine Sand
Plot size: 91.875 ft^2
Applied fertilizer in lbs/a broadcast: 385 lbs/a of 46-0-0
Soil test to 6": 13-ppm P, 152-ppm K, OM-1.8 , pH-7.7
Soil test to 2' in lb/a: 30 lbs of N
Yield goal: 100 bu/a
Planting population: 1.25 million seeds/a
Herbicides applied: None
Fungicides applied: None
Rainfall: 8.5 in. (1/1/2016 - 7/19/2016)
Irrigation: 6.8 in. (1/1/2016 - 7/19/2016)
[+] Days after planting
* 0: no lodging - 9: plants lying flat on ground
† Protein content adjusted to a 12% moisture

Winter Rye Dryland Variety Trial **WREC, Williston, ND**

Variety	Days to heading	Plant height	Winter Survival	Protein[†]	Test weight[1]	Yield[2]
	(julian)	(in)	(%)	(%)	(lb/bu)	2016 (bu/a)
Hazlet	142	38	100	11.5	64.1	78.0
Dacold	143	37	99	13.3	60.6	67.0
Hancock	140	38	100	13.5	62.1	66.7
DR02	142	36	100	13.5	61.0	62.4
Spooner	140	34	100	12.9	62.9	61.3
DREB15	138	37	100	13.9	61.5	52.2
Rymin	141	33	100	15.8	60.1	51.8
Aroostok	137	37	100	16.2	60.6	35.2
Wheeler	144	43	100	18.3	60.8	29.2
Mean	141	37.0	100	14.3	61.5	56.0
CV (%)	1.0	10.7	0.4	10.0	1.6	11.8
LSD (5%)	2.0	5.8	0.5	2.1	1.5	9.6
LSD (10%)	1.7	4.8	0.4	1.7	1.2	8.0

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft
Soil test (0-6"): P=27 ppm; K=226 ppm; pH=6.6; OM=2.5%
(0-24"): NO3-N=24 lb/a
Applied fertilizers in lb/a: N=36; P_2O_5=26; K_2O=0
[1]Test Weight adjusted to 13.5% moisture
[2]Yield adjusted to 13.5% moisture
[†]Protein adjusted to 12% moisture
Planted: 9-25-2015
Harvested: 7-22-2016

Dryland Intrastate Winter Wheat Yield Trial **EARC, Sidney, MT**

Variety	Winter survival %	Plant Height cm	Grain YLD bu/ac	Protein %	TW lb/bu
Yellowstone	100	95	63.7	9.2	60.5
Judee	100	85	56.2	9.9	62.3
Decade	100	87	56.0	11.7	60.2
Brawl CL Plus	100	94	78.3	11.6	62.6
Bearpaw	100	87	46.2	9.8	59.3
Rampart	100	94	47.0	11.1	61.3
SY Clearstone 2CL	100	96	60.4	9.1	60.3
Jerry	100	**102**	60.0	11.7	60.7
WB-Quake	100	88	43.5	12.0	60.2
Warhorse	100	86	48.1	11.2	61.1
Colter	100	95	66.1	10.2	61.2
Northern	100	91	60.7	10.4	59.9
Cowboy	100	90	67.6	8.8	61.1
Broadview	100	93	67.0	11.5	61.2
SY Wolf	100	93	78.5	10.6	63.6
SY Monument	100	90	72.2	10.3	61.1
SY Sunrise	100	90	77.6	10.3	63.2
Freeman	100	94	68.8	9.2	61.3
Keldin	100	92	77.3	11.5	62.8
AVG	**100**	**92**	**62.9**	**10.5**	**61.3**
CV (%)		3.5	9.1	8.7	0.9
LSD (0.05)		5	9.5	1.5	0.8

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Pea
Residual soil N: 166 lb N/ac, no additional N added
Planted: Sep 16, 2015
Harvested: July 19, 2016

Applied fertilizer: No fertilizer
Herbicide: Full Deck; Discover
Fungicide: Avaris
Precipitation April – August 2016: 9.74 in
Precipitation September 2015 – August 2016: 14.55 in

Barley Variety Descriptions

Variety	Origin[1]	Use[2]	Year released	Height	Maturity	Lodging	Resistance to[3]				Quality Factors	
							Stem Rust	Loose Smut	Net Blotch	Spot Blotch	Test Weight	Grain Protein
Two-Row												
AC Metcalfe*	Canada	M	1997	medium	late	M	S	MR	MS	MS	medium	medium
B Merit	BARI	F/M	2002	m tall	late	MS	MS	S	MS	S	low	medium
CDC Copeland*	Canada	M	1999	tall	m late	MS	MR	S	MS	VS	low	medium
Champion	WB	F	1997	medium	medium	MR	R	S	MR	NA	m low	medium
Conlon*	NDSU	F/M	1996	m short	early	MS	S	S	MR	MS	m high	m low
Conrad*	BARI	M	2007	m tall	m late	MR	NA	S	NA	NA	m high	m low
Craft*	MSU	F/M		tall	medium	MR	NA	S	S	NA	m high	m high
Eslick	MSU	F	2003	medium	m late	MS	S	NA	NA	MS	medium	m low
Geraldine	MSU	F/M		m short	m late	MR	NA	S	NA	NA	m high	m high
Harrington*	Canada	F/M	1981	m short	late	S	S	S	MS	S	medium	m low
Haxby	MSU	F	2003	medium	medium	MS	S	S	S	MS	v high	medium
Hockett*	MSU	F/M	2008	medium	medium	MS	S	S	NA	NA	medium	m high
Lilly	Germany	F	NA	short	medium	MR	S	NA	S	MR	medium	medium
ND Genesis	NDSU	F/M	2015	medium	m late	MR	S	NA	MR	MR	high	low
Pinnacle*	NDSU	F/M	2006	medium	m late	MR	S	S	MS	MR	high	low
Rawson	NDSU	F	2005	medium	medium	MR	S	S	MR	MR	high	m low
Six-Row												
Celebration*	BARI	F/M	2008	m short	medium	R	S	S	MS/S	MR/R	medium	medium
Innovation	BARI	M	2009	m short	medium	MR	S	S	MS/S	MR/R	medium	medium
Lacey *	MN	F/M	1999	m short	medium	MR	S	S	MS/S	MR/R	medium	medium
Legacy*	BARI	F/M	2000	medium	m late	MR	S	S	MS/S	MR/R	medium	medium
Quest*	MN	M	2010	m short	medium	MS	S	S	MR	MR/R	m low	medium
Robust*	MN	F/M	1983	tall	medium	MS	S	S	MS/S	MR/R	medium	m high
Stellar-ND*	NDSU	F/M	2005	m short	medium	R	S	S	MS/S	MR/R	medium	m low
Tradition*	BARI	F/M	2003	m short	medium	R	S	S	MS/S	MR/R	medium	m low
Specialty												
CDC Cowboy	Canada	H	NA	v tall	medium	S	MR	S	M	M	medium	m high
Haybet	MSU	H	1989	tall	medium	S	NA	S	NA	NA	low	medium
Hays	MSU	H	2003	m tall	medium	MS	NA	NA	NA	NA	low	medium

[1] Refers to developer: BARI = Busch Ag Resources; Inc.; MN = University of Minnesota; MSU = Montana State University; NDSU = North Dakota State University; WB = WestBred.
[2] F = feed; M = malt.
[3] R = resistant; MR = moderately resistant; M = intermediate; MS = moderately susceptible; S = susceptible; VS = very susceptible. NA = data not available.
* Recommended as malting in Western U.S.

Always take a good look at what you're about to eat. It's not so important to know what it is, but it's critical to know what it was.

Barley Dryland Variety Trial **WREC, Williston, ND**

Variety	Plant Height	Heading Date	Protein†	Test weight‡	Plump %	Yield#		
						2016	2-Yr Avg	3-Yr Avg
	(in)	DAP*	(%)	(lb/bu)	>6/64	(bu/a)	(bu/a)	(bu/a)
Two Row								
Pinnacle	22	45	13.8	50.6	88.5	83.3	72.2	71.8
Rawson	24	43	14.0	50.8	92.9	83.0	62.5	66.7
Hockett	23	47	16.1	50.2	67.6	77.0	63.9	66.1
ND Genesis	23	45	14.2	49.8	91.4	77.1	59.8	62.8
Conlon	23	43	16.0	49.5	89.5	71.4	53.7	61.9
CDC Meredith	22	53	15.7	48.3	66.5	82.1	63.8	-
LCS Genie	20	54	15.6	50.3	73.7	81.9	-	-
AAC Synergy	24	48	15.1	48.9	76.9	81.8	-	-
Voyager	23	51	15.7	47.9	74.3	81.8	-	-
SY Sirish	20	50	16.1	49.9	71.0	78.1	-	-
ABI Balster	22	48	17.2	47.1	52.8	76.3	-	-
LCS Odyssey	21	53	15.9	49.5	79.3	75.9	-	-
ABI Growler	22	51	16.7	49.2	74.8	75.2	-	-
Six Row								
Celebration	26	45	15.6	48.6	75.8	87.1	63.2	68.1
Tradition	24	44	15.7	48.6	66.7	77.9	63.3	68.0
Quest	24	44	16.1	49.2	76.3	76.7	62.7	66.6
Lacey	26	44	15.9	48.6	73.9	77.6	60.1	63.7
Innovation	22	43	16.4	47.4	73.3	73.9	59.9	61.5
Stellar-ND	25	43	17.3	47.8	67.0	66.6	57.7	58.5
Mean	22.9	47.0	15.7	48.7	75.4	78.1	-	-
CV (%)	6.2	3.4	4.4	1.7	8.7	6.6	-	-
LSD (5%)	2.0	2.3	1.0	1.2	9.3	7.4	-	-
LSD (10%)	1.7	1.9	0.8	1.0	7.8	6.2	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft
Previous crop: Safflower
Planted: 4-22-2016
Harvested: 8-2-2016
Soil test (0-6"): P=27 ppm; K=226 ppm; pH=6.6; OM=2.5%
(0-24"): NO3-N=24 lb/a
Soil type: Williams-Bowbells loam
Applied fertilizers in lb/a: N=66; P_2O_5=45; K_2O=0; S=5

DAP* = Days after planting

†Protein adjusted to 0% moisture

‡Test Weight = Reported on a 13.5% moisture basis

#Yield = Reported on a 13.5% moisture basis

Chemical Applications: Sharpen @ 2 oz/acre (4-20-16) and Supremacy/Axial @ 5 oz/ac and 16 oz/ac (6-3-2016)

"Farmers constantly experiment. We try new products, new methods, new management styles, all within the domain of an ever-changing mother nature."

Mas Masumoto

Barley Divide Variety Trial - WREC **Divide County, ND**

Variety	Lodging	Protein†	Test weight	Plump %	Yield		
					2016	2-Yr Avg	3-Yr Avg*
	(0-9 Scale)	(%)	(lb/bu)	>6/64	(bu/a)	(bu/a)	(bu/a)
Two Row							
ND Genesis	0	11.0	53.5	92.5	132.4	-	-
Pinnacle	5	11.0	54.1	89.4	122.1	113.0	104.7
Hockett	7	13.2	53.4	77.0	119.2	114.9	-
Conlon	7	12.2	53.7	91.2	109.6	96.6	85.9
Six Row							
Innovation	1	13.2	51.2	90.8	123.1	108.0	97.9
Lacey	3	13.5	53.5	90.3	121.1	110.9	103.4
Tradition	3	13.8	53.1	87.6	103.3	99.8	95.3
Celebration	5	13.7	52.9	87.5	102.7	102.1	102.1
Mean		12.7	53.2	88.3	116.7	-	-
CV (%)		6.3	1.5	5.7	6.2	-	-
LSD (5%)		1.4	1.3	8.7	12.7	-	-
LSD (10%)		1.1	1.1	7.2	10.5	-	-

Location: Latitude 48° 48'N; Longitude 103° 18'W; Elevation 2044 ft — Previous crop: Soybean
Planted: 4-28-2016 — Harvested: 8-29-2016
Soil test (0-6"): P=19.5 ppm; K=380 ppm; pH=7.1; OM=4.2% — Soil type: Farnuf-Alkabo
(0-24"): NO3-N=25.5 lb/a
Applied fertilizers in lb/a: N=27; P_2O_5=18; K_2O=0; S=5
Chemical Applications: Sharpen @ 2 oz/acre and Supremacy/Axial @ 5 oz/ac and 16 oz/ac
†Protein adjusted to 0% moisture
*Average of years 2013, 2014, and 2016

Barley Golden Valley Variety Trial - WREC **Golden Valley County, ND**

Variety	Protein†	Test weight	Plump %	Yield		
				2016	2-Yr Avg	3-Yr Avg*
	(%)	(lb/bu)	>6/64	(bu/a)	(bu/a)	(bu/a)
Two Row						
Hockett	11.4	55.0	96.0	80.5	77.2	-
Pinnacle	10.7	53.1	97.3	70.4	66.2	74.32
ND Genesis	12.1	51.5	94.6	70.3	-	-
Conlon	11.7	53.0	98.3	66.8	62.8	66.1
Six Row						
Innovation	11.9	50.2	95.4	58.3	66.4	81.65
Tradition	9.7	51.4	93.0	65.5	69.6	81.36
Celebration	10.7	51.2	90.7	71.5	69.1	75.65
Lacey	10.1	51.5	90.9	72	69.1	78.8
Mean	11.1	52.1	94.5	69.4	-	-
CV (%)	6.2	1.1	28.7	12.1	-	-
LSD (5%)	1.2	1.0	2.6	14.7	-	-
LSD (10%)	1.0	0.8	2.2	12.2	-	-

Location: Latitude 46° 50'N; Longitude 103° 59'W; Elevation 2890 ft — Previous crop: lentil
Planted: 5-17-2016 — Harvested: 8-31-2016
Soil test (0-6"): P=7 ppm; K=202 ppm; pH=7.9; OM=2.5% — Soil type: Grail-Grassna complex
(0-24"): NO3-N=35 lb/a
Applied fertilizers in lb/a: N=5; P_2O_5=18; K_2O=0: S=5
Chemical Applications: Sharpen @ 2 oz/acre and Supremacy/Axial @ 5 oz/ac and 16 oz/ac
†Protein adjusted to 0% moisture
*Average of years 2013, 2014, and 2016

Barley McKenzie Variety Trial - WREC **McKenzie County, ND**

Variety	Protein†	Test weight ‡	Plump %	Yield#	
				2016	2-Yr Avg
	(%)	(lb/bu)	>6/64	(bu/a)	(bu/a)
Two Row					
Pinnacle	12.1	54.2	92.2	96.4	71.0
Hockett	12.8	54.7	91.5	87.5	62.4
Conlon	13.5	55.1	96.0	88.0	60.5
ND Genesis	12.1	53.9	91.8	97.1	66.3
Six Row					
Celebration	12.9	52.1	88.6	89.9	69.1
Lacey	12.2	52.6	89.1	88.8	64.7
Innovation	11.8	51.5	92.8	87.1	62.4
Tradition	11.9	52.0	86.7	82.9	62.1
Mean	12.4	53.3	91.1	89.7	-
CV (%)	4.7	0.7	2.0	4.7	-
LSD (5%)	1.0	0.6	3.1	7.3	-
LSD (10%)	0.8	0.5	2.6	6.0	-

Location: Arnegard, ND; Latitude 47° 47'N; Longitude 103° 25'W; Elevation 2250 ft Previous crop: Lentil
Planted: 5/9/2016 Harvested: 8/23/2016
Soil test (0-6"): P=7 ppm; K=235 ppm; pH=7.1; OM=4.2% Soil type: Williams-Belfield-Grail
(0-24"): NO3-N=4 lb/a
Applied fertilizers in lb/a: N=68; P_2O_5=21; K_2O=0; S=5

†Protein adjusted to 0% moisture
‡Test Weight = Reported on a 13.5% moisture basis
#Yield = Reported on a 13.5% moisture basis
*Moisture stress caused low yields in 2015, contributing to a low 2 yr. avg.

Barley Irrigated Variety Trial — **WREC, Nesson Valley, ND**

Variety	Origin	Year of release	Plant height (in)	Days to head (DAP+)	Lodging (0-9*)	Protein† (%)	Test weight (lb/bu)	Plumps (%)	Yield 2016 (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
Two Row											
Pinnacle	ND	2006	27.9	65	0	13.1	52.6	91.7	93.3	115.6	118.4
Conrad	BAR	2007	26.4	68	0	14.5	50.4	85.1	92.6	115.3	117.2
Hockett	MT	2008	25.6	66	0	13.6	53.1	89.8	91.9	109.7	114.3
AC Metcalfe	Canada	1997	27.8	67	0	15.0	52.0	85.9	88.1	101.8	105.4
Conlon	ND	1996	26.1	65	0	16.1	52.8	91.1	85.0	85.7	95.4
ND Genesis	ND	2015	28.4	66	0	13.1	51.7	86.6	101.1	115.5	-
CDC Copeland	Canada	1999	28.4	70	0	13.4	50.7	84.9	92.9	115.0	-
CDC Meredith	Canada	2008	27.8	69	0	13.9	51.3	89.0	110.1	-	-
Lilly	Germany	-	22.2	68	0	13.0	51.1	87.3	92.6	-	-
Scarlett	Germany	1995	23.9	71	0	13.9	52.1	92.3	89.7	-	-
Harrington	Canada	1981	25.6	70	1	14.1	49.9	76.6	81.9	-	-
Six Row											
Quest	MN	2010	27.2	65	0	15.0	51.0	88.2	88.8	103.8	113.4
Innovation	BAR	2009	23.5	64	0	14.3	48.7	92.4	86.0	103.5	112.7
Tradition	BAR	2003	28.2	64	0	14.6	51.4	91.3	82.6	100.4	112.2
Lacey	MN	1999	26.7	65	0	15.1	51.2	89.3	87.4	101.0	111.2
Stellar-ND	ND	2005	27.0	64	0	14.7	50.8	92.7	80.7	98.5	108.8
Celebration	BAR	2008	27.8	65	0	15.6	52.0	92.1	83.9	95.7	107.5
Rasmusson	MN	2008	26.6	64	0	14.5	51.3	89.6	95.1	-	-
Mean			26.4	66.4	0.1	14.2	51.3	88.3	90.8	104.7	110.6
C.V.			5.9	1.4	328.0	3.9	1.5	3.7	8.4	-	-
LSD 5%			2.2	1.3	NS	2.4	NS	15.1	17.0	-	-
LSD 10%			1.8	1.1	NS	2.0	NS	12.6	14.2	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: Soybean
Planted: 4/13/2016 — Harvested: 8/2/2016
Plot size: 91.875 ft^2 — Soil type: Lihen Loamy Fine Sand
Applied fertilizer in lbs/a broadcast: 260 lbs/a of 46-0-0
Soil test to 6": 24-ppm P, 230- ppm K, OM-2.2, pH-7.6
Soil test to 2' : 18 lbs of N
Yield goal: 120 bu/a
Planting population: 1.25 million seeds/a
Herbicides applied: Starane 10 oa/a + Tacoma 1EC 10 oz/a + Bison 1.5 pt/a (5/17/2016)
Fungicides applied: none
Rainfall: 8.70 in. (4/13/2016 - 8/2/2016)
Irrigation: 6.8 in. (4/13/2016 - 8/2/2016)
+ Days after planting
* 0: no lodging - 9: plants lying flat on ground
† Protein content adjusted to a 0% moisture

Dryland Intrastate Barley Variety Evaluation **EARC, Sidney, MT**

Variety	Height cm	Heading Date DAP	Grain Yld bu/ac	TW lb/bu	Protein %	Plump %	Thin %
Balster	69	166	90.0	51.6	11.4	95	5
Champion	78	165	112.0	55.2	11.9	98	2
Copeland	74	167	100.4	53.7	12.1	97	3
Genie	67	167	109.2	53.0	11.0	97	3
Growler	62	168	82.3	52.9	12.0	95	5
Harrington	66	167	95.0	53.6	12.3	96	4
Haxby	62	165	106.3	55.6	12.0	98	2
Hockett	62	166	104.6	54.3	10.5	98	2
Metcalfe	67	165	90.5	54.1	12.2	96	4
Odyssey	68	167	**115.1**	52.8	10.9	98	2
Overture	73	169	108.5	53.5	11.6	98	2
Synergy	71	167	100.1	52.7	11.4	98	2
Vespa	63	167	93.1	52.9	11.1	98	2
Westminster	71	166	108.5	53.7	12.3	99	1
AVG	**68**	**167**	**101.1**	**53.5**	**11.6**	**97.2**	**2.8**
CV (%)	8.4	0.5	11.0	1.4	7.3	2.1	72.8
LSD (0.05)	9	1	17.3	1.2	1.4	3	3

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Safflower
Residual soil N: 143.5 lb N/ac, no additional N added
Planted: April 8, 2016
Harvested: August 1, 2016
Applied fertilizer: No fertilizer
Herbicide: Full Deck; Axial
Precipitation April – August 2016: 9.74 in
Precipitation September 2015 – August 2016: 14.55 in

Irrigated Intrastate Barley Variety/Line Evaluation **EARC, Sidney, MT**

Variety/Line	Plant Height cm	Heading Date DAP	Grain Yld bu/ac	Test W lb/bu	Protein %	Plump %	Thin %
Balster	79	172	104.3	52.4	13.4	92	8
Champion	84	172	102.6	53.2	12.9	92	9
Copeland	87	172	105.7	53.5	13.5	96	5
Genie	82	**175**	100.2	51.2	12.9	91	9
Growler	82	172	107.6	52.3	13.7	95	5
Harrington	82	172	93.3	52.7	13.3	91	9
Haxby	78	171	91.4	**54.8**	13.9	93	7
Hockett	79	172	93.5	53.7	9.8	91	10
Metcalfe	**94**	172	90.6	53.5	13.4	97	4
Odyssey	82	174	102.4	51.4	12.2	89	12
Overture	78	173	**115.6**	50.2	12.8	96	4
Synergy	89	172	96.4	52.5	12.7	94	6
Vespa	77	173	105.6	52.9	13.5	96	4
Westminster	86	173	105.4	53.0	12.7	**97**	3
AVG	**83**	**173**	101.0	**52.7**	**12.9**	**94**	**7**
CV (%)	5.0	0.4	9.0	1.6	7.1	5.3	36.5
LSD (P<0.05)	6	1	14.0	1.3	1.5	5.3	5.3

Location: EARC irrigated farm
Soil type: Savage Silty Clay
Previous crop: Safflower
Residual soil N: 78 lb N/ac
Planted: April 21, 2016
Harvested: August 5, 2016
Applied fertilizer: 200 lb/ac 46-0-0
Herbicide: Full Deck; Axial
Precipitation April – August 2016: 9.74 in
Precipitation September 2015 – August 2016: 14.55 in

Recrop Barley Variety Yield Evaluation **EARC, Sidney, MT**

Variety	Height cm	Heading Date DAP	Grain YLD bu/ac
Champion	54	169	**78.8**
Conlon	52	172	70.0
Conrad	56	172	69.0
Copeland	55	**173**	70.8
Craft	60	170	69.9
Eslick	48	171	74.0
Genesis	59	170	67.2
Harrington	53	170	66.4
Haxby	59	167	73.9
Haybet	59	167	56.7
Hays	57	172	73.2
Hockett	55	169	67.9
Lavina	60	167	69.5
Merit	56	170	67.1
Metcalfe	58	170	61.9
Moravian115	46	171	66.9
Pinnacle	56	169	68.0
Rawson	**63**	170	58.4
Stepford	57	166	57.5
Stockford	56	169	56.9
AVG	**56**	**170**	**67.9**
CV (%)	6.4	0.9	8.5
LSD (P<0.05)	6	2	9.5

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Pea and Safflower
Residual soil N: 100 lb N/ac
Planted: April 12, 2016
Harvested: August 3, 2016
Applied fertilizer: No fertilizer
Herbicide: Full Deck; Axial
Precipitation April – August 2016: 9.74 in
Precipitation September 2015 – August 2016: 14.55 in

Clean, tasty, real foods do not come processed in boxes or bags; they come from the earth, the sea, the field, or the farm.

Suzanne Somers

OAT VARIETY DESCRIPTIONS

VARIETY	ORIGIN[1]	GRAIN COLOR	HEIGHT	MATURITY	LODGING	RESISTANCE TO[2]			QUALITY FACTORS	
						STEM RUST	CROWN RUST	BARLEY YELLOW DWARF	TEST WEIGHT	GRAIN PROTEIN
AC PINNACLE	CANADA	WHITE	TALL	LATE	MS	R	R	S	MEDIUM	LOW
AAC JUSTICE	AAFC/MN	WHITE	TALL	LATE	R	S	R	NA	HIGH	NA
BEACH	NDSU	WHITE	TALL	M LATE	MR	S	MR/MS	MS	MEDIUM	M HIGH
CDC DANCER	CANADA	WHITE	TALL	LATE	MR	S	MS	S	HIGH	MEDIUM
CDC MINSTREL	CANADA	WHITE	TALL	LATE	MR	S	S	S	M HIGH	MEDIUM
FURLONG	CANADA	RED	TALL	LATE	MR	S	S	T	HIGH	MEDIUM
HAYDEN	SDSU	WHITE	MEDIUM	MED	M	S	MR/MS	MT	M HIGH	MEDIUM
HIFI	NDSU	WHITE	TALL	LATE	MR	MR	R	T	M HIGH	MEDIUM
HORSEPOWER	SDSU	WHITE	MEDIUM	E MEDIUM	R	MS	MR	MR	MEDIUM	MEDIUM
HYTEST	SDSU	WHITE	TALL	EARLY	MS	S	MS	S	V HIGH	HIGH
JURY	NDSU	WHITE	TALL	LATE	MS	R	R	MT	M HIGH	MEDIUM
KILLDEER	NDSU	WHITE	MED	MED	MR	S	MS	MT	M HIGH	MEDIUM
LEGGETT	CANADA	WHITE	TALL	LATE	MR	MR	R	S	MEDIUM	MEDIUM
MORTON	NDSU	WHITE	TALL	LATE	R	S	S	MT	HIGH	MEDIUM
NEWBURG	NDSU	WHITE	TALL	LATE	MS	R	R	MT	MEDIUM	MEDIUM
OTANA	MT	WHITE	TALL	LATE	S	S	S	S	HIGH	MEDIUM
PAUL	NDSU	HULLESS	V TALL	LATE	MS	R	MR	T	V HIGH	HIGH
ROCKFORD	NDSU	WHITE	TALL	LATE	R	S	R	MT	M HIGH	MEDIUM
SOURIS	NDSU	WHITE	MED	MED	R	MS	R	MS	HIGH	MEDIUM
STALLION	SDSU	WHITE	TALL	LATE	M	S	MR	NA	HIGH	MEDIUM

[1] Refers to developer: NDSU = North Dakota State University; SDSU = South Dakota State University.

[2] R = resistant; MR = moderately resistant; M = intermediate; MS = moderately susceptible; S = susceptible; VS = very susceptible; T = tolerant; MT = moderately tolerant; NA = data not available.

Oat Dryland Variety Trial **WREC, Williston, ND**

Variety	Heading Date DAP[1]	Height (in)	Test weight[‡] (lb/bu)	Yield[#] 2016 (bu/a)	Yield[#] 2-Yr Avg (bu/a)	Yield[#] 3-Yr Avg (bu/a)
AC Pinnacle	52	29.8	45.2	103.3	83.3	90.9
CDC Dancer	50	31.0	45.7	101.1	86.5	84.1
Minstrel CDC	48	27.8	45.8	105.8	82.7	82.7
Killdeer	48	27.0	45.3	111.9	88.6	81.6
Otana	51	33.3	45.4	86.2	74.1	80.1
Leggett	53	30.5	45.4	104.4	82.4	77.0
Deon (MN)	52	30.2	45.7	82.3	74.6	76.8
Souris	50	25.3	46.3	93.0	77.9	76.0
Rockford	51	30.0	46.5	100.5	77.6	75.9
Newburg	50	32.5	46.3	84.6	73.1	75.7
Jury	50	32.7	46.3	81.6	72.3	74.3
AC Furlong	53	31.7	44.2	101.1	78.3	74.3
HiFi	52	30.6	45.3	92.4	76.1	72.3
Beach	50	30.0	47.5	86.0	69.3	64.3
Stallion	50	31.6	46.2	92.1	64.6	62.9
Hytest	48	32.5	46.8	77.0	65.1	60.9
Paul	53	32.9	51.9	62.6	61.6	52.2
Goliath	49	34.1	47.0	77.7	69.6	-
Mean	50.5	30.7	46.3	91.3	-	-
CV (%)	2.2	5.8	5.9	1.2	-	-
LSD (5%)	1.5	2.5	7.6	0.7	-	-
LSD (10%)	1.3	2.1	6.4	0.6	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft Previous crop: Safflower
Planted: 5-4-2016 Harvested: 8-11-2016
Soil test (0-6"): P=17 ppm; K=266 ppm; pH=6.2; OM=2.4%; Soil type: Williams-Bowbells loam
(0-24"): NO3-N=4 lb/a
Applied fertilizers in lb/a: N=44; P_2O_5=18; K_2O=0; S=5

DAP* = Days after planting

[†]Protein adjusted to 12.0% moisture

[‡]Test Weight = Reported on a 13.5% moisture basis

[#]Yield = Reported on a 13.5% moisture basis

Chemical Applications: Bromac Advanced @ 2 pints/ac (6/9/16)

Nature gave us all
something to fall back
on, and sooner or later
we all land flat on it.

Oats Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Year of release	Plant height	Days to head	Lodging	Test weight	Yield	
							2016	2-Yr Avg
			(in)	(DAP+)	(0-9*)	(lb/bu)	(bu/a)	(bu/a)
AC Pinnacle	Canada	1999	45.3	71	3	41.3	208.6	203.6
Horsepower	SD	2012	38.2	63	0	42.2	202.8	192.3
Souris	ND	2006	39.3	66	0	42.7	194.7	191.5
Goliath	SD	2013	49.2	69	2	43.1	181.6	190.8
Jury	ND	2012	46.4	67	3	41.9	197.2	189.9
Leggett	Canada	2005	46.9	69	1	42.8	193.3	186.9
HiFi	ND	2001	43.2	69	1	42.7	178.0	176.6
Newburg	ND	2011	45.2	66	3	42.3	178.7	176.5
Rockford	ND	2008	46.9	69	1	42.4	187.3	174.4
CDC Minstrel	Canada	2006	46.4	69	1	40.5	192.0	173.0
Deon	MN	2013	46.2	70	3	41.7	207.7	-
AAC Justice	AAFC/MN	2015	44.2	69	2	43.2	207.6	-
Otana	MT	1977	46.5	68	4	40.2	198.2	-
Maida	ND	2005	47.2	66	0	42.9	189.7	-
Hayden	SD	2015	43.2	67	0	42.9	188.8	-
GM423	General Mills	-	46.1	71	3	38.8	184.2	-
Morton	ND	2001	47.9	66	0	41.6	180.9	-
Beach	ND	2004	48.1	68	1	43.3	175.3	-
Loyal	SD	2000	45.3	71	3	42.8	171.5	-
Shelby 427	SD	2008	45.0	64	2	43.6	163.4	-
AC Kaufman	AAFC	2000	47.3	70	3	41.3	155.4	-
Buff	SD	2002	42.3	63	2	51.3	134.3	-
Mean			45.3	67.7	1.6	42.5	185.1	185.6
C.V.			6.1	1.9	106.5	2.9	13.5	-
LSD 5%			3.9	1.8	2.4	1.8	35.2	-
LSD 10%			3.3	1.5	2.0	1.5	29.4	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft Previous crop: Soybean

Planted: 4/14/2016 Harvested: 8/8/2016

Residue status at planting: 0" of Soybean stubble Soil type: Lihen Loamy Fine Sand

Plot size: 91.875 ft^2

Applied fertilizer in lbs/a broadcast: 385 lbs/a of 46-0-0

Soil test to 6": 24-ppm P, 230- ppm K, OM-2.2, pH-7.6

Soil test to 2' : 18 lbs of N

Yield goal: 200 bu/a

Planting population: 1.5 million seeds/a

Herbicides applied: Starane 10 oz/a + Bison 1.5 pt/a (5/17/2016)

Fungicides applied: none

Rainfall: 8.71 in (4/14/2016 - 8/8/2016)

Irrigation: 6.8 in. (4/13/2016 - 8/8/2016)

+ Days after planting

* 0: no lodging - 9: plants lying flat on ground

Flax Variety Descriptions

Variety[1]	Origin[2]	Relative Maturity	Seed Color	Plant Height	Resistance To Wilt	Relative Yield
AC Lightning	Canada	late	brown	m tall	R	v good
Bison	NDSU	mid	brown	medium	MR	good
Carter	NDSU	mid	yellow	medium	MR	v good
CDC Arras	Canada	mid	brown	medium	MR	good
CDC Bethume	Canada	m late	brown	m tall	MR	v good
CDC Glas	Canada	m late	brown	m tall	MR	v good
CDC Neela	Canada	m late	brown	medium	MR	good
CDC Plava	Canada	mid	brown	medium	MR	good
CDC Sanctuary	Canada	mid	brown	m tall	MR	v good
CDC Sorrel	Canada	m late	brown	m tall	MR	v good
Gold ND	NDSU	mid	yellow	m tall	MR/R	good
Hanley	Canada	m early	brown	medium	R	v good
Linott	Canada	m early	brown	medium	MS/MR	v good
McGregor	Canada	late	brown	medium	MR	good
Neche	NDSU	mid	brown	medium	R	good
Nekoma	NDSU	late	brown	medium	MR	v good
Omega	NDSU	mid	yellow	medium	MS	good
Pembina	NDSU	mid	brown	medium	MR	good
Prairie Blue	Canada	m late	brown	medium	NA	good
Prairie Grande	Canada	m early	brown	medium	MR	v good
Prairie Sapphire	Canada	mid	brown	medium	MR	good
Prairie Thunder	Canada	medium	brown	short	NA	good
Rahab 94	SDSU	mid	brown	medium	MR	v good
Shape	Canada	mid	brown	medium	R	good
Webster	SDSU	late	brown	tall	MR	good
York	NDSU	late	brown	medium	R	v good

[1] All varieties have resistance to prevalent races of rust; all have good oil yield and oil quality.

[2] Refers to developer: NDSU = North Dakota State University; SD = South Dakota State University.

Dryland Flax Variety Trial **WREC, Williston, ND**

Variety	Days to Flower	Days to Mature	Plant Height	Oil		Test Weight	Yield		
				2016	3-Yr Avg		2016	2-Yr Avg	3-Yr Avg
	DAP[1]	DAP[1]	inch	----%----		lb/bu	(bu/a)	(bu/a)	(bu/a)
Brown Seeded									
Bison	52	91	21	37.2	38.0	53.8	20.4	23.3	21.4
York	52	90	21	36.0	37.3	54.0	20.9	23.8	22.1
Prairie Grande	52	90	20	36.7	38.0	53.7	22.4	24.7	22.3
Pembina	52	90	21	37.6	38.3	53.8	22.6	25.1	22.3
Shape	53	90	21	37.6	39.0	53.5	23.5	24.8	22.4
Webster	52	89	20	37.6	38.4	54.0	23.7	25.6	22.5
Prairie Sapphire	53	90	20	38.2	39.3	53.1	23.3	25.1	22.5
CDC Bethume	52	91	20	36.4	37.6	54.0	22.1	24.9	22.7
Prairie Thunder	53	91	21	35.6	37.1	53.9	22.8	25.1	22.8
Nekoma	52	90	21	37.1	38.3	53.8	22.6	24.9	23.3
Rahab 94	52	90	20	37.2	38.3	53.3	23.4	25.5	23.5
Prairie Blue	53	90	20	37.9	38.9	53.6	22.7	25.6	23.9
CDC Glas	53	89	21	37.9	38.7	52.8	22.4	26.4	23.9
CDC Sanctuary	53	91	21	37.6	38.3	53.6	26.9	27.5	24.5
CDC Sorrel	54	90	22	37.1	38.4	53.6	25.0	27.2	24.6
CDC Neela	52	89	19	36.1	-	53.8	24.5	-	-
CDC Plava	53	89	20	37.2	-	53.5	25.0	-	-
Yellow Seeded									
Carter	52	92	21	37.0	37.9	53.9	22.2	26.2	23.6
Gold ND	53	90	22	37.3	38.7	54.3	23.6	26.7	24.3
Omega	54	89	19	37.1	37.9	54.3	18.6	23.0	22.3
Mean	52.6	89.9	20.6	37.12	-	53.72	22.93	-	-
CV (%)	0.8	1.2	5.8	2.8	-	0.3	11.1	-	-
LSD (5%)	0.6	1.5	1.7	1.48	-	0.25	3.56	-	-
LSD (10%)	0.5	1.3	1.4	1.24	-	0.21	2.98	-	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft Previous crop: Durum

Planting Date: 4/23/2016 Harvest Date: 8/16/2016

Harvested area: 49.2 ft^2

Soil test (0-6"): P=17 ppm; K=274 ppm; pH=6.5; OM=2.2% Soil type: Williams-Bowbells loam

(0-24"): NO3-N=33 lb/a

Applied fertilizer in lb/a: 47.2 N : 4 P2O5 : 0 K2O

Chemical Applications: Spartan Charge with RT3 at 3.75fl.oz/a (preplant spring applied) (4/30/2016), Bromac Advanced at 12fl.oz/a (5/26/2016), Assure II at 12 fl.oz/a (6/10/2016), Gramoxone SL at 1qt./a (8/1/2016)

DAP[1] = Days after planting

Farming is not just a JOB. It's a way of LIFE.

Flax Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Seed type	Days to flower	Days to mature	Plant height	Lodging	Oil†	Test weight	Yield	
									2016	2-Yr Avg
			(DAP+)	(DAP+)	(in)	(0-9*)	(%)	(lb/bu)	(bu/a)	(bu/a)
Bison	ND	Brown	55	100	23.2	1	34.8	54.9	51.4	-
Carter	ND	Yellow	55	101	22.8	0	33.5	54.8	46.0	39.3
CDC Glas	Canada	Brown	54	97	23.0	0	34.5	53.7	56.7	52.7
CDC Sorrel	Canada	Brown	57	98	22.2	0	34.1	54.2	49.0	-
Gold ND	ND	Yellow	57	100	23.6	0	33.6	55.0	46.3	-
Prairie Blue	Canada	Brown	55	98	22.0	0	34.1	54.2	50.2	45.0
Webster	SD	Brown	54	98	24.0	0	34.0	54.7	47.6	44.5
York	ND	Brown	53	100	23.4	0	33.2	54.6	46.6	-
Mean			55.3	98.9	23.0	0.0	33.8	54.6	49.2	45.4
C.V.%			1.4	1.4	3.6	222.5	2.0	0.6	10.0	-
LSD 5%			2.4	2.4	1.4	NS	1.2	0.6	8.6	-
LSD 10%			2.0	2.0	1.2	NS	1.0	0.5	7.1	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft
Previous crop: Potato
Planted: 4/21/2016
Harvested: 8/15/2016
Plot size: 78.75 ft^2
Soil type: Lihen Loamy Fine Sand
Applied fertilizer in broadcast: 420 lbs/a of 46-0-0
Soil test to 6": 13-ppm P, 152-ppm K, OM-1.8, pH-7.7
Soil test to 2' : 7 lbs of N
Yield goal = 50 bu/a
Planting population = 30 lbs/a
Herbicides applied: Spartan 3 oz/a (4/27/2016) and Section 2EC 6 oz/a (6/7/2016)
Rainfall: 8.36 in. (4/21/2016 - 8/15/2016)
Irrigation: 6.8 in (4/21/2016 - 8/15/2016)
+ Days after planting
* 0: no lodging - 9: plants lying flat on ground
† Oil content adjusted to a 9% moisture

In winter's chill or summer's heat…FARMERS & RANCHERS work so the world can eat.

Safflower Variety Descriptions

Variety	Origin[1]	PVP[2]	Hull Type[3]	Oil Type[4]	Irrigated Yield[5]	Dryland Yield[5]	TWT[5]	Oil[5]	Maturity	Tolerance[6] Alt	Tolerance[6] BB
Baldy	MSU	YES	N	HIGH LINO	GOOD	GOOD	V HIGH	LOW	MED		
Cardinal	MSU/NDSU	YES	N	HIGH LINO	V GOOD	V GOOD	HIGH	FAIR	MED	T	MT
Finch	MSU/NDSU	NO	N	HIGH LINO	GOOD	V GOOD	V HIGH	FAIR	M EARLY	MS	T
Hybrid 200	STI	YES	N	HIGH OLEIC	V GOOD	V GOOD	V HIGH	FAIR	MED	MT	
Hybrid 300	STI	YES	N	HIGH OLEIC	V GOOD	V GOOD	V HIGH	FAIR	MED	MT	
Hybrid 446	STI	YES	N	HIGH OLEIC	V GOOD	V GOOD	V HIGH	FAIR	MED	MT	
Hybrid 528	STI	YES	STP	HIGH OLEIC	GOOD	GOOD	M HIGH	GOOD	MED	MT	
Hybrid 621	STI	YES	STP	HIGH OLEIC	GOOD	GOOD	M HIGH	GOOD	MED	MT	
Hybrid 1601	STI	YES	STP	HIGH OLEIC	V GOOD	V GOOD	MED	GOOD	M LATE	MT	MT
Hybrid 9049	STI	YES	N	HIGH OLEIC	V GOOD	V GOOD	V HIGH	FAIR	MED	MT	MT
MonDak	MSU/NDSU	YES	N	HIGH OLEIC	GOOD	V GOOD	HIGH	FAIR	M EARLY	T	MT
Montola 2000	MSU/NDSU	YES	N	HIGH OLEIC	M GOOD	GOOD	MED	GOOD	EARLY	MS	MS
Montola 2001	MSU/NDSU	YES	STP	HIGH OLEIC	GOOD	FAIR	MED	GOOD	MED	MT	MT
Montola 2003	MT/NDSU	YES	N	HIGH OLEIC	V GOOD	V GOOD	M HIGH	GOOD	M EARLY	MT	MT
Montola 2004	MSU/NDSU	YES	N	HIGH OLEIC	GOOD	GOOD	M HIGH	GOOD	M EARLY	MS	MT
Morlin	MSU/NDSU	YES	STP	HIGH LINO	V GOOD	GOOD	MED	GOOD	M LATE	T	T
NutraSaff	MSU/NDSU	YES	RED	HIGH LINO	GOOD	GOOD	MED	HIGH	MED	T	MT
Rubis Red	MSU	YES	N	HIGH LINO	GOOD	GOOD	V HIGH	LOW	MED		
STI 1201	STI	YES	STP	HIGH OLEIC	GOOD	GOOD	M HIGH	GOOD	MED	MT	
STI 1401	STI	YES	STP	HIGH OLEIC	GOOD	GOOD	M HIGH	HIGH	MED	MT	

[1] Refers to developer: MSU = Montana State University; NDSU = North Dakota State University; STI = Safflower Technologies International.

[2] PVP = Plant Variety Protection. "YES" indicates that the variety is protected and the seed may be sold for planting purposes only as a class of certified seed (Title V option) and/or exclusive licensed variety.

[3] STP = striped, N = normal, RED = reduced.

[4] Lino = linoleic.

[5] Relative ratings of yield, test weight, and oil will vary under conditions of moderate-severe disease infestation.

[6] Alt = Alternaria leaf spot disease, BB = bacterial blight, S = susceptible, MS = moderately susceptible, MT = moderately tolerant, T = tolerant.

Safflower Dryland Variety Trial — **WREC, Williston, ND**

Variety	Stand	Days to First Flower[1]	Plant Height	Oil			Test Weight	Yield		
				2016	2-Yr Avg	3-Yr Avg		2016	2-Yr Avg	3-Yr Avg
	%	DAP[2]	inch		----%----		lb/bu	(lb/a)	(lb/a)	(lb/a)
NutraSaff	73	76	21	47.8	47.7	46.3	38.9	1382	1451	1270
Finch	55	77	22	36.3	36.7	35.7	44.8	1736	1644	1420
Hybrid 528	40	76	22	41.2	42.2	42.1	33.9	1525	1650	1424
STI 1201	55	77	18	41.5	42.3	42.6	37.4	1589	1610	1464
Hybrid 621	64	75	22	38.2	39.3	39.3	38.6	1882	1796	1599
Hybrid 9049	53	75	20	30.5	31.3	31.0	43.9	1909	1846	1709
Hybrid 200	23	76	20	30.0	31.7	32.1	42.9	1377	1773	1762
Montola 2003	65	77	19	37.5	37.8	37.7	41.8	2176	2069	1785
MonDak	55	77	21	35.4	36.0	35.7	42.5	2251	2217	1915
Cardinal	66	77	24	35.7	36.5	35.2	44.5	2585	2240	1937
Hybrid 446	61	75	21	30.7	32.1	32.2	45.4	2692	2576	2160
Hybrid 1601	59	76	22	36.1	36.6	37.2	41.4	2558	2650	2161
Baldy	54	75	22	27.2	-	-	47.9	1779	-	-
Hybrid 300	58	76	21	31.7	-	-	44.4	2334	-	-
Rubis Red	48	77	23	30.0	-	-	48.2	2102	-	-
STI 1401	53	76	21	45.3	-	-	35.9	1449	-	-
Mean	54.9	75.9	21.2	35.95	-	-	42.03	1957.84	-	-
CV (%)	26.9	0.9	5.8	2.5	-	-	1.6	16.5	-	-
LSD (5%)	19.1	1.0	1.7	1.30	-	-	0.91	417.71	-	-
LSD (10%)	16.0	0.8	1.4	1.09	-	-	0.76	349.48	-	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft — Previous crop: Durum
Planting Date: 5/5/2016 — Harvest Date: 9/13/2016 and 9/14/2016
Harvested area: 49.2 ft^2
Soil test (0-6"): P=17 ppm; K=274 ppm; pH=6.5; OM=2.2% — Soil type: Williams-Bowbells loam
(0-24"): NO3-N=33 lb/a
Applied fertilizer in lb/a: 41.94 N : 34 P2O5 : 0 K2O : 8.5 S
Chemical Applications: Prowl H_2O at 3pints/a (preplant spring applied), Spartan Charge at 2.75fl.oz/a (preplant spring applied), and Equation SC at 10fl.oz/a (at flowering), Gramoxone SL at 1quart/a (preharvest dessication)
First Flower[1] = 50% of flowers from primary head
DAP[2] = Days after planting

Off-Station Safflower Dryland Variety Trial **WREC, Golden Valley County, ND**

Variety	Oil		Test Weight	Yield	
	2016	2-Yr Avg		2016	2-Yr Avg
	----%----		lb/bu	(lb/a)	(lb/a)
NutraSaff	47.8	48.4	36.9	2259	1645
Finch	36.7	36.9	43.6	2719	2044
Hybrid 200	31.8	32.7	42.2	2226	2050
MonDak	34.2	35.0	42.6	3190	2149
Cardinal	35.5	36.1	43.3	2864	2237
Montola 2003	35.9	37.0	42.0	3089	2341
Hybrid 446	29.7	31.8	43.3	2902	2423
Hybrid 1601	35.1	36.0	39.5	3188	2791
Hybrid 300	31.2	-	43.6	2966	-
STI 1401	45.7	-	34.0	1845	-
Mean	36.36	-	41.11	2725.00	-
CV (%)	2.3	-	1.8	11.3	-
LSD (5%)	1.45	-	1.29	529.18	-
LSD (10%)	1.2	-	1.06	436.78	-

Location: Latitude 46° 50'N; Longitude 103° 59'W; Elevation 2890 ft
Planting Date: 5/17/2016
Harvested: 10/10/2016
Harvested area: 49.2 ft^2
Previous crop: Spring Wheat
Soil type: Williams-Belfield-Grail
Soil test (0-6"): P=7 ppm; K=202 ppm; pH=7.9; OM=2.5%
(0-24"): NO3-N= 35 lb/a
Applied fertilizer in lb/a: 40.1 N : 34 P2O5 : 0 K2O : 8.5 S
Chemical Applications: Mad Dog 5.4# at 44fl.oz/a with Prowl H^2O at 48fl.oz/a (preplant spring applied)

A clever person solves a problem. A wise person avoids it.

Off-Station Safflower Dryland Variety Trial **WREC, McKenzie County, ND**

Variety	Oil			Test Weight	Yield		
	2016	2-Yr Avg	3-Yr Avg		2016	2-Yr Avg	3-Yr Avg
		----%----		lb/bu	(lb/a)	(lb/a)	(lb/a)
NutraSaff	46.0	47.5	46.0	33.9	1446	1211	1051
Finch	36.5	37.1	34.8	40.3	1464	1334	1215
MonDak	35.9	35.2	33.1	41.0	1529	1378	1289
Montola 2003	36.1	36.4	34.3	39.6	1437	1411	1323
Hybrid 446	31.2	31.9	31.9	42.3	1712	1434	1434
Hybrid 1601	36.5	35.9	35.4	40.2	1860	1846	1474
Cardinal	35.7	36.6	33.8	40.8	1597	1503	1505
Hybrid 200	32.6	32.1	-	39.9	1191	1244	-
Hybrid 300	33.2	-	-	42.1	1817	-	-
STI 1401	47.0	-	-	34.7	1609	-	-
Mean	37.06	-	-	39.49	1566.21	-	-
CV (%)	2.7	-	-	1.7	14.2	-	-
LSD (5%)	1.71	-	-	1.18	382.71	-	-
LSD (10%)	1.4	-	-	0.97	315.88	-	-

Location: Arnegard, ND; Latitude 47° 47'N; Longitude 103° 25'W; Elevation 2250 ft
Planting Date: 5/9/2016
Harvest Date: 10/10/2016
Harvested area: 49.2 ft^2
Previous Crop: Lentil
Soil type: Williams-Belfield-Grail
Soil test (0-6"): P=7 ppm; K=235 ppm; pH=6.5; OM=2.2%
(0-24"): NO3-N= 4lb/a
Applied fertilizer in lb/a: 71 N : 22 P2O5 : 0 K2O : 5.5 S
Chemical Applications: Harmony GT at 0.4fl.oz/a with Clethodim 2E at 8fl.oz/a (6/24/2016)

Safflower Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Plant Height (in)	Days to flower (DAP+)	Oil† (%)	Test weight (lb/bu)	Yield 2016 (lb/a)	Yield 2-Yr Avg (lb/a)	Yield 3-Yr Avg (lb/a)
Hybrid 1601	25.1	84	35.6	39.9	2225	2210	1831
Hybrid 446	26.0	84	29.3	41.9	1712	1653	1663
MonDak	21.9	85	34.0	42.0	1787	1682	1652
Hybrid 9049	23.2	84	29.0	41.2	1497	1518	1536
Montola 2003	19.7	86	36.2	41.0	1449	1364	1491
Hybrid 528	24.8	84	41.1	33.3	1497	1549	1420
Hybrid 200	23.4	84	30.3	41.4	1203	1403	1417
Finch	25.1	85	33.4	42.2	1444	1483	1401
Cardinal	26.6	85	34.0	43.2	1363	1297	1340
NutraSaff	24.1	86	45.6	38.4	1198	1083	985
STI 1201	20.2	84	41.0	37.4	1170	1310	-
Hybrid 300	26.0	84	31.2	42.5	1843	-	-
STI 1401	22.6	85	46.6	35.8	1268	-	-
Rubis Red	25.7	84	27.6	45.8	1215	-	-
Baldy	23.5	83	24.1	44.0	994	-	-
Mean	23.9	84.4	34.6	40.7	1457.6	1504.7	1473.7
C.V.	8.90	1.5	1.93	1.92	17.3	-	-
LSD 5%	3.43	2.0	1.05	1.14	388.5	-	-
LSD 10%	2.87	1.7	0.88	0.95	324.6	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft Previous crop: Sugarbeet

Planted: 4/21/2016 Harvested: 9/13/2016

Plot size: 52 ft^2 Soil type: Lihen Loamy Fine Sand

Applied fertilizer in broadcast: 330 lb/a of 46-0-0

Soil test to 6": 24-ppm P, 230- ppm K, OM-2.2, pH-7.6

Soil test to 2' : 18 lbs of N

Yield goal: 2000 lb/a

Planting population: Conventional 20 lbs PLS, Hybrid 18 lbs PLS

Herbicides applied: Prowl H2O 3 pt/a (4/27/2016), Section 2EC 6 oz/a plus Cornbelt Trophy Gold 1qt/100 gal (6/7/2016), Gramoxone 2 pt/a (9/2/2016)

Fungicides applied: Priaxor D 8 oz/a (7/21/2016), Priaxor D 8 oz/a + Endura 11 oz/a (7/28/2016)

Rainfall: 9.1 in (4/21/2016 - 9/13/2016)

Irrigation: 6.8 in. (4/13/2016 - 8/3/2016)

Irrigation dates and amounts (inches): 1.2 (6/24) 1.0 (6/28), 1.0 (7/8), 1.2 (7/15), .8 (7/18), and 1.6 (8/11)

+ Days after planting

† Oil adjusted to an oven dry basis

It's not about how bad You want it… It's about how hard You are willing to work for it.

Dryland Canola Conventional Variety Trial **WREC, Williston, ND**

Variety	Brand/Company	Stand	Days to Flower	Days to Mature	Plant Height	Seed Oil Content		Yield	
						2016	2-Yr Avg	2016	2-Yr Avg
		(%)	DAP[1]	DAP[1]	inch	(%)	(%)	(lb/a)	(lb/a)
C1511 (SU)	Cibus	93	47	93	34	43.8	39.3	1748	1453
C1516 (SU)	Cibus	95	49	94	39	45.1	40.7	1711	1460
C5507	Cibus	95	47	93	34	46.8	-	1887	-
C5513	Cibus	92	48	94	34	46.0	-	1842	-
C5522	Cibus	97	48	94	31	46.6	-	1657	-
Mean		94.2	47.8	93.6	34.4	45.66	-	1769.0	-
CV (%)		5.0	2.3	0.8	9.4	1.2	-	7.7	-
LSD (5%)		NS	1.6	NS	NS	0.84	-	NS	-
LSD (10%)		NS	1.3	NS	4.0	0.70	-	NS	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft Previous crop: Durum

Planted: 5/3/2016 Harvested: 8/16/2016

Harvested area: 49.2 ft^2

Soil test (0-6"): P=17 ppm; K=274 ppm; pH=6.5; OM=2.2% Soil type: Williams-Bowbells loam

(0-24"): NO3-N=33 lb/a

Applied fertilizers in lb/a: N=64.68; P_2O_5=20; K_2O=0; S=19.67

Chemical Applications: Stinger 8 oz/a for weed control (5/26), Tombstone Helios for flea beetle control 2.5 oz/a (6/6), and Assure II 12 oz/a for weed control (6/10)

DAP[1]= Days after planting

Dryland Canola Roundup Ready Variety Trial **WREC, Williston, ND**

Variety	Brand/Company	Days to Flower	Days to Mature	Plant Height	Seed Oil Content			Yield		
					2016	2-Yr Avg	3-Yr Avg	2016	2-Yr Avg	3-Yr Avg
		DAP[1]	DAP[1]	inch	(%)	(%)	(%)	(lb/a)	(lb/a)	(lb/a)
HyCLASS 930	Winfield	43	92	30	46.6	44.9	45.8	2159	1723	1701
7150RR	Integra	43	91	29	45.5	45.3	45.5	2056	1733	1729
HyCLASS 955	Winfield	45	94	33	43.5	43.7	44.6	2173	1760	1787
Star 402	Star Specialty Seed	44	92	29	46.6	45.6	46.5	2237	1856	1805
V12-1	Cargill	47	91	33	44.0	43.7	-	2078	1645	-
6074 RR	BrettYoung	46	93	31	45.2	-	-	2237	-	-
6080 RR	BrettYoung	46	92	32	45.0	-	-	2228	-	-
CS2000	Canterra Seeds	48	93	37	43.2	-	-	2277	-	-
CS2100	Canterra Seeds	45	92	30	44.6	-	-	2104	-	-
HyCLASS 972	Winfield	43	91	27	46.1	-	-	2286	-	-
V12-3	Cargill	47	92	31	44.9	-	-	2254	-	-
V22-1	Cargill	46	90	32	45.2	-	-	2012	-	-
Mean		45.2	91.7	31.2	45.04	-	-	2175.2	-	-
CV (%)		1.9	1.1	8.0	1.5	-	-	6.0	-	-
LSD (5%)		1.2	1.4	3.6	0.95	-	-	182.1	-	-
LSD (10%)		1.0	1.2	3.0	0.79	-	-	152.0	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft Previous crop: Durum

Planted: 5/2/2016 Harvested: 8/12/2016

Harvested area: 49.2 ft^2

Soil test (0-6"): P=17 ppm; K=274 ppm; pH=6.5; OM=2.2% Soil type: Williams-Bowbells loam

(0-24"): NO3-N=33 lb/a

Applied fertilizers in lb/a: N=64.68; P_2O_5=20; K_2O=0; S=19.67

Chemical Applications: Stinger 8 oz/a for weed control (5/26), Mad Dog 5.4# for weed control 6 oz/a (6/1), and Tombstone Helios for flea beetle control 2.5 oz/a (6/6)

DAP[1]= Days after planting

Irrigated Canola Variety Evaluation EARC, Sidney, MT

Brooke Bohannon, Yesuf Mohammed, Chengci Chen Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown and Benton Carr

Irrigated Canola Variety Evaluation **EARC, Sidney, MT**

Cultivar	Mean Yield (bu/ac)	Oil content (%)	Test weight (lb/bu)
GT50	24.7	40.0	50.3
NCH13G046	30.4	41.7	51.1
Empire	30.3	43.3	50.1
Cara	15.5	40.0	49.5
Arriba	16.5	36.9	49.7
BY16-768	27.3	46.9	48.1
6074 RR	28.8	45.9	49.9
6080 RR	32.3	46.4	49.0
InVigor L140P	30.7	44.0	48.9
InVigor L130	32.5	44.3	49.6
InVigor 5440	34.0	43.6	50.0
C1511	35.8	41.0	49.0
C1516	31.8	42.7	50.6
DKL30-20	36.8	47.7	49.4
G35153	35.5	45.9	49.4
G49720	35.8	46.2	49.6
DKL70-10	37.0	46.4	49.0
G49773	36.5	45.1	49.4
CXP15507	30.5	46.7	48.0
CXP15513	28.0	46.1	49.8
CXP15522	27.7	45.1	47.7
HyClass930	31.4	47.7	48.9
Hyclass955	38.4	46.7	49.3
Hyclass970	35.8	46.9	49
Hyclass972	34.5	45.5	50.2
Mean	31.1	44.5	49.4
CV (%)	15.7	4.0	0.9
LSD (0.05)	6.9	2.5	0.6

Canola seeding date: May 9, 2016
Canola harvesting date: August 18, 2016
Seeding rate: 10 live seeds/ft2 with 12” row spacing

Irrigated Canola Foliar Fungicide Trial — EARC, Sidney, MT

Frankie Crutcher, Chengci Chen, Yesuf Mohammed

Effect of Fungicide Treatment on Irrigated Canola Yield — **EARC, Sidney, MT**

Treatment #	Adj. Yield (lb/ac @ 8% moisture)	Oil (%)	Test Weight (lb/bu)	Stand (%)	Height (cm)
1	1343 AB	44.6 A	50.80	76	77
2	1469 AB	44.1 AB	50.20	95	79
3	1235 B	43.5 AB	50.65	87	80
4	1285 AB	44.4 A	50.61	81	85
5	1524 A	44.1 A	50.40	94	77
6	1249 AB	43.8 AB	50.50	96	77
7	1286 AB	42.5 AB	50.47	93	69
8	1231 B	42.0 B	50.49	76	69
9	1488 AB	44.3 A	50.87	91	88
Mean	1345	43.7	50.55	88	78
LSD	276	2.2	NS	NS	NS
CV(%)	14.5	3.7	1.2	15.2	10.8

Fungicide Treatments Description for Irrigated Canola — **EARC, Sidney, MT**

Treatment #	Fungicide	Rate (oz./cwt.)
1	Untreated Control	0
2	Proline	4.3 oz./A
3	Endura	5.8 oz. wt./A
4	Intuity	6 oz./A
5	Intuity Hefty Premium Crop Oil	6 oz./A 16 oz./A
6	Intuity Methylated Seed Oil	6 oz./A 16 oz./A
7	Intuity Hefty Premium NIS	6 oz./A 0.25% v/v
8	Intuity Quash Hefty Premium NIS	6 oz./A 4 oz. wt./A 0.25% v/v
9	Quash Hefty Premium NIS	4 oz. wt./A 0.25% v/v

Variety: InVigor L140 (Liberty resistant)
Planted: May 9
Harvested: August 18
Soil Type: William Clay Loam
Previous Crops: Sugarbeet
Residual Soil N to 3 ft: 30 lb/ac
Residual Soil P to 6 in: 22.5 ppm
Applied Fertilizer: None
Irrigated (sprinkler) on May 20 0.82", June 17 1.00", June 23 1.45", July 6 1.78", July 18 1.78", August 5 2.28", September 6 1.36"

Herbicides: Prowl H2O May 1
Insecticides: June 6 Sevin® XLR applied for flea beetle control
Precipitation April – September, 2016: 13.85 in
Observation dates: May 24, June 6, June 13, July 19
Disease rated on August 15
Treatments: See 2nd table
Date of fungicide application: 6/28/2016

Comments: Flea beetles were observed in the plots and Sevin® XLR was applied to control them. No flea beetles were observed after June 10.

Results: There was no significant differences in treatment for emergence (data not shown). No disease was observed in the plots including the untreated control. The oil percentage and yield, however, were significantly different between treatments (top table). Treatment 5 increased both oil percentage and yield.

Carinata Irrigated Variety Trial - NDSU — **WREC, Nesson Valley, ND**

Variety	Origin	Days to flower (DAP+)	Flower duration (Days)	Days to mature (DAP+)	Plant height (in)	Lodging (0-9*)	Oil† (%)	Test weight (lb/bu)	Yield (lb/a)
20.111	Agrisoma	50	20	107	38.2	2	33.9	51.0	4387
5223	Agrisoma	51	21	105	40.4	2	34.9	51.9	3989
A120	Agrisoma	51	20	106	44.7	1	34.1	52.0	3904
M-01	Agrisoma	53	20	104	37.7	2	33.6	51.4	3763
L140P‡	Bayer	47	14	98	37.6	2	38.5	51.2	3732
3A22.1	Agrisoma	49	21	103	35.2	2	33.0	52.4	3545
Mean		50.0	19.1	103.8	39.0	1.8	34.6	51.7	3886.5
C.V. LSD		4.3	9.6	2.2	8.1	50.1	3.5	0.6	12.6
5%LSD		3.2	2.8	3.5	4.8	NS	1.8	0.4	740.4
10%		2.6	2.3	2.9	3.9	NS	1.5	0.4	608.9

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft Planted: 5/6/2016 — Previous crop: Barley
Plot size: 52.5 ft^2 — Harvested: 8/26/2016
Applied fertilizer in broadcast: 260 lbs/a of 46-0-0 — Soil type: Lihen Loamy Fine Sand
Soil test to 6": 16-ppm P, 200- ppm K, OM-2.0 pH-8.5
Soil test to 2' : 38 lbs N/a
Yield goal: 2500 lbs/a
Planting population: 523,000 seeds/a
Herbicides applied: Assure II 7 oz/a and Trophy Gold 2 pt/a (6/10/2106) Fungicides applied:
Priaxor D 8 oz/a (7/8/2016)
Rainfall: 7.46 in. (5/6/2016 - 8/26/2016)
Irrigation: 7.5 in. (5/6/2016 - 8/26/2016)
+ Days after planting
* 0: no lodging - 9: plants lying flat on ground
† Oil content adjusted to a 8.5% moisture
‡ Canola variety used as check

Soybean Conventional Dryland Variety Trial — **WREC, Williston, ND**

Variety	Company/Brand	Maturity Group[1]	Maturity Date	Plant Height	Oil[2] 2016	Oil[2] 2-Yr Avg	Protein[3] 2016	Protein[3] 2-Yr Avg	Test Weight[4]	Yield[5] 2016*	Yield[5] 2-Yr Avg**
			(date)	inch	----%----		----%----		lb/bu	(bu/a)	(bu/a)
Sheyenne	NDSU	0.7	9/5	26	13.8	14.4	35.6	34.0	52.3	23.0	25.6
Ashtabula	NDSU	0.4	9/3	27	14.2	14.9	34.4	33.7	50.6	24.7	22.9
ND Henson	NDSU	00.0	9/2	26	13.6	14.2	36.4	35.5	52.4	22.5	22.5
Mean			9/4	26.1	13.86	-	35.49	-	51.75	23.41	-
CV (%)			1.5	10.3	3.3	-	3.1	-	0.8	22.1	-
LSD (5%)			2.2	3.8	0.66	-	1.5	-	0.58	7.94	-
LSD (10%)			1.9	3.2	0.55	-	1.28	-	0.48	6.63	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft
Planting Date: 5/19/2016
Harvest Date: 10/13/2016
Harvested area: 49.2 ft^2
Previous crop: Barley
Soil test (0-6"): P=20 ppm; K=252 ppm; pH=6.3; OM=2.5%
(0-24"): NO3-N=39 lb/a
Applied fertilizer in lb/a: none, seed inoculated with liquid inoculant at planting
Soil type: Williams-Bowbells loam
Chemical Applications: Spartan Charge at 3.5fl.oz/a (preplant spring applied)
Maturity Group[1] = provided by the company
Oil[2] = Oil content adjusted to 13% mositure
Protein[3] = Protein content adjusted to 13% mositure
Test Weight[4] = Test weight content adjusted to 13% moisture
Yield[5] = Yield content adjusted to 13% moisture
*Due to drought stress, lower than average yields were exhibited
**Yield averages from previous years were not adjusted to 13% moisture

Conventional Soybean Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Maturity group	Days to mature	Plant height	Lodging	Protein†	Oil‡	Test weight	Yield		
									2016	2-Yr Avg	3-Yr Avg
			(DAP+)	(in)	(0-9*)	(%)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Ashtabula	NDSU	0.4	112	38.8	0	36.7	37.9	56.1	78.2	65.1	53.7
Sheyenne	NDSU	0.7	116	41.3	1	37.1	37.9	56.9	71.2	65.7	52.6
ND Bison (ND09-5798)	NDSU	0.7	118	35.4	0	36.8	37.7	56.0	80.8	66.4	-
ND Henson	NDSU	0.0	112	36.2	4	37.2	38.3	56.3	82.4	65.8	-
Mean			114.4	37.9	1.0	37.0	37.9	56.3	78.1	65.8	53.1
C.V.%			0.9	6.3	62.4	0.8	0.6	0.9	8.3	-	-
LSD 5%			1.6	3.8	1.0	0.4	0.4	0.8	10.4	-	-
LSD 10%			1.3	3.1	0.8	0.4	0.3	0.7	8.4	-	-

Location of the WREC Nesson Site: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft Previous crop: barley

Planted: 5/17/2016 Harvested: 10/13/2016

Standard Harvested Plot area: 61.25 ft^2 Soil Type: Lihen Loamy Fine Sand

Applied Fertilizer in broadcast: none

Soil test to 6": 16-ppm P, 200- ppm K, OM-2.0 pH-8.5

Soil test to 2' : 38 lbs N/a

Yield Goal = 50 bu

Planting Population = 200,000 seeds/a

Herbicides Applied: Section 2EC 6 oz/a (6/7/16), Basagran 1 pt/a + Assure II 7 oz/a (6/10/16)

Fungicides Applied: Priaxor D 8 oz/a (7/8/2016)

Rainfall: 12.00 in (5/17/2016 - 10/13/2016)

Irrigation: 11.15 in (5/17/2016 - 10/13/2016)

+ Days After Planting

* 0 no lodging - 9: plants lying flat on ground

† Protein adjusted to 13% moisture

‡ Oil content adjusted to 13% moisture

Stop worrying about what you have to loose and start focusing on what you have to gain.

Soybean Roundup Ready Dryland Variety Trial — **WREC, Williston, ND**

Variety	Company/Brand	Maturity Group[1]	Stand	Maturity Date	Plant Height	Oil[2]		Protein[3]		Test Weight[4]	Yield[5]	
						2016	2-Yr Avg	2016	2-Yr Avg		2016*	2-Yr Avg**
			%	(date)	inch	----%----		----%----		lb/bu	(bu/a)	(bu/a)
LS-00835N RR2	Legacy Seed	0.8	93	9/5	23	14.1	14.9	34.4	33.3	51.8	16.9	18.8
20090	Integra	00.9	94	9/3	22	14.6	15.5	32.9	31.0	52.7	19.0	20.1
LS-0135 RR2	Legacy Seed	0.1	96	9/3	26	14.5	15.4	35.2	33.2	52.6	19.1	21.3
S03RY36	Dyna-Gro	0.3	94	9/9	20	13.5	14.2	37.4	36.2	54.1	18.8	22.0
20300	Integra	0.3	96	9/10	21	13.6	14.5	36.7	33.9	53.5	18.9	23.0
LS-0214 RR2	Legacy Seed	0.2	95	9/6	23	14.2	15.0	36.6	34.5	51.8	23.9	23.6
LS-0334 RR2	Legacy Seed	0.3	96	9/12	20	14.1	14.9	35.6	33.6	53.5	20.0	24.7
66G14	REA Hybrids	0.6	97	9/13	21	13.9	14.3	34.7	33.5	53.1	21.7	25.7
64G94	REA Hybrids	0.4	98	9/5	20	14.7	15.4	33.1	32.3	51.2	25.4	27.1
20097	Integra	00.9	93	9/3	27	14.2	-	35.6	-	52.1	21.0	-
20215	Integra	00.1	92	9/10	17	14.1	-	34.2	-	53.6	19.4	-
50098 R2XTEND	Integra	0.4	94	9/5	22	13.7	-	33.7	-	53.2	17.8	-
6008R2	NuTech	00.8	95	9/2	22	14.6	-	33.1	-	53.1	17.9	-
LS-00834 RR2	Legacy Seed	0.7	92	9/2	20	14.2	-	34.4	-	51.8	18.2	-
R00727	REA Hybrids	00.7	96	8/31	22	14.4	-	33.7	-	49.5	21.5	-
S009RY56	Dyna-Gro	00.9	94	9/4	24	14.2	-	34.2	-	52.5	20.0	-
S04XT77	Dyna-Gro	0.4	93	9/7	19	15.0	-	32.0	-	52.8	17.7	-
Mean			94.6	9/6	21.7	14.20	-	34.56		52.53	19.83	-
CV (%)			2.3	1.9	9.6	3.3	-	3.5		1.1	12.1	-
LSD (5%)			3.0	2.9	2.9	0.66	-	1.7		0.85	3.41	-
LSD (10%)			2.5	2.4	2.5	0.55	-	1.41		0.71	2.84	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft
Planting Date: 5/19/2016
Harvest Date: 9/30/2016
Harvested area: 49.2 ft^2
Previous crop: Barley
Soil test (0-6"): P=20 ppm; K=252 ppm; pH=6.3; OM=2.5%
(0-24"): NO3-N=39 lb/a
Applied fertilizer in lb/a: none, seed inoculated with liquid inoculant at planting
Soil type: Williams-Bowbells loam
Chemical Applications: Mad Dog 5.4# at 24fl.oz/a (6/23/2016)
Maturity Group[1] = provided by the company
Oil[2] = Oil content adjusted to 13% mositure
Protein[3] = Protein content adjusted to 13% mositure
Test Weight[4] = Test weight content adjusted to 13% moisture
Yield[5] = Yield content adjusted to 13% moisture
*Due to drought stress, lower than average yields were exhibited
**Yield averages from previous years were not adjusted to 13% moisture

Off-Station Soybean Roundup Ready Dryland Variety Trial — **WREC, McKenzie County, ND**

Variety	Company/Brand	Maturity Group[1]	Oil[2]		Protein[3]		Test Weight[4]	Yield[5]	
			2016	2-Yr Avg	2016	2-Yr Avg		2016	2-Yr Avg**
			----%----		----%----		lb/bu	(bu/a)	(bu/a)
6008R2	NuTech	00.8	16.5	15.5	28.7	33.4	52.1	23.4	24.9
20300	Integra	0.3	14.4	14.6	29.6	33.5	52.2	24.8	29.5
20090	Integra	00.9	15.9	15.1	29.2	33.1	52.4	24.1	29.5
20215	Integra	00.1	15.0	14.7	30.4	34.2	51.5	28.1	29.8
20097	Integra	00.9	16.5	-	29.2	-	52.0	26.7	-
64G94	REA Hybrids	0.4	16.2	-	28.8	-	50.9	28.6	-
66G14	REA Hybrids	0.6	15.2	-	29.0	-	51.6	24.1	-
R00727	REA Hybrids	00.7	15.8	-	29.3	-	49.6	20.1	-
S009RY56	Dyna-Gro	00.9	15.6	-	29.9	-	51.4	22.3	-
S03RY36	Dyna-Gro	0.3	15.5	-	30.1	-	52.3	20.3	-
Mean			15.66	-	29.43	-	51.60	24.25	-
CV (%)			3.0	-	1.0	-	0.7	8.0	-
LSD (5%)			0.80	-	0.5	-	0.63	3.31	-
LSD (10%)			0.66	-	0.42	-	0.52	2.73	-

Location: Latitude 47° 47'N; Longitude 103° 25'W; Elevation 2250 ft
Planting Date: 5/23/2016
Harvest Date: 10/10/2016
Harvested area: 49.2 ft^2
Previous Crop: Lentil
Soil test (0-6"): P=7 ppm; K=235 ppm; pH=6.5; OM=2.2%
(0-24"): NO3-N=4 lb/a
Applied fertilizer in lb/a: none, seed inoculated with liquid inoculant at planting
Soil type: Williams-Belfield-Grail
Chemical Applications: RT3 at 28fl.oz/a (6/24/2016)
Maturity Group[1] = provided by the company
Oil[2] = Oil content adjusted to 13% mositure
Protein[3] = Protein content adjusted to 13% mositure
Test Weight[4] = Test weight content adjusted to 13% moisture
Yield[5] = Yield content adjusted to 13% moisture
**Yield averages from previous years were not adjusted to 13% moisture

Roundup Ready Irrigated Soybean Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Maturity group	Days to mature	Plant height	Lodging	Protein†	Oil‡	Test weight	Yield		
									2016	2-Yr Avg	3-Yr Avg
			(DAP+)	(in)	(0-9*)	(%)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
20215	Integra	00.1	118	29.2	0	36.7	37.6	56.5	69.7	59.6	56.1
LS-0334 RR2	Legacy Seeds, Inc.	0.3	120	34.4	1	37.6	38.4	56.4	66.9	61.5	52.9
LS-0214 RR2	Legacy Seeds, Inc.	0.2	114	36.5	0	35.9	36.9	55.9	76.2	66.9	-
LS-0135 RR2	Legacy Seeds, Inc.	0.1	107	37.1	2	33.0	34.7	56.7	70.6	63.6	-
S03RY36	Dyna-Gro	0.3	115	32.6	0	35.0	36.3	56.4	59.7	58.6	-
R0216	REA Hybrid	0.2	108	37.4	2	34.0	35.5	56.3	66.8	57.2	-
6008R2	NuTech	00.8	107	32.1	0	30.7	32.2	56.3	60.5	51.8	-
LS-00835N RR2	Legacy Seeds, Inc.	00.8	116	31.4	0	30.3	31.8	55.5	52.8	50.3	-
S04XT77	Dyna-Gro	0.4	112	33.5	1	36.1	37.4	55.4	71.6	-	-
50098 R2XTEND	Integra	00.9	112	34.6	1	34.8	35.8	55.1	70.6	-	-
LS01R656	Legend Seeds, Inc.	0.1	109	37.2	2	33.3	34.8	56.8	70.0	-	-
LS-00834 RR2	Legacy Seeds, Inc.	00.8	107	30.0	0	34.2	35.4	56.1	68.8	-	-
64G94	REA Hybrid	0.4	111	25.0	1	30.3	32.2	54.7	66.1	-	-
R00727	REA Hybrid	00.7	104	24.4	0	32.4	33.6	54.5	62.1	-	-
S009RY56	Dyna-Gro	00.9	117	32.2	0	30.5	32.0	56.1	52.9	-	-
Mean			111.3	32.7	0.6	33.4	34.8	55.9	65.4	58.6	52.9
CV			2.1	9.7	89.5	6.4	5.6	0.7	16.7	-	-
LSD 5%			3.4	4.5	0.7	3.1	2.8	0.6	15.6	-	-
LSD 10%			2.8	3.7	0.6	2.6	2.3	0.5	13.0	-	-

Location of the WREC Nesson Site: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft
Previous crop: barley
Planted: 5/17/2016
Harvested: 10/14/2016
Standard Harvested Plot area: 61.25 ft^2
Soil Type: Lihen Loamy Fine Sand
Applied Fertilizer in broadcast: none
Soil test to 6": 16-ppm P, 200- ppm K, OM-2.0 pH-8.5
Soil test to 2' : 38 lbs N/a
Yield Goal = 50 bu
Planting Population = 200,000 seeds/a
Herbicides Applied: Roundup 24oz/a (6/14/2016)
Fungicides Applied: Priaxor D 8 oz/a (7/8/2016)
Rainfall: 12.00 in (5/17/2016 - 10/14/2016)
Irrigation: 11.95 in (5/17/2016 - 10/14/2016)
+ Days After Planting
* 0 no lodging - 9: plants lying flat on ground
† Protein adjusted to 13% moisture
‡ Oil content adjusted to 13% moisture

Corn Dryland Variety Trial **WREC, Williston, ND**

Variety	Company	Maturity[1]	Days to Silk	Ear Height	Harvest Moisture†	Test Weight	Yield[3] 2016	Yield[3] 2-Yr Avg	Yield[3] 3-Yr Avg
			DAP[2]	inch	(%)	lb/bu	(bu/a)	(bu/a)	(bu/a)
3142	Integra	81	62	28	8.4	57.6	46.7	50.7	52.7
2803	Integra	78	61	32	8.4	56.9	47.1	48.5	53.1
L-2213 VT2PRO	Legacy Seeds	82	63	26	8.8	57.5	54.4	55.7	56.3
5F-775	NuTech\G2 Genetics	75	61	30	8.1	54.3	62.9	57.9	58.4
5F-379	NuTech\G2 Genetics	79	62	29	8.2	55.1	49.0	50.6	58.9
5F-781	NuTech\G2 Genetics	81	63	32	8.4	55.8	55.3	57.7	60.7
5N-183	NuTech	83	62	29	8.1	55.4	59.3	63.9	62.8
1B820-RIB	REA Hybrids	82	62	30	9.4	57.2	52.3	49.1	-
3537	Integra	85	64	32	9.6	57.9	53.1	57.7	-
3236	Integra	82	63	34	9.0	58.2	44.5	-	-
2B840-RIB	REA Hybrids	84	61	30	9.4	56.9	57.1	-	-
2B850-RIB	REA Hybrids	85	63	27	9.2	56.4	49.1	-	-
L-2245 VT2PRO	Legacy Seeds	83	63	32	8.7	59.0	54.4	-	-
Mean			62.2	30.0	8.7	56.79	52.71	-	-
CV (%)			1.0	8.4	9.1	1.1	12.7	-	-
LSD (5%)			0.9	3.6	NS	0.93	9.59	-	-
LSD (10%)			0.8	3.0	1.0	0.78	7.99	-	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft
Planting Date: 6/2/2016
Harvest Date: hand harvested (10/12/2016), threshed (10/24/2016)
Harvested area: 106 ft^2
Previous crop: Soybean
Soil type: Williams-Bowbells loam
Soil test (0-6"): P=32 ppm; K=334 ppm; pH=6.0; OM=2.3%
(0-24"): NO3-N=68 lb/a
Chemical Applications: RT3 at 32fl.oz/a (preplant spring applied), Fierce 3fl.oz/a (preplant spring applied), and Mad Dog 5.4# at 24fl.oz/a for in-crop weeds (6/23/2016)
Harvest Moisture† = After hand harvest all ears were dried @ 90°F for 9 days. Harvest moisture was taken before threshing all ears. Maturity[1] = provided by company
DAP[2] = Days after planting
Yield[3] = Yield adjusted to 15.5% moisture

Irrigated Corn Variety Trial **WREC, Nesson Valley, ND**

Variety	Brand/ Company	Relative maturity	Days to silk+ (DAP*)	Ear height† (in)	Harvest moisture‡ (%)	Test Weight (lb/bu)	Yield¥ 2016 (bu/a)	Yield¥ 2 yr. avg. (bu/a)	Yield¥ 3 yr. avg. (bu/a)
3537VT2PRIB	Integra	85	70	45.5	18.6	56.1	224.5	191.8	188.6
5N-183	NuTech Seed	83	69	47.7	18.6	56.4	223.4	177.8	174.1
1B820-RIB	REA Hybrids	82	68	41.2	17.3	56.4	180.4	153.2	160.8
3142VT3PRIB	Integra	81	69	46.1	17.6	57.9	187.2	150.8	156.0
1B790-RIB	REA Hybrids	79	68	45.1	17.1	57.6	197.5	170.7	-
2803VT2PRIB	Integra	78	68	44.1	17.9	55.9	194.9	163.0	-
2B840-RIB	REA Hybrids	84	69	41.3	18.5	55.3	215.4	159.1	-
5F-379	NuTech/G2 Genetics	79	68	46.9	16.1	54.5	176.7	133.0	-
2B850-RIB	REA Hybrids	85	69	42.8	18.1	55.6	204.2	-	-
3236	Integra	82	69	44.3	18.5	56.2	155.8	-	-
Mean			68.6	44.5	17.8	56.2	196.0	162.4	169.9
C.V.%			0.9	6.5	5.5	0.7	8.5	-	-
LSD 5%			0.9	4.2	1.4	0.6	24.1	-	-
LSD 10%			0.8	3.5	1.2	0.5	20.0	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft Planted: 5/13/2016
Previous crop: Durum Harvested: 10/25/2016
Plot size: 130ft^2
Soil Type: Lihen Loamy Fine Sand
Applied Fertilizer in broadcast: 420 lbs of 46-0-0 (5/23/2016)
Soil test to 6": 15-ppm P, 185-ppm K, OM-2.2, pH-8.5
Soil test to 2' in lb/a: 41 lbs N
Yield Goal: 190 bu/a
Planting Population: 38,000 seeds/a
Row spacing: 30 inch
Herbicide applied: Roundup 26 oz/a + Class Act 3qt/ 100 gal (6/23/2016) Rainfall: 12.02 inches (5/13/2016 - 10/25/2016)
Irrigation: 11.95 inches (5/13/2016 -10/25/2016)
+ The number of days from planting until 1 inch silk has emerged
* Days after planting
† The height of the main ear measured from the ground to the shank of the ear
‡ Moisture taken at harvest
¥ Yields adjusted to harvest moisture

Faba Bean Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Days to flower (DAP+)	Flower duration (Days)	Days to mature (DAP+)	Plant height (in)	Pod height (in)	Lodging (0-9*)	Protein† (%)	Test weight (lb/bu)	1000 Kernel weight (g)	Seeds / pound (lb)	Yield (lb/a)
Laura	54	10	106	32.2	13.3	1	25.8	64.2	562.1	81	5868
Boxer	54	10	105	33.0	11.5	1	25.2	64.3	529.0	86	5679
Fabelle	54	8	100	28.1	12.1	1	19.9	64.3	526.0	87	5534
Fanfare	53	10	104	33.5	12.3	1	24.8	64.8	539.6	84	4794
Tobasco	54	9	103	27.7	12.5	2	23.4	64.7	430.8	106	4661
Mean	54	8	100	28	12	1	19.9	64	526	87	5534
C.V.%	1.7	11.1	2.3	13.5	10.0	52.7	2.5	0.5	4.8	5.3	15.8
LSD 5%	1.4	1.6	3.7	6.4	1.9	0.9	1.0	0.5	38.6	7.3	1288.7
LSD 10%	1.1	1.3	3.1	5.3	1.5	0.8	0.8	0.4	31.6	5.9	1054.1

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft Previous crop: barley

Planted: 5/6/2016 Harvested: 8/29/2016

Plot size: 52.5 ft^2 Soil type: Lihen Loamy Fine Sand

Applied Fertilizer in broadcast: none

Soil test to 6": 16-ppm P, 200- ppm K, OM-2.0 pH-8.5

Soil test to 2' : 38 lbs N/a

Yield goal: 2500 lbs/a

Planting population: 125,000 seeds/a

Herbicides applied: Section 2EC 6oz/a + Trophy Gold 2pt/a (6/7/2016) and Gramoxone 1.5 pt/a (9/2/2016)

Fungicides applied: Priaxor D 6 oz/a (6/28/2016), Priaxor D 8 oz/a (7/8/2016), Priaxor D 8 oz/a + Endura 11 oz/a (7/21/2016)

Rainfall: 7.9 in. (5/16 - 9/9)

Irrigation: 9.55 in. (5/6/2016 - 8/16/2016)

+ Days after planting

* 0: no lodging - 9: plants lying flat on ground

† Protein adjusted to 16% moisture

My Tractor Costs More Than Your Beemer.

TheFreshQuotes

Irrigated Faba Bean Variety Evaluation **EARC, Sidney, MT**

Cultivars	Mean grain yield (lb/ac)
Boxer	842
Fabelle	2362
Fan Fare	1485
Laura	1114
Tabasco	959
Mean	1352
CV (%)	22.99
LSD (0.05)	479
Pr>F	0.0005

Faba bean seeding date: April 22, 2016
Faba bean harvesting date: Sep. 21, 2016
Seeding rate: 5 live seed/ft^2
NO TEST WEIGHTS OR PROTEIN AVAILABLE THIS YEAR.

Navy Bean Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Days to mature	Canopy height	Lodging	Test weight	250 Kernel weight	Seeds / pound	Yield†		Harvest/ shatter loss‡
								2016	2-Yr Avg	
		(DAP+)	(in)	(0-9*)	(lb/bu)	(g)	(lb)	(lb/a)	(lb/a)	(lb/a)
Vista	Ag. Can.	98	17.3	1	64.6	40.8	1112	4451	3448	304
T9905	Hyland	100	16.7	2	64.3	49.3	921	4632	3411	230
HMS Medalist	Provita	98	16.6	1	64.7	41.3	1098	4261	3300	180
Ensign	ADM-Seedwest	99	17.2	3	64.9	47.5	962	3823	3029	466
Mean		98.4	16.9	2.0	64.8	44.4	1030.4	4041.7	3164.6	322.6
C.V.%		2.4	7.8	28.4	0.6	4.0	3.5	7.7	-	-
LSD 5%		3.7	2.1	0.8	0.6	2.8	57.4	528.3	-	-
LSD 10%		3.0	1.7	0.6	0.5	2.3	46.5	428.1	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft Previous crop: barley
Planted: 5/16/2016 Harvested: 9/9/2016
Plot size: 52.5 ft^2 Soil type: Lihen Loamy Fine Sand
Applied Fertilizer in broadcast: none
Soil test to 6": 16-ppm P, 200- ppm K, OM-2.0 pH-8.5
Soil test to 2' : 38 lbs N/a
Yield goal: 2500 lbs/a
Planting population: 125,000 seeds/a
Herbicides applied: Section 2EC 6oz/a + Trophy Gold 2pt/a (6/7/2016),
Assure II 7 oz/a + Basagran 1 pt/a + Trophy Gold 2pt/a (7/10/2016), and Gramoxone 2 pt/a (9/2/2016)
Fungicides applied: Priaxor D 8 oz/a (7/8/2016), Priaxor D 8 oz/a + Endura 11 oz/a (7/21/2016)
Rainfall: 7.9 in. (5/16/2016 - 9/9/2016)
Irrigation: 9.55 in. (5/9/2016 - 8/16/2016)
+ Days after planting
* 0: no lodging - 9: plants lying flat on groun
† Dry beans direct harvested
‡ Harvest loss figured on number of beans left in square foot following harvest and not represented in 2016 yield

Misc. Bean Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Market class	Days to mature	Canopy height	Lodging	Test weight	250 Kernel weight	Seeds / pound	Yield†		Harvest/ shatter loss‡
									2016	2-Yr Avg	
			(DAP+)	(in)	(0-9*)	(lb/bu)	(g)	(lb)	(lb/a)	(lb/a)	(lb/a)
Eclipse	NDSU	BL	94	17.4	0	63.9	42.3	1073	4667	3735	415
Loreto	Provita	BL	98	16.8	4	64.1	44.6	1017	3960	3566	489
Zorro	MSU	BL	94	16.2	1	64.7	42.1	1077	4080	3431	181
Rosie	-	SR	103	17.1	1	61.1	112.2	404	3394	3379	701
Merlot	MSU	BL	97	16.4	2	61.5	78.4	579	3080	3066	640
Talon	NDSU	DRK	98	14.7	2	58.9	105.7	431	2340	2324	1083
Pink Panther	Seminis	DRK	99	16.2	1	57.6	123.5	368	2155	2234	1980
Montcalm	MSU	DRK	98	13.6	0	58.1	102.9	441	1960	2151	1257
Rosetta	MSU/ARS	PK	94	17.0	0	62.7	69.7	652	3234	-	964
Mean			96.9	16.2	1.3	61.4	80.2	671.4	3207.8	2985.6	856.7
C.V.%			2.4	9.1	53.0	1.0	5.3	3.5	14.0	-	-
LSD 5%			3.3	2.2	1.0	0.9	6.2	34.5	657.5	-	-
LSD 10%			2.8	1.8	0.8	0.8	5.2	28.6	545.0	-	-

BL = Black, DRK = Dark Red Kidney, LRK = Light Red Kidney, PK = Pink, SR = Small Red

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: barley

Planted: 5/16/2016 — Harvested: 9/9/2016

Plot size: 52.5 ft² — Soil type: Lihen Loamy Fine Sand

Applied Fertilizer in broadcast: none

Soil test to 6": 16-ppm P, 200- ppm K, OM-2.0 pH-8.5

Soil test to 2' : 38 lbs N/a

Yield goal: 2500 lbs/a

Planting population: 125,000 seeds/a

Herbicides applied: Section 2EC 6oz/a + Trophy Gold 2pt/a (6/7/2016),
Assure II 7 oz/a + Basagran 1 pt/a + Trophy Gold 2pt/a (7/10/2016), and Gramoxone 2 pt/a (9/2/2016)

Fungicides applied: Priaxor D 8 oz/a (7/8/2016), Priaxor D 8 oz/a + Endura 11 oz/a (7/21/2016)

Rainfall: 7.9 in. (5/16/2016 - 9/9/2016)

Irrigation: 9.55 in. (5/9/2016 - 8/16/2016)

+ Days after planting

* 0: no lodging - 9: plants lying flat on ground

† Dry beans direct harvested

‡ Harvest loss figured on number of beans left in square foot following harvest and not represented in 2016 yield

Pinto Bean Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Days to mature	Canopy height	Lodging	Test weight	250 Kernel weight	Seeds / pound	Yield†		Harvest/ shatter loss‡
								2016	2-Yr Avg	
		(DAP+)	(in)	(0-9*)	(lb/bu)	(g)	(lb)	(lb/a)	(lb/a)	(lb/a)
Lariat	NDSU	98	17.3	3	60.6	88.4	513	3945	3924	319
La Paz	Provita	98	17.9	3	62.8	79.4	571	4366	3911	479
Palomino	NDSU	99	16.4	2	59.0	88.2	514	4686	3808	957
Maverick	NDSU	95	14.0	4	59.7	85.8	529	3999	3690	497
Stampede	NDSU	95	17.4	1	60.6	77.4	586	3097	3259	869
Windbreaker	Seminis	95	14.8	2	59.6	89.2	509	3698	3181	1151
ND-307	NDSU	99	15.6	2	58.3	94.5	480	3669	3109	474
Monterrey	Provita	97	18.2	2	62.7	76.7	592	4646	-	278
Mean		96.8	16.5	2.3	60.4	85.0	536.9	4013.4	3554.6	627.8
C.V.%		1.2	10.3	39.3	0.5	2.2	2.2	12.8	-	-
LSD 5%		1.8	2.5	1.3	0.5	2.8	17.7	755.9	-	-
LSD 10%		1.5	2.1	1.1	0.4	2.3	14.6	625.4	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft
Previous crop: barley
Plot size: 52.5 ft²
Planted: 5/16/2016
Applied Fertilizer in broadcast: none
Harvested: 9/9/2016
Soil test to 6": 16-ppm P, 200- ppm K, OM-2.0 pH-8.5
Soil type: Lihen Loamy Fine Sand
Soil test to 2' : 38 lbs N/a
Yield goal: 2500 lbs/a
Planting population: 125,000 seeds/a
Herbicides applied: Section 2EC 6oz/a + Trophy Gold 2pt/a (6/7/2016),
Assure II 7 oz/a + Basagran 1 pt/a + Trophy Gold 2pt/a (7/10/2016), and Gramoxone 2 pt/a (9/2/2016)
Fungicides applied: Priaxor D 8 oz/a (7/8/2016), Priaxor D 8 oz/a + Endura 11 oz/a (7/21/2016)
Rainfall: 7.9 in. (5/16/2016 - 9/9/2016)
Irrigation: 9.55 in. (5/9/2016 - 8/16/2016)

+ Days after planting
* 0: no lodging - 9: plants lying flat on ground
† Dry beans direct harvested
‡ Harvest loss figured on number of beans left in square foot following harvest and this loss is not represented in 2016 yield

Irrigated Dry Bean Variety Evaluation **EARC, Sidney, MT**

Variety	Grain yield lb/ac
AC 11G 13-SR1	**3896**
ALPENA	3331
BK 11-8	3778
CELRK	2979
CENTENNIAL	3171
CO 14790-3	2925
COSD-35	2914
COSD-7	3539
DINASTY	3242
Eclipse	3392
La Paz	4037
LIGHT HOUSE	3629
NE12-15-161	3261
Othello	3840
Palomino	3502
PT-11-13	3675
PT9-5-6	4057
SAMURAI	3474
XRAV-40-4	3618
YETI	3020
ZENITH	2752
AVG	3430
CV	19.6
LSD (0.05)	762

Location: EARC irrigated farm located in Sidney, MT
Soil Type: Savage Clay Loam
Precipitation May – September 2016: 9.5 in
Irrigation water depth used through the growing season: 14 inch

Dryland Sunflower Variety Trial **WREC, Williston, ND**

Variety	Company	Hybrid Type	Oil Type	Downy Mildew Resistant	Plants per Acre	Days to Flower	Days to Mature	Plant Height	Oil			Test Weight	Yield		
									2016	2-Yr Avg	3-Yr Avg		2016	2-Yr Avg	3-Yr Avg
					Acre	DAP[1]	DAP[1]	inch		----%----		(lb/bu)	(lb/a)	(lb/a)	(lb/a)
Talon	Nuseed	Express	NuSun	No	13236	64	95	51	34.4	32.9	31.9	29.6	1689	1544	1692
Hornet	Nuseed	Clearfield	High Oleic	Yes	16586	67	101	46	39.3	37.3	35.4	32.4	1988	1720	1764
Cobalt II	Nuseed	Clearfield	High Oleic	Yes	17256	64	97	46	37.5	35.4	34.0	32.9	2240	1814	1768
Camaro II	Nuseed	Clearfield	NuSun	Yes	15581	66	97	47	37.0	36.0	34.3	34.3	2002	1877	1795
68H7	NuTech	Express	High Oleic	Yes	15246	65	105	53	38.5	36.7	34.6	34.8	2480	1913	1817
N4HM354	Nuseed	Clearfield	High Oleic	Yes	17592	63	94	50	38.2	36.2	-	33.6	2118	1799	-
63C4	NuTech	Clearfield	NuSun	Yes	18932	63	95	49	38.6	-	-	33.1	1371	-	-
Daytona	Nuseed	Clearfield	High Oleic	No	17927	65	103	45	38.4	-	-	33.7	2108	-	-
Falcon	Nuseed	Express	NuSun	No	17089	66	100	45	38.1	-	-	34.6	1879	-	-
Mean					16604.9	64.7	98.3	47.9	37.77	-	-	33.23	1986.03	-	-
CV (%)					8.3	0.9	1.3	6.7	1.8	-	-	1.9	8.6	-	-
LSD (5%)					1999.7	0.8	1.9	4.7	1.00	-	-	0.91	248.55	-	-
LSD (10%)					1657.7	0.7	1.6	3.9	0.83	-	-	0.76	206.04	-	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft Previous crop: Durum

Planting Date: 6/3/2016 Harvest Date: 10/26/2016

Harvested area: 50.75 ft^2

Soil test (0-6"): P=17 ppm; K=274 ppm; pH=6.5; OM=2.2% Soil type: Williams-Bowbells loam

(0-24"): NO3-N=33 lb/a

Applied fertilizer in lb/a: 85.56 N

Chemical Applications: RT3 at 32fl.oz/a (preplant spring applied), Prowl H_2O at 3pints/a (preplant spring applied)

DAP[1] = Days after planting

LENTIL VARIETY DESCRIPTIONS

Variety	Origin[1]	Seed Color	Relative Maturity	Relative Height	Seed Size	Resistance To	
						Ascochyta	Anthracnose
Avondale	USDA	GREEN	MEDIUM	TALL	MEDIUM	NA	NA
CDC Greenland	Canada	GREEN	EARLY	MEDIUM	V LARGE	R	S
CDC Imigreen*	Canada	GREEN	MEDIUM	MEDIUM	LARGE	R	S
CDC Impala*	Canada	RED	EARLY	SHORT	EXTRA SMALL	R	R
CDC Impact*	Canada	RED	LATE	SHORT	SMALL	NA	NA
CDC Impress*	Canada	GREEN	M LATE	SHORT	LARGE	R	NA
CDC Imvincible	Canada	GREEN	EARLY	MEDIUM	SHORT	R	R
CDC LeMay	Canada	GREEN	EARLY	SHORT	SMALL	MS	S
CDC Maxim*	Canada	RED	M EARLY	MEDIUM	SMALL	R	R
CDC Redberry	Canada	RED	MEDIUM	MEDIUM	SMALL	R	R
CDC Redcoat	Canada	RED	M LATE	TALL	LARGE	R	R
CDC Red Rider	Canada	RED	M EARLY	MEDIUM	SMALL	MR	MS
CDC Richlea	Canada	GREEN	M LATE	MEDIUM	MEDIUM	S	S
CDC Rosetown	Canada	RED	EARLY	SHORT	SMALL	MR	MR
CDC Rouleau	Canada	RED	MEDIUM	MEDIUM	SMALL	MR	MS
CDC Viceroy	Canada	GREEN	M EARLY	MEDIUM	SMALL	R	MR
Crimson	USDA	RED	EARLY	M SHORT	SMALL	S	S
Essex	USDA	GREEN	MEDIUM	M TALL	MEDIUM	NA	S
Eston	Canada	GREEN	EARLY	MEDIUM	SMALL	S	S
Merritt	USDA	GREEN	M LATE	MEDIUM	LARGE	NA	NA
Morena	USDA	BROWN	EARLY	TALL	SMALL	NA	S
ND Eagle	NDSU	GREEN	EARLY	MEDIUM	SMALL	NA	NA
Pardina	Spain	BROWN	EARLY	SHORT	SMALL	NA	NA
Pennell	USDA	GREEN	MEDIUM	MEDIUM	LARGE	NA	S
Riveland	USDA	GREEN	M LATE	TALL	V LARGE	NA	S

[1] Refers to developer: USDA = United States Department of Agriculture.

***** Clearfield lentil with imidazolinone tolerance.

Dryland Lentil Clearfield Variety Trial **WREC, Williston, ND**

Variety	Days to Flower	Days to Mature	Vine Length	Canopy Height	Height Index	1000 Seed Weight	Test Weight	Yield	
								2016	2-Yr Avg
	DAP[1]	DAP[1]	inch	inch	(%)	(g)	lb/bu	(lb/a)	(lb/a)
Extra Small Red									
CDC Impala	53	87	12	11	91	26	63.7	1514	1431
French Green									
CDC Peridot	47	82	12	8	71	36	63.5	1743	-
Medium Green									
CDC Imigreen	50	86	16	12	77	57	61.5	2038	1566
CDC Impress	50	87	13	11	91	46	61.6	1705	-
Small Green									
CDC Imvincible	50	85	12	12	96	31	63.3	2241	1757
Small Red									
CDC Dazil	50	87	12	10	89	32	63.1	2057	-
CDC Maxim	51	85	12	10	83	35	63.0	1739	1677
CDC Proclaim	51	86	12	10	88	38	63.0	1974	-
Mean	50.2	85.6	12.4	10.6	85.7	37.6	62.86	1876.3	-
CV (%)	2.5	1.8	9.0	10.2	8.6	3.1	0.4	7.7	-
LSD (5%)	1.9	2.3	1.6	1.6	10.8	1.7	0.35	211.51	-
LSD (10%)	1.5	1.9	1.4	1.3	8.9	1.4	0.29	175.01	-

Location, WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft Previous crop: Barley

Planting Date: 5/6/2016 Harvest Date: 8/11/2016

Harvested area: 49.2 ft^2

Soil test (0-6"): P=20 ppm; K=252 ppm; pH=6.3; OM=2.5% Soil type: Williams-Bowbells loam
(0-24"): NO3-N=39 lb/a

Applied fertilizer in lb/a: none; seed inoculated with peat-based inoculant at planting

Chemical Applications: Proline 480 SC at 5fl.oz/a (6/21/2016), Gramosone SL at 1qt./a (8/5/2016)

DAP[1]= Days after planting

"Just remember, when
you're over the hill, you
pick up speed."

Charles M. Schultz

Dryland Lentil Statewide Conventional VT — **WREC, Williston, ND**

Variety	Stand	Days to Flower	Days to Mature	Vine Length	Canopy Height	Height Index	Lodging	1000 Seed Weight	Test Weight	Yield		
										2016	2-Yr Avg	3-Yr Avg
	(%)	DAP[1]	DAP[1]	inch	inch	(%)	0-9	(g)	lb/bu	(lb/a)	(lb/a)	(lb/a)
French Green												
CDC Lemay	92	53	87	12	11	93	1	31	63.4	1814	1688	1515
Large Green												
CDC Greenland	93	53	89	15	13	84	1	61	59.9	2119	1712	1549
Pennell	99	50	85	12	11	90	0	62	59.9	2182	1888	1664
Riveland	97	48	86	15	12	80	3	72	60.0	2156	1762	1548
Medium Green												
Avondale	100	49	87	14	13	92	0	49	61.9	2241	1985	1720
CDC Richlea	98	51	88	13	12	92	0	44	62.1	2209	2004	1746
Small Green												
CDC Viceroy	98	49	86	14	12	86	1	32	63.3	1940	1737	1528
Eston	98	49	85	11	10	90	0	33	63.7	1628	1686	1503
ND Eagle	98	48	83	13	11	86	0	37	62.8	2051	-	-
Small Red												
CDC Red Rider	95	52	90	14	12	87	1	42	62.9	2386	2008	1774
CDC Redberry	97	51	88	13	12	93	0	39	62.6	1874	1687	1520
CDC Rosetown	96	54	89	13	13	94	0	28	63.5	1732	1605	1436
CDC Rouleau	98	51	86	14	13	95	0	35	62.7	2576	2070	1817
Spanish Brown												
Pardina	96	48	83	12	9	78	8	41	64.1	1889	1824	1621
Mean	96.7	50.3	86.4	13.2	11.6	88.6	1.0	43.2	62.35	2057.0	-	-
CV (%)	2.1	2.0	1.9	6.9	10.1	8.5	69.6	2.6	0.3	7.4	-	-
LSD (5%)	2.8	1.4	2.3	1.3	1.6	10.6	1.5	1.6	0.25	211.77	-	-
LSD (10%)	2.4	1.2	1.9	1.1	1.4	8.9	1.3	1.3	0.21	176.91	-	-

Location, WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft — Previous crop: Barley

Planting Date: 5/5/2016 — Harvest Date: 8/9/2016 & 8/11/2016

Harvested area: 49.2 ft^2

Soil test (0-6"): P=20 ppm; K=252 ppm; pH=6.3; OM=2.5% — Soil type: Williams-Bowbells loam

(0-24"): NO3-N=39 lb/a

Applied fertilizer in lb/a: none; seed inoculated with peat-based inoculant at planting

Chemical Applications: Proline 480 SC at 5fl.oz/a (6/21/2016)

DAP[1]= Days after planting

Lentil Irrigated Variety Trial — **WREC, Nesson Valley, ND**

Variety	Origin	Seed type	Days to flower	Days to mature	Canopy height	Vine length	Lodging	1000 seed weight	Test weight	Yield
			(DAP+)	(DAP+)	(in)	(in)	(0-9*)	(g)	(lb/bu)	(lb/a)
CDC Maxim	Canada	Small Red	64	99	13.3	15.8	3	38.8	61.9	4279
CDC Proclaim	Canada	Small Red	63	97	12.3	14.9	2	41.1	61.6	4056
CDC Impala	Canada	Extra Small Red	65	97	11.5	15.5	4	31.5	62.9	3864
CDC Dazil	Canada	Small Red	65	99	10.4	17.2	6	35.5	61.2	3679
CDC Imvincible	Canada	Small Green	64	99	9.8	16.6	6	33.9	60.9	3348
CDC Impress	Canada	Large Green	64	96	9.6	16.7	7	51.9	58.6	3149
CDC Peridot	Canada	French Green	63	97	8.9	14.4	8	36.8	60.9	3065
CDC Imigreen	Canada	Large Green	66	99	11.0	17.6	6	54.1	57.8	2496
Mean			63.3	96.8	8.9	14.4	7.5	36.8	60.9	3065.2
C.V.%			2.7	2.3	11.1	12.3	29.0	2.4	0.8	12.7
LSD 5%			2.6	NS	1.8	2.9	2.2	1.4	0.7	642.0
LSD 10%			2.1	2.8	1.5	2.4	1.8	1.2	0.6	531.2

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: barley

Planted: 4/22/2016 — Harvested: 8/12/2016

Applied Fertilize in broadcast: none — Soil type: Lihen Loamy Fine Sand

Soil test to 6": 16-ppm P, 200- ppm K, OM-2.0 pH-8.5

Soil test to 2' : 38 lbs N/a

Yield goal = 2,500 lb/a

Planting population = 750,000 seeds/a

Herbicides applied: Sharpen 0.75 oz/a + Pursuit 1 oz/a + Prowl H2O 2 pt/a (4/28/2016), Section 2EC 6 oz/a (6/7/2016), Assure II 7 oz/a (7/10/2016), and Gramoxone Inteon 1 pt/a (8/9/2016)

Fungicides applied: Priaxor D 6 oz/a (6/28/2016 and 7/8/2016)

Rainfall: 8.35 in. (4/22/2016 - 8/12/2016)

Irrigation: 6.5 in. (4/22/2016 - 8/12/2016)

+ Days after planting

* 0: no lodging - 9: plants lying flat on ground

Dryland Lentil Variety Evaluation Trials EARC, Sidney, MT

Chengci Chen, Yesuf Assen Mohammed, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown and Benton Carr

Lentil Variety Evaluation Trials (Both Statewide And Western Regional) Planting and Harvesting Dates

Experiment	Location	Planting date	Harvesting date
Lentil Yield Trial	Sidney Dryland	April 11	August 8
	Richland, MT	May 4	October 14

Some Physiographic Characteristics of the Different Locations - EARC

	Sidney Dryland	Sidney Irrigated	Richland, MT
Latitude	47^0 46' N	47^0 40' N	48^0 72' N
Longitude	104^0 14' W	104^0 08' W	106^0 14' W
Elevation (ft)	2200	1950	
Soil type:	William clay loam	William clay loam	Farnuf Reeder loam
Previous crop:	Chemical fallow	Sugar beet	Chemical fallow
Applied fertilizer:	No chemical fertilizer	No chemical fertilizer	
Herbicides:	Prowl H2O at 3 pt/ac and Assure II at 12 fl oz/ac	Prowl H2O at 3 pt/ac and Assure II at 12 fl oz/ac	Roundup

Comments: At the Richland, MT site, there was too much moisture at the time of flowering and grain filling. This resulted in continued vegetative growth with limited grain filling thus low yield.

Statewide Lentil Variety Evaluations - EARC

Variety/Lines	Grain Yield (lb/ac)	
	Richland, MT	Sidney Dryland
Large Green		
Medium Green		
Avondale	1678	2315
CDC Richlea	1346	2325
CDC Imi-Green	1035	1851
Small Green		
CDC Imvincible CL	1204	2353
Eagle	1799	**2425**
CDC Viceroy	1673	2392
Small Brown		
Small Red		
CDC Impala CL	1589	1694
CDC Redcoats	**2214**	2253
Mean	**1567**	**2200**
LSD (0.05)0	**231**	**Ns**
CV (%)	**10.05**	**25.70**

*Results from Huntley dry are from one replication only.

Western Regional Lentil Variety Evaluation - EARC **Richland, MT**

Variety/Lines	Grain Yield (lb/ac)	Height (cm)	Test Wt (lb/bu)
Avondale	1213	38	59.35
Eston	1389	44	60.60
LC01602273E	1290	42	62.07
LC08600005E	1348	44	58.68
LC08600113P	901	42	62.53
LC08600116P	1013	45	62.33
LC09600054E	**1411**	40	62.68
LC09600066E	1198	39	60.65
LC10600494P	813	41	57.90
LC14600006P	562	43	61.90
LC14600010P	631	43	62.25
LC14600017P	873	43	62.27
LC14600106L	929	40	56.30
LC1660NZ003E	697	40	61.50
NDL080187L	1031	39	56.00
NDL090185R	1260	**46**	59.03
NDL120423T	1098	43	**64.25**
NDL120432T	1071	41	63.13
NDL120480T	1251	40	63.00
Pardina	394	37	59.35
Mean	***1045***	***42***	***60.91***
LSD	***417***	***Ns***	***1.53***
C.V. (%)	***28.24***	***14.00***	***1.79***

Materials and Methods:

The seeds were treated with fungicide and insecticide and inoculated with appropriate rhizobium to enhance biological nitrogen fixation. The plot size was 50 ft^2 at Sidney (both dryland and irrigated sites) and 100 ft^2 at Richland site. All grain yield data were adjusted to 13% moisture content before statistical analysis. The general linear model of SAS was used for analysis of variance. The protected least significant difference (LSD) at alpha = 0.05 was used to differentiate treatment means.

Sprinkler Irrigated Field Lentil Fungicide Trial — EARC, Sidney, MT

Frankie Crutcher, Sherry Turner, Yesuf Mohammed, Chengci Chen

Effect of Fungicide Treatment on Disease and Yield of Irrigated Lentil — **EARC, Sidney, MT**

	Adj. Yield (lb/ac)	Disease Rating[a]
1	1192	16
2	1594	11
3	1237	16
4	1827	14
5	956	25
6	1297	8
7	1300	6
8	1204	18
9	1188	19
10	1190	11
11	1501	3
12	1475	12
Mean	1330	13
LSD	497.9	16.2
CV(%)	2.0	2.0

[a] Disease scale based on percent foliar symptoms

Fungicide Treatment Description for Irrigated Lentil — **EARC, Sidney, MT**

Treatment #	Seed Applicaton	Rate (oz/cwt)	Foliar Application	Rate
1	Untreated Control	1.5	none	
2	Apron Maxx RFC	1.5	none	
3	Apron Maxx RFC	0.08	none	
	Vibrance	0.66		
	Cruiser 5FS	0.66		
4	Apron Maxx RFC	1.5	none	
	Vibrance	0.08		
	Cruiser 5FS	2.04		
	Mertect 340F	0.66		
5	Obvius(BAS72000F)	4.6	none	
	Cruiser 5FS	0.66		
6	Evergol Energy	1	none	
	Cruiser 5FS	0.66		
7	Obvius	4.6	Priaxor	6.0 oz/A
	Cruiser 5FS	0.66		
8	Cruiser Maxx	5	Elatus/Induce	4.76oz/A/0.125% v/v
9	Vibrance Maxx	1.54	Elatus/Induce	4.76oz/A/0.125% v/v
10	Vibrance Maxx	1.54	Elatus/Induce	4.76oz/A/0.125% v/v
	Mertect 340-F	1.05		
11	Apron Maxx RFC	1.5	Delaro	880ml/ha
			Induce	0.125% v/v
12	Apron Maxx RFC	1.5	Proline 480	5 oz/A
			Induce	0.125% v/v

Variety: CDC Richlea
Planted: May 1
Harvested: August 8
Soil Type: Clay Loam
Previous Crops: Sugarbeet
Residual Soil N to 3 ft: 30 lb/ac
Residual Soil P to 6 in: 22.5 ppm
Applied Fertilizer: None

Irrigated (sprinkler) on May 20 0.82", June 17 1.00", June 23 1.45", July 6 1.78", July 18 1.78", August 5 2.28", September 6 1.36"
Herbicides: May 1 Prowl H2O
Precipitation April – September, 2016: 13.85 in
Observation dates: May 17, June 8, and July 7
Disease rated on July 28
Treatments: See 2nd table
Date of fungicide application: June 28

FIELD PEA VARIETY DESCRIPTIONS

Variety	Origin	Vine Habit[1]	Growth Habit[2]	Vine Length	Relative Maturity	Seed Size	Resistance to Powdery Mildew
Yellow Cotyledon							
AC Agassiz	AC	SL	SD	TALL	MEDIUM	MEDIUM	R
AC Earlystar	AC	SL	SD	TALL	EARLY	MEDIUM	R
Bridger	Legume Logic	SL	SD	MEDIUM	MEDIUM	MEDIUM	MS
CDC Amarillo	CDC	SL	SD	MEDIUM	MEDIUM	MEDIUM	R
CDC Leroy	CDC	SL	SD	M SHORT	MED LATE	SMALL	R
CDC Meadow	CDC	SL	SD	MEDIUM	EARLY	MEDIUM	R
CDC Saffron	CDC	SL	SD	MEDIUM	MEDIUM	MEDIUM	R
CDC Treasure	CDC	SL	SD	MEDIUM	EARLY	SMALL	R
Delta	Limagrain	SL	SD	MEDIUM	MEDIUM	MEDIUM	MR
DS Admiral	Danisco	SL	SD	TALL	MEDIUM	LARGE	R
Jetset	Meridian	SL	SD	MEDIUM	Medium	M SMALL	R
Korando	Pulse USA	SL	SD	MEDIUM	EARLY	MEDIUM	R
Montech 4152	Montech	SL	SD	MEDIUM	EARLY	LARGE	NA
Mystique	Pulse USA	SL	SD	M SHORT	M LATE	M SMALL	MR
Spider	Nickerson	SL	SD	MEDIUM	MEDIUM	LARGE	R
SW Midas	Sweden	SL	SD	SHORT	M LATE	SMALL	R
SW Trapeze	Sweden	SL	SD	M SHORT	MEDIUM	MEDIUM	NA
Vegas	Pulse USA	SL	SD	SHORT	M LATE	LARGE	NA
Green Cotyledon							
Aragorn	Progene	SL	SD	M SHORT	M EARLY	M LARGE	NA
Arcadia	Pulse USA	SL	SD	MEDIUM	EARLY	SMALL	MS
CDC Striker	Canada	SL	SD	MEDIUM	MEDIUM	M LARGE	S
Cruiser	WA	SL	SD	MEDIUM	MEDIUM	M SMALL	S
Daytona	Meridian	SL	SD	MEDIUM	LATE	MEDIUM	R
K-2	Legume Logic	SL	SD	MEDIUM	EARLY	M SMALLL	S
Majoret	Sweden	SL	SD	MEDIUM	M LATE	MEDIUM	S
Stirling	WA	SL	SD	SHORT	EARLY	MEDIUM	R
Viper	Pulse USA	SL	SD	M SHORT	M EARLY	MEDIUM	MR

[1] SL=semi-leafless. [2] SD=semi-dwarf.

Dryland Field Pea Variety Trial **WREC, Williston, ND**

Variety	Days to Flower	Days to Mature	Vine Length	Canopy Height	Height Index	Lodging	Protein		1000 Seed Weight	Test Weight[2]	Yield[3]		
							2016	3-Yr Avg			2016	2-Yr Avg	3-Yr Avg
	DAP[1]	DAP[1]	inch	inch	%		----%----		g	lb/bu	(bu/a)	(bu/a)	(bu/a)
Green Cotyledon													
Cruiser	59	90	20	14	74	3	22.1	24.8	198	61.1	37.8	33.2	37.2
LN1123	60	93	21	17	80	3	21.5	23.4	244	62.9	36.8	35.7	39.3
CDC Striker	58	91	17	14	83	3	22.4	24.3	226	61.3	39.6	38.8	40.8
Arcadia	59	91	16	12	71	4	22.8	24.8	228	61.5	39.4	36.7	41.3
CDC Patrick	60	92	20	16	79	2	20.7	-	190	62.2	39.6	-	-
CDC Raezer	61	93	21	17	83	2	22.0	-	235	60.7	33.0	-	-
K2	60	93	18	16	88	2	22.4	-	230	61.7	38.8	-	-
Viper	60	93	21	17	82	3	24.0	-	257	60.9	34.1	-	-
Yellow Cotyledon													
Nette 2010	59	94	20	17	83	2	22.0	24.6	257	62.9	37.5	31.6	38.2
Bridger	62	92	18	16	88	2	23.1	25.7	226	62.5	38.8	34.7	38.3
Abarth	60	92	20	17	85	1	22.6	24.9	257	60.7	40.4	34.6	38.6
Korando	60	94	21	17	81	4	24.3	26.8	294	62.2	40.3	34.9	39.2
DS Admiral	60	90	22	17	77	4	22.6	25	254	62.3	37.7	35.3	40.6
Durwood	59	93	22	19	84	1	21.5	24.1	265	62.2	43.1	39.0	41.4
Hyline	62	92	21	16	76	1	20.4	23.9	252	62.6	44.5	40.4	42.1
Agassiz	60	94	20	17	84	1	20.8	24.3	253	62.0	44.7	40.7	44.1
CDC Amarillo	60	93	22	19	87	0	20.8	-	261	62.9	43.8	37.3	-
CDC Saffron	60	92	20	17	88	1	22.1	-	270	62.4	45.8	38.0	-
AAC Carver	60	91	21	17	83	2	20.0	-	251	62.8	44.1	-	-
AC Earlystar	59	91	23	17	75	3	21.3	-	232	62.3	45.6	-	-
Jetset	60	92	22	16	77	4	24.3	-	244	61.0	35.1	-	-
Majestic	61	92	23	20	85	1	23.2	-	266	61.2	38.8	-	-
Navarro	58	94	20	16	79	3	21.9	-	291	62.6	37.2	-	-
PUSA 0614	61	93	22	18	80	3	26.0	-	267	61.0	38.6	-	-
Salamanca	61	92	22	18	81	4	22.5	-	261	62.0	42.7	-	-
Spider	60	95	24	20	85	1	22.5	-	259	63.2	43.1	-	-
Mean	59.8	92.3	20.7	16.8	81.4	2.3	22.29	-	248.7	61.98	40.0	-	-
CV (%)	2.3	1.0	7.8	8.5	9.7	45.8	2.8	-	3.4	0.8	8.7	-	-
LSD (5%)	1.9	1.3	2.2	2.0	11.0	1.6	0.89	-	11.9	0.68	4.87	-	-
LSD (10%)	1.6	1.1	1.9	1.7	9.2	1.3	0.74	-	10.0	0.57	4.07	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft Previous crop: Barley
Planted: 4/22/2016 Harvested: 8/5/2016
Harvested area: 49.2 ft^2
Soil test (0-6"): P=20 ppm; K=252 ppm; pH=6.3; OM=2.5% Soil type: Williams-Bowbells loam
(0-24"): NO3-N=39 lb/a
Applied fertilizer in lb/a: none; seed inoculated with peat-based inoculant at planting
Chemical Applications: Spartan Charge with RT3 at 4fl.oz/a (preplant spring applied) (4/13/2016), Raptor at 4fl.oz/a with Basagran at 6fl.oz/A (6/1/2016), and Gramoxone SL at 1 qt/A (7/29/2016)
DAP[1]= Days after planting
Test Weight[2] = Test Weight content adjusted to 13.5% moisture
Yield[3] = Yield content adjusted to 13.5% moisture

"Don't interfere with something that ain't botherin' you none."

Judge Roy Bean

Off-Station Dryland Field Pea Variety Trial **WREC, Divide County, ND**

Variety	Protein		1000 Seed Weight	Test Weight[1]	Yield[2]		
	2016	3-Yr Avg*			2016	2-Yr Avg*	3-Yr Avg*
	----%----		g	lb/bu	(bu/a)	(bu/a)	(bu/a)
Green Cotyledon Type							
Cruiser	18.6	23.5	147	59.1	39.4	40.2	35.2
CDC Striker	15.7	21.6	171	58.8	52.5	53.9	46.8
Arcadia	15.1	-	173	59.2	40.0	-	-
Yellow Cotyledon Type							
DS Admiral	14.6	21.1	191	60.9	44.0	47.1	41.9
Agassiz	17.7	22.6	193	59.1	52.6	52.2	43.5
Mystique	23.6	-	209	58.5	51.0	47.7	-
Spider	16.6	-	193	59.6	44.5	-	-
Mean	17.4	-	182.4	59.33	46.28	-	-
CV (%)	6.1	-	5.4	0.6	9.2	-	-
LSD (5%)	1.86	-	17.0	0.58	7.11	-	-
LSD (10%)	1.53	-	14.0	0.48	5.84	-	-

Location: Latitude 48° 48'N; Longitude 103° 18'W; Elevation 2044 ft

Planted: 4/28/2016

Harvested: 8/29/2016

Harvested area: 49.2 ft^2

Previous crop: Soybean

Soil type: Farnuf-Alkabo

Soil test (0-6"): P=19.5 ppm; K=380 ppm; pH=7.1; OM=4.2%

(0-24"): NO3-N=25.5 lb/a

Applied fertilizer in lb/a: none; seed inoculated with peat-based inoculant at planting

Chemical Applications: Raptor at 4fl.oz/a with Basagran at 6fl.oz/a (6/6/2016)

Test Weight[1] = Test Weight content adjusted to 13.5% moisture

Yield[2] = Yield content adjusted to 13.5% moisture

*Average of years 2012,2014, and 2016

Off-Station Dryland Field Pea Variety Trial **WREC, Golden Valley County, ND**

Variety	Protein		1000 Seed Weight	Test Weight[1]	Yield[2]		
	2016	3-Yr Avg			2016	2-Yr Avg	3-Yr Avg
	----%----		g	lb/bu	(bu/a)	(bu/a)	(bu/a)
Green Cotyledon							
Cruiser	28.9	25.7	185	58.8	34.5	35.2	30.1
CDC Striker	27.4	24.7	153	59.4	30.2	37.3	34.3
Arcadia	27.0	-	158	59.5	44.6	-	-
Yellow Cotyledon							
Mystique	27.8	25.5	197	58.7	43.9	35.7	32.5
DS Admiral	26.2	23.8	201	59.7	50.6	42.5	39.7
Agassiz	27.6	24.5	214	59.3	53.3	48.3	43.4
Spider	27.4	-	213	59.8	49.8	-	-
Mean	27.5	-	188.6	59.31	43.85	-	-
CV (%)	3.7	-	9.4	0.5	10.3	-	-
LSD (5%)	NS	-	31.7	0.54	8.12	-	-
LSD (10%)	NS	-	26.0	0.44	6.67	-	-

Location: Latitude 46° 50'N; Longitude 103° 59'W; Elevation 2890 ft
Planted: 5/17/2016
Harvested: 8/31/2016
Harvested area: 49.2 ft^2
Previous crop: Spring Wheat
Soil type: Grail-Grassna complex
Soil test (0-6"): P=7 ppm; K=202 ppm; pH=7.9; OM=2.5%
(0-24"): NO3-N=35 lb/a
Applied fertilizer in lb/a: N=6.6; P_2O_5=22; K_2O=0; S = 5.5
Chemical Applications: Roundup at 44fl.oz/a with Prowl H^2O at 48fl.oz/a (preplant spring applied) (5/17/2016)
Test Weight[1] = Test Weight content adjusted to 13.5% moisture
Yield[2] = Yield content adjusted to 13.5% moisture

"I have always said there is only one thing that can bring our nation down - our dependence on foreign countries for food and energy. Agriculture is the backbone of our economy."

John Salazar

Off-Station Dryland Field Pea Variety Trial **WREC, McKenzie County, ND**

Variety	Protein		1000 Seed Weight	Test Weight[1]	Yield[2]		
	2016	3-Yr Avg			2016*	2-Yr Avg	3-Yr Avg
	----%----		g	lb/bu	(bu/a)	(bu/a)	(bu/a)
Green Cotyledon							
Cruiser	25.4	27.1	199	57.5	11.5	19.4	26.2
CDC Striker	24.9	25.8	206	58.1	12.2	24.6	29.8
Yellow Cotyledon							
Agassiz	24.8	26.4	235	58.1	23.9	29.9	31.3
DS Admiral	24.8	25.7	238	58.1	16.6	23.8	33.7
Mystique	26.2	27.2	225	56.7	27.7	30.4	34.6
Spider	26.1	-	247	58.1	26.2	-	-
Mean	25.4	-	224.9	57.78	19.69	-	-
CV (%)	2.2	-	4.6	0.7	24.4	-	-
LSD (5%)	1.02	-	18.6	0.69	8.05	-	-
LSD (10%)	0.84	-	15.3	0.56	6.59	-	-

Location: Latitude 47° 47'N; Longitude 103° 25'W; Elevation 2250 ft
Planted: 5/9/2016
Harvested: 8/23/2016
Harvested area: 49.2 ft^2
Previous crop: Lentil
Soil type: Belfield-Grail
Soil test (0-6"): P=7 ppm; K=235 ppm; pH=7.1; OM=4.2%
(0-24"): NO3-N=4 lb/a
Applied fertilizer in lb/a: none; seed inoculated with peat-based inoculant at planting
Chemical Applications: Clethodim at 8fl.oz/a with Basagran at 16fl.oz/a (6/24/2016)
Test Weight[1] = Test Weight content adjusted to 13.5% moisture
Yield[2] = Yield content adjusted to 13.5% moisture
* Disease Issues: Yield likely affected by severe powdery mildew infestation

"A good farmer is nothing more nor less than a handy man with a sense of humus."

E.B. (Elwyn Brooks) White

Field Pea Irrigated Variety Trial **WREC, Nesson Valley, ND**

Variety	Origin	Days to flower	Days to mature	Canopy height	Vine length	Lodging	Protein†	1000 seed weight	Test weight	Yield		
										2016	2-Yr Avg	3-Yr Avg
		(DAP+)	(DAP+)	(in)	(in)	(0-9*)	(%)	(g)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Yellow Cotyledon Type												
Agassiz	AC	56	92	20.2	22.0	1	26.5	277	64.3	66.5	70.0	61.3
DS Admiral	Danisco	57	85	21.5	22.6	1	28.1	255	63.9	45.6	60.7	55.6
Cooper	-	58	97	20.4	21.2	1	28.4	283	64.1	61.7	-	-
Mystique	Pulse USA	56	95	23.1	24.2	2	27.5	277	64.8	61.0	-	-
Spider	Nickerson	58	93	21.5	24.3	1	26.2	246	64.9	59.6	-	-
Korando	Pulse USA	53	90	24.0	25.3	1	29.7	289	63.8	56.6	-	-
Vegas	Pulse USA	54	88	21.0	21.4	1	28.1	249	64.2	55.2	-	-
Golden	-	57	89	19.1	20.5	1	28.1	235	64.7	53.1	-	-
Green Cotyledon Type												
CDC Striker	Canada	57	86	17.2	17.5	1	24.9	241	64.4	62.1	72.9	64.8
Cruiser	WA	55	87	17.0	21.9	2	26.5	255	63.9	52.2	58.5	52.5
Aragorn	Progene	53	84	15.8	20.0	3	27.0	263	63.0	50.3	59.1	-
Arcadia	Pulse USA	56	87	18.6	19.6	1	25.8	250	64.4	60.4	-	-
Greenwood	-	56	86	18.9	22.0	2	24.3	223	64.1	53.9	-	-
K2	Legume Logic	56	90	19.1	19.8	1	27.9	251	63.9	51.4	-	-
Blue Moon	-	57	92	18.2	19.9	1	28.2	262	64.2	48.3	-	-
Viper	Pulse USA	56	87	21.2	23.4	1	28.6	228	63.8	43.6	-	-
Mean		55.8	89.2	19.8	21.6	1.4	27.2	255.2	64.2	55.1	64.2	58.6
C.V.%		2.0	3.4	11.4	10.4	39.1	2.9	4.8	0.7	10.5	-	-
LSD 5%		1.6	4.4	3.2	3.2	0.8	1.1	17.6	0.6	8.3	-	-
LSD 10%		1.3	3.6	2.7	2.7	0.7	0.9	14.7	0.5	6.9	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft Previous crop: barley
Planted: 4/22/2016 Harvested: 8/1/2016
Plot size: 61.25 ft^2 Soil type: Lihen Loamy Fine Sand
Applied fertilizer in broadcast: none
Soil test to 6": 16-ppm P, 200- ppm K, OM-2.0 pH-8.5
Soil test to 2' : 38 lbs N/a
Yield goal = 50 bu
Planting population = 400,000 seeds/a
Herbicides applied: Spartan Charge 3 oz/a (4/27/2016), Section 2EC 6 oz/a (6/7/2016),
Basagran 1 pt/a + Assure II 7 oz/a + Trophy Gold 2qt/a (6/10/2016), and Gramoxone Inteon 1.5 pt/a (7/27/2016)
Fungicides applied: Priaxor D 6 oz/a (6/28/2016 and 7/8/2016)
Rainfall: 8.2 in. (4/22/2016 - 8/1/2016)
Irrigation: 6.5 in. (4/22/2016 - 8/1/2016)
+ Days after planting
* 0: no lodging - 9: plants lying flat on ground
† Protein content adjusted to a 0% moisture

"Teaching kids how to feed themselves and how to live in a community responsibly is the center of an education."

Alice Waters

Dry Pea Variety Evaluation Trials EARC, Sidney, MT

Chengci Chen, Yesuf Assen Mohammed, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown, Benton Carr

Dry Pea Variety Evaluation Trials (Both Statewide and Western Regional) Planting and Harvesting Dates

Experiment	Location	Planting Date	Harvesting Date
Dry Pea Yield Trial	Sidney Dryland	April 8	July 19
	Sidney Irrigated	April 21	July 29
	Richland, MT	May 3	August 25

Some Physiographic Characteristics of the Different Locations - EARC

	Sidney Dryland	Sidney Irrigated	Richland, MT
Latitude	47^0 46' N	47^0 40' N	48^0 72' N
Longitude	104^0 14' W	104^0 08' W	106^0 14' W
Elevation (ft)	2200	1950	2936
Soil type:	William clay loam	William clay loam	Farnuf Reeder loam
Previous crop:	Chemical fallow	Sugar beet	Chemical fallow
Applied fertilizer:	No chemical fertilizer	No chemical fertilizer	
Herbicides:	Prowl H2O at 3 pt/ac and Assure II at 12 fl oz/ac	Prowl H2O at 3 pt/ac and Assure II at 12 fl oz/ac	Roundup

The seeds were treated with fungicide and insecticide and inoculated with appropriate rhizobium to enhance biological nitrogen fixation. The plot size was 50 ft^2 at Sidney (both dryland and irrigated sites) and 100 ft^2 at Richland site. All grain yield data was adjusted to 13% moisture content before statistical analysis. The general linear model of SAS was used for analysis of variance. Statistical analysis for yellow and green dry pea was done separately. The protected least significant difference (LSD) at alpha = 0.05 was used to differentiate treatment means.

Statewide Dry Green Pea Variety Evaluation-EARC Richland, Sidney Dryland and Sidney Irrigated

Green Pea Variety/Line	Grain Yield (lb/ac)		
	Richland, MT	Sidney Dryland	Sidney Irrigated
Aragon	5036	2966	3507
Arcadia	5865	3783	**5277**
CDC Patrick	4703	3733	4737
CDC Raezer	4778	3707	3825
Cruiser	5291	3294	4218
Ginny	5697		
Greenwood	5406	3795	4440
Hampton	4023	3630	4103
K2		3468	4161
LN 1123	5846	3656	2068
Majoret	4897	**3819**	4406
PS0877MT457	5330	3275	4470
PSO826MT190	5100	3579	3484
PSO877MT076	3797	3701	3110
PSO877MT499	5456	3681	2440
Viper	**6085**	3477	3963
Mean	5166	3571	3917
LSD (0.05)	603	Ns	562
CV (%)	8.14	12.22	10.13

Statewide Dry Yellow Pea Variety Evaluation - EARC **Richland, Sidney Dryland and Sidney Irrigated**

Yellow Pea Variety/Line	Grain Yield (lb/ac)		
	Richland, MT	Sidney Dryland	Sidney Irrigated
AAC Carver	5691	4101	5138
AAC Lacombe		4494	4729
AC Earlystar	5228	3953	4883
Abarth	5940	4156	4051
Agassiz	5538	3915	5321
Bridger	5791	3865	4474
CDC Amarillo	5451	4006	5347
CDC Saffron	6043	4172	4887
CDC Treasure	5560	4006	4756
DS Admiral	5166	3591	4643
Delta	5459	3628	4352
Durwood	5694	3986	4591
Gunner	5767		
Hyline	5397		
Jetset	6102	3812	4111
Korando	5797	3851	4479
MP 1907		**4596**	**5681**
Majestic	6041		
Mystique	5704	3717	4036
Navarro	5769	3765	3825
Nette 2010	**6486**	4038	4458
PSO826MT460	4724	3791	3955
PSO826MT492		3993	5231
PSO877MT632	3625	2921	4105
Pro 093-7410	5656		
Pro 143-6220	4860		
Pro 143-6236	4853		
SW Marquee	5434		
SW Midas	5112	3715	4381
Salamanca	6154		
Spider	5428		
Mean	5541	3924	4617
LSD (0.05)	800	536	663
CV (%)	10.27	9.67	10.15

"There is no gilding of setting sun
or glamour of poetry to light up
the ferocious and endless toil of
the farmers wives."

Hamlin Garland

Western Regional Dry Pea Variety Evaluation – EARC **Richland, MT**

Variety/Lines	Grain Yield (lb/ac)	Plant Height (cm)	Test wt (lb/bu)
Yellow pea			
DS Admiral	4554	97	64.00
PS07100925	4971	90	64.08
PS081004	5291	**104**	63.70
PS08101022	**5616**	99	63.65
PS12100111	4941	87	**64.93**
PS14100068	5024	88	64.85
PS14100069	4797	99	64.08
PS1514BNZ244	5251	92	63.03
PS1514BNZ300	4269	89	64.48
PS1514BNZ400	5042	87	64.33
SS-41	4565	89	63.00
Mean	4938	93	64.01
LSD (0.05)	524	Ns	0.85
C.V (%)	7.35	9.88	0.93
Green pea			
Hampton	4706	91	62.98
PS03101445	**5399**	93	**64.33**
PS05100840	4813	79	63.53
PS08100133	5161	95	63.85
PS10100131	4071	89	63.80
PS10100158	4872	89	63.98
PS10100558	5228	**101**	63.85
Mean	4892	90	63.75
LSD (0.05)	450	Ns	Ns
C.V (%)	6.20	9.54	0.80

"Like a gardener I believe what goes down must come up."

Lynwood L. Giacomini

Enhancing Yield and Nutritional Quality of Dry Pea through Micro-Nutrient Fertilization
EARC, Sidney, MT

Yesuf Assen Mohammed, Chengci Chen, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown, Benton Carr

The Effect Of Micro-Nutrient Foliar Application Rates On Dryland Pea Yield

Richland, MT & EARC, Sidney, MT

Micro-Nutrient	Rate (lb/ac)	Mean Grain Yield (lb/ac)	
		Richland, MT	Sidney Dryland
Zinc	0	4643	3886
	0.5	5333	3814
	1	5483	3397
	1.5	5502	3659
	Mean	5240	3689
	LSD	337	Ns
	CV	4.02	6.65
Iron	0	4643	3886
	1	4808	4065
	2	5145	4161
	3	5112	3885
	Mean	4927	3999
	LSD	387	Ns
	CV	4.91	9.14
Copper	0	4643	3886
	0.5	5554	3938
	1	5752	3460
	1.5	4943	3709
	Mean	5223	3748
	LSD	741	Ns
	CV	8.88	12.22
Manganese	0	4643	3886
	1	5637	3184
	2	5519	3724
	3	5522	3823
	Mean	5330	3654
	LSD	577	Ns
	CV	6.64	10.63
Molybdenum	0	4643	3886
	0.5	5294	4490
	1	5141	4014
	1.5	5257	4084
	Mean	5076	4119
	LSD	474	Ns
	CV	5.84	10.03
Boron	0	4643	3886
	0.5	5642	3798
	1	4968	4223
	1.5	5289	4347
	Mean	5135	4064
	LSD	641	333
	CV	7.80	6.14

Results: The grain yield increase due to micronutrient application at Richland, MT site was significant but only response to born application was recorded at Sidney dryland site. The yield increase was substantial for some of the micronutrient foliar application. For instance, application of 1 lb/ac copper resulted in 23% (18 bu/ac) grain yield increase over the control treatment. This data is only from one year result. The plan is to continue the experiment at least for one more year to make reliable conclusion and recommendation. The quality parameters will be included in the next report when sample analysis is completed.

Greenhouse Pea /Line Variety Vigor Evaluation — EARC, Sidney, MT

Maninder Walia and Chengci Chen

Greenhouse Pea Line/Variety Trial — **EARC, Sidney, MT**

Variety/Line	No. of Nodules/Plant	Nodule Fresh wt.	Aboveground Dry wt./plant	Belowground Dry wt./plant	Root Length	Shoot ht.
		(g)	(g)	(g)	(cm)	(cm)
PSO877MT632	13.53	0.149	1.30	0.65	18.6	26.0
PSO826MT290	5.77	0.062	1.57	0.74	19.1	35.4
PSO826MT460	8.11	0.139	1.40	0.80	20.8	19.2
PSO877MT457	10.74	0.098	1.34	0.67	18.7	23.5
Delta	7.85	0.079	1.36	0.68	18.3	20.7
DS Admiral	7.77	0.094	1.46	0.84	17.8	20.1
CDC Striker	6.73	0.087	1.58	0.84	18.9	21.3
Majoret	6.23	0.051	1.49	0.89	17.8	21.1
Cruiser	8.6	0.152	1.54	0.84	21.1	19.7
PSO826MT190	12.88	0.138	1.48	0.69	21.3	22.5
Mean	8.82	0.105	1.45	0.76	19.2	22.9
CV	43.7	74.2	17.8	25.4	17.4	22.9
LSD (5%)	4.47	NS	NS	NS	NS	6.10

Location: EARC
Planted: 8-23-2016
Harvested: 9-14-2016
NS = nonsignificant

Greenhouse Pea Line/Variety Seedling Vigor Trial — **EARC, Sidney, MT**

Variety/Line	Root Length	Shoot ht.	Vigor Index I	Vigor Index II
	(cm)	(cm)		
PSO877MT632	9.07	3.2	1202	44.03
PSO826MT290	11.21	8.16	1898	47.97
PSO826MT460	9.2	2.31	1128	47.34
PSO877MT457	11.28	2.35	1335	45.29
Delta	9.33	1.19	1052	44.87
DS Admiral	7.02	2.45	946	49.37
CDC Striker	6.99	0.71	754	45.61
Majoret	7.57	2.65	981	44.40
Cruiser	9.19	0.92	971	47.04
PSO826MT190	8.82	2.11	1093	47.13
Mean	8.97	2.60	1136	46.30
CV	13.2	21.9	14.4	4.9
LSD (5%)	1.71	0.82	236	3.25

Location: EARC
Incubated in germinator for 8 days at 30°C.
Vigor Index I = Germination% x seedling length
Vigor Index II = Germination% x seedling dry weight

Sprinkler Irrigated Field Pea Fungicide Trial EARC, Sidney, MT

Frankie Crutcher, Sherry Turner, Yesuf Mohammed, Chengci Chen,

Effect of Fungicide Treatment on Disease and Yield of Irrigated Peas EARC, Sidney, MT

Treatment #	Disease Rating[a]	Adj. Yield (lb/ac)
1	3.1 A	4024
2	2.9 A	3812
3	3.0 A	3591
4	2.9 A	4315
5	3.0 A	3793
6	2.5 AB	4080
7	2.3 B	3893
8	2.1 B	4014
9	2.5 AB	3608
10	2.3 B	3879
Mean	2.7	3901
LSD	16.2	197.9
CV(%)	2.1	9.9

[a] Disease scale 1-7, 7=dead 0=no disease

Letters in common did not differ significantly according to a t-test at a significance level of 5%

Fungicide Treatment Description for Irrigated Pea Fungicide Trial EARC, Sidney, MT

Treatment #	Seed Application	Rate (oz/cwt)	Foliar Application	Rate
1	Untreated Control	0	none	
2	Apron Maxx RFC	1.5	none	
3	Apron Maxx RFC	0.08	none	
	Vibrance	0.66		
	Cruiser 5FS	0.66		
4	Apron Maxx RFC	1.5	none	
	Vibrance	0.08		
	Cruiser 5FS	2.04		
	Mertect 340F	0.66		
5	Obvius	4.6	none	
	Cruiser 5FS	0.66		
6	Evergol Energy	1	none	
	Cruiser 5FS	0.66		
7	Obvius	4.6	Priaxor/Preference	4oz/A/0.5% v/v
	Cruiser 5FS	0.66		
8	Cruiser Maxx	5	Elatus/Induce	4.76oz/A/0.125% v/v
9	Vibrance Maxx	1.54	Elatus/Induce	4.76oz/A/0.125% v/v
10	Vibrance Maxx	1.54	Elatus/Induce	4.76oz/A/0.125% v/v
	Mertect 340-F	1.05		

Variety: Montech 4152
Planted: April 22
Harvested: August 2
Soil Type: Clay Loam
Previous Crops: Sugarbeet
Residual Soil N to 3 ft: 30 lb/ac
Residual Soil P to 6 in: 22.5 ppm
Applied Fertilizer: None

Irrigated (sprinkler) on May 20 0.82", June 17 1.00", June 23 1.45", July 6 1.78", July 18 1.78", August 5 2.28", September 6 1.36"
Herbicides: May 1 Prowl H2O
Precipitation April – September, 2016: 13.85 in
Observation dates: June 8, July 7
Disease rated on July 28
Treatments: See 2nd table
Date of fungicide application: June 28

Comments: A crust on the soil developed after planting and may have affected emergence.

Results: There was no significant differences in treatment for emergence (data not shown). There was significant difference between treatments for disease, with treatments 7, 8, and 10 having less disease symptoms.

Dryland Chickpea Variety Trial **WREC, Williston, ND**

Variety	Stand	Days to Flower	Days to Mature	Plant Height	Seed Size				1000 Seed Weight	Test Weight	Yield		
					<8mm	8-9mm	9-10mm	>10mm			2016*	2-Yr Avg	3-Yr Avg
	(%)	DAP[1]	DAP[1]	inch	(%)	(%)	(%)	(%)	(g)	lb/bu	(lb/a)	(lb/a)	(lb/a)
Desi													
CDC Anna	92	52	87	17	100	0	0	0	194	62.9	1545	1829	1883
Large Kabuli													
CDC Frontier	96	51	89	17	84	16	0	0	324	62.3	1872	1983	2090
CDC Luna	95	49	88	16	63	33	4	0	342	61.7	1564	1721	1735
Sawyer	94	51	89	16	37	40	21	2	408	61.9	1392	1575	1635
Sierra	86	54	90	18	22	43	30	6	458	61.1	895	1211	1269
Small Kabuli													
B-90	91	52	89	19	99	1	0	0	232	63.0	1663	1701	1757
Mean	92.2	51.3	88.6	17.3	67.3	22.1	9.2	1.2	326.3	62.15	1488.4	-	-
CV (%)	2.3	2.8	0.5	8.0	6.7	13.3	27.1	74.5	3.8	1.0	13.5	-	-
LSD (5%)	3.1	2.1	0.7	2.1	6.1	5.3	3.8	1.1	18.9	NS	297.40	-	-
LSD (10%)	2.5	1.7	0.6	1.7	5.1	4.4	3.1	0.9	15.7	0.74	246.08	-	-

Location, WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft Previous crop: Barley

Planting Date: 5/6/2016 Harvest Date: 8/18/2016

Harvested area: 49.2 ft^2

Soil test (0-6"): P=20 ppm; K=252 ppm; pH=6.3; OM=2.5% Soil type: Williams-Bowbells loam

(0-24"): NO3-N=39 lb/a

Applied fertilizer in lb/a: none; seed inoculated with peat-based inoculant at planting

Chemical Applications: Proline 480 SC at 5fl.oz/a (6/21/2016)

DAP[1]= Days after planting

*Disease Issues: yield affected by Ascochyta infestation

Chickpea Variety Evaluation Trials EARC, Sidney, MT

Chengci Chen, Yesuf Assen Mohammed, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown, Benton Carr

Chickpea (Both Statewide and Western Regional) Variety Evaluation Trials Planting and Harvesting Dates

Experiment	Location	Planting date	Harvesting date
Chickpea Yield Trial	Sidney Dryland	April 12	August 17
	Sidney Irrigated	April 22	September 19
	Richland, MT	May 4	October 15

Some Physiographic Characteristics of the Different Locations - EARC

	Sidney Dryland	Sidney Irrigated	Richland, MT
Latitude	47^0 46' N	47^0 40' N	48^0 72' N
Longitude	104^0 14' W	104^0 08' W	106^0 14' W
Elevation (ft)	2200	1950	
Soil type:	William clay loam	William clay loam	Farnuf Reeder loam
Previous crop:	Chemical fallow	Sugar beet	Chemical fallow
Applied fertilizer:	No chemical fertilizer	No chemical fertilizer	
Herbicides:	Prowl H2O at 3 pt/ac and Assure II at 12 fl oz/ac	Prowl H2O at 3 pt/ac and Assure II at 12 fl oz/ac	Roundup

The seeds were treated with fungicide and insecticide and inoculated with appropriate rhizobium to enhance biological nitrogen fixation. The plot size was 50 ft^2 at Sidney (both dryland and irrigated sites) and 100 ft^2 at Richland site. All grain yield data was adjusted to 13% moisture content before statistical analysis. The general linear model of SAS was used for analysis of variance. The protected least significant difference (LSD) at alpha = 0.05 was used to differentiate treatment means.

Comments:

The Richland, MT site was too moist and too cold during flowering and grain filling time than normal. Too much moisture at Sidney irrigated site resulted in vegetative growth and disease. These conditions resulted in low yield for these specific sites. In addition, the deer ate the pods at Richland site. As a result, the chickpea grain yields from Richland site were very low compared with Sidney site. These remarks should be taken into account while interpreting the results of lentil and chickpea yield trials.

"Farming is a profession of hope"

Brian Brett

Statewide Chickpea Variety Evaluation **EARC, Sidney, MT**

Variety/Lines	Grain Yield (lb/ac)		
	Richland, MT	Sidney Dryland	Sidney Irrigated
BGC090017	142	3427	**1855**
CDC Alma	186	3302	477
CDC Frontier	**277**	**4040**	1040
CDC Leader	155	3926	1609
CDC Orion	135	2120	831
Myles	87	3677	1504
Sawyer	116	2392	482
Sierra	10	2463	347
Mean	136	3160	1032
LSD (0.05)	68	1022	332
CV (%)	35.31	22.89	22.77

Percentage of Chickpea Seed Size Greater Than 8.7 Mm Diameter. This Data is from the Statewide Chickpea Variety Evaluation Trial **Sidney Dryland Site, MT**

Variety	Percent of seed size > 8.7 mm (22/64) diameter
BGC090017	75.4
CDC Alma	59.7
CDC Frontier	49.3
CDC Leader	64.4
CDC Orion	48.1
Myles	0.0
Sawyer	77.6
Sierra	**86.3**
Mean	56.9
LSD (0.05)	10.8
CV	13.49

Western Regional Chickpea Variety Evaluation - EARC **Richland, MT**

Variety/Lines	Grain Yield (lb/ac)[¥]
CA04900843C	32
CA079080034C	12
CA079080043C	100
CA079080547C	9
CA089080429C	50
CA089080531C	38
CDC Frontier	244
Myles	230
Mean LSD (0.05) C.V. (%)	No yield information – see explanation below.

[¥]Yield was extremely low and highly variable between replications for a given variety to do statistics. This was due to disease and serious deer damage. In fact we have been told by one of the producer not to harvest it because of poor pods per plant. We presented this data on this table just to show the performance of the varieties if someone is interested in to get information under such circumstances.

Sprinkler Irrigated Chickpea Fungicide Trial — EARC, Sidney MT

Frankie Crutcher, Sherry Turner, Yesuf Mohammed and Chengci Chen

Table 1: Effect of Variety on Yield and Disease of Irrigated Chickpea — EARC, Sidney, MT

Variety	Disease Rating	Adj. Yield (lb/ac)
Frontier	3.7 C	2322 A
Sawyer	5.0 B	987 B
Sierra	5.7 A	747 C

Letters in common did not differ significantly according to a t-test at a significance level of 5%.

Variety: CDC Frontier, Sierra, and Sawyer
Planted: May 1
Harvested: September 29
Soil Type: Clay Loam
Previous Crops: Sugarbeet
Residual Soil N to 3 ft: 30 lb/ac
Residual Soil P to 6 in: 22.5 ppm
Applied Fertilizer: None

Irrigated (sprinkler) on May 20 0.82", June 17 1.00", June 23 1.45", July 6 1.78", July 18 1.78", August 5 2.28", September 6 1.36"
Herbicides: May 1 Prowl H2O
Precipitation April – September, 2016: 13.85"
Disease rated for *Ascochyta rabiei* on August 22
Treatments: See Table 7
Date of first application: June 23
Date of second application: July 12

Results:

The variety used had a significant effect on disease and yield, but fungicide treatments did not (Table 1 and Table 2). However, there was a significant difference in yield between the number of fungicide applications (Table 3 and Table 5). A closer look at the data revealed that this effect was only observed for Sierra (Table 4). All fungicide treatments on Sierra increased yield except 10 and 11 (Table 4). For both Frontier and Sawyer there was no significant difference between the treated plots and the untreated plots regardless of the fungicide used.

Table 2: Effect of Fungicide Treatment on Yield and Disease of Irrigated Chickpea — EARC, Sidney, MT

Treatment #	Disease Rating[a]	Adj. Yield (lb/ac)
1	4.9	1548
2	4.8	1068
3	4.8	1369
4	4.9	1320
5	4.9	1396
6	4.9	1480
7	4.9	1377
8	4.8	1473
9	4.9	1250
10	4.7	1490
11	4.6	1269
12	4.6	1326
13	4.9	1153

[a] Disease scale 0-7, 0 = no disease, 7 = dead

Table 3: Interaction of Variety and Number of Fungicide Applications on Irrigated Chickpea — EARC

Variety	Number of Applications	Disease Rating[a]	Adj. Yield (lb/ac)
Frontier	0	4.0	1875.2
Frontier	1	3.6	2141.7
Frontier	2	3.7	2794.4
Sawyer	0	4.7	1192.9
Sawyer	1	5.2	822.6
Sawyer	2	4.7	1255.4
Sierra	0	6.0	505.2
Sierra	1	5.9	552.6
Sierra	2	5.4	1181.0

[a]Disease scale 0-7, 0 = no disease, 7 = dead

Table 4: Effect of Treatment and Application Number on Different Varieties of Chickpea **EARC**

		Frontier		Sawyer		Sierra	
Treatment	**App #**	**Disease**	**Adj. Yield[a]**	**Disease**	**Adj.Yield**	**Disease**	**Adj. Yield**
1	1	4	2306.8	5.25	933.3	5.75	846
	2	3.5	3209.5	5	1171	5.5	1379
2	1	3.25	1725	5.5	785.3	6.125	276.5
	2	3	1953.5	5	1051.5	5	1035
3	1	3.5	1910.3	5.125	813.5	6	428
	2	4	3472	5	1559.5	5	982.5
4	1	3.75	2317.3	5.375	643	5.75	551.8
	2	3.5	2306	5	950.5	5.5	1601
5	1	3.75	2254.8	5.25	1150.3	5.75	630.3
	2	4	2028	5	981	6	1102.5
6	1	3.5	1996.8	5.25	701.5	6.125	390.3
	2	4	3193	4.5	1420	5.5	1988
7	1	3.75	2225.5	5.375	774	6.125	434.8
	2	3.5	2772	4.5	1162	5.25	1592.5
8	1	3.75	2329.3	5.25	752.3	5.75	632.3
	2	4	3243.5	4.5	1174	5.25	1411.5
9	1	3.875	2106.8	5.5	515.3	6	443.3
	2	4	2863	4.5	1439	5	820.5
10	1	3.75	2453.8	5	1020.5	6	700.8
	2	3.5	2525	4	1749	5	782
11	1	3.625	2661.3	4.625	981.75	5.625	557.5
	2	3.5	1933	5	883.5	5.5	537
12	1	3.125	1412.5	4.75	800.3	5.75	718.5
	2	3.75	3604	4.5	1524	5.5	940
13 (Neg)	0	4	1875.2	4.71	1192.9	6	505.2

[a]Disease scale 0-7, 0 = no disease, 7 = dead

Table 5: Fungicide Treatment Description for Chickpea Study **EARC, Sidney, MT**

Treatment #	Fungicide	Rate/ac
1	Priaxor	6.0 oz
	Preference	0.5% v/v
2	Endura	6.0 oz
3	Proline 480 SC	5 oz
	Induce	0.125% v/v
4	Serenade Optimum	16 oz
	Propulse	10.05 oz
	Induce	0.125% v/v
5	Propulse	8 oz
	Induce	0.125% v/v
6	Delaro	12 oz
	Induce 90	0.125% v/v
7	Delaro	12 oz
	Induce	0.125% v/v
	Serenade Optimum	16 oz
8	Proline 480 SC	5 oz
	Induce	0.125% v/v
	Serenade Optimum	16 oz
9	Quadris Flowable	6 oz
	Induce	
10	Bravo Weather Stik	32 oz
11	Elatus (azoxystrobin+strobilurin)	4.76 oz
	Induce	
12	AG Copp 75*	2 lb
13	Untreated Control	

Dryland Chickpea Fungicide Trial — EARC, Richland MT

Frankie Crutcher, Sherry Turner, Yesuf Mohammed, Chengci Chen

Table 1: Average Effect of Variety on Yield and Disease of Chickpea — Richland, MT

Variety	Disease Rating	Adj. Yield (lb/ac)
Frontier	1.1 C	498 B
Sawyer	2.3 B	567 A
Sierra	4.1 A	180 C

Letters in common did not differ significantly according to a t-test at a significance level of 5%.

Table 2: Average Effect of Fungicide Treatment on Yield and Disease of Chickpea — Richland, MT

Fungicide Treatment #[a]	Disease Rating[b]	Adj. Yield (lb/ac)
1	2.6	401
2	2.4	508
3	2.6	444
4	2.8	375
5	2.4	391
6	2.3	457
7	2.0	462
8	2.6	364
9	2.4	446
10	2.5	397
11	2.7	373
12	2.5	414
13	2.8	377

[a] Reps 1-4 received one foliar application, reps 5 and 6 received two

[b] Disease scale 0-7, 0 = no disease, 7 = dead

Variety: CDC Frontier, Sierra, and Sawyer
Planted: May 4
Harvested: October 15
Soil Type: Farnuf Reeder Loam
Previous Crops: 2015 Fallow
Seed Treatment: Apron Maxx and Cruiser
Herbicides: Preplant Prowl H2O

Observation dates: June 15, June 23, July 6
Observed: *Ascochyta rabiei* observed July 6
Disease rating for *A. rabiei* on August 18
Treatments: See Table 7
Date of first application: July 8
Date of second application: July 22

Results:

The variety used had a significant effect on disease and yield, but fungicide treatments did not (Table 1 and Table 2). However, there was a significant difference in yield between the number of fungicide applications (Table 3). A closer look at the data revealed that this effect was only observed for Sierra (Table 4). All fungicide treatments on Sierra increased yield except 6 and 11 (Table 4). For both Frontier and Sawyer there was no significant difference between the treated plots and the untreated plots regardless of the fungicide used.

Table 3: Interaction of Variety and Number of Fungicide Applications of Chickpea — Richland, MT

Variety	Number of Applications	Disease Rating	Adj. Yield (lb/ac)
Frontier	0	1.0	496 A
Frontier	1	1.1	530 A
Frontier	2	1.1	435 A
Sawyer	0	2.3	529 A
Sawyer	1	2.4	577 A
Sawyer	2	2.2	555 A
Sierra	0	4.9	107 B
Sierra	1	4.2	146 B
Sierra	2	3.8	270 B

Letters in common did not differ significantly according to a t-test at a significance level of 5%

Table 4: Effect of Treatment and Application Number on Different Varieties of Chickpea Richland, MT

		Frontier		Sawyer		Sierra	
Treatment	**App #**	**Disease[a]**	**Adj. Yield**	**Disease**	**Adj. Yield**	**Disease**	**Adj. Yield**
1	1	1.25	483.3	3	499.5	4	156.5
	2	1	573	2	505.5	3.5	252.5
2	1	1	687.5	2.75	702.5	4	190.5
	2	1	453	2	659.5	3.25	302.5
3	1	1	515	2.25	663.8	4.5	185.3
	2	1.5	452.5	2	516.5	4	299
4	1	1.25	494.3	2.5	503	4.5	110
	2	1	444.5	2	594	5.25	125.5
5	1	1	452	1.875	512.3	4	129
	2	1	429	2	552	4.5	350
6	1	1	680	2	600.3	4.25	220.3
	2	1.33	336.3	2.5	561.5	4	95
7	1	1	528.3	2.375	598.8	3	194.3
	2	1	491.5	2	580	2	444
8	1	1.25	514.5	2.5	443.8	4.25	106.5
	2	1	372.5	2	533.5	4	237.5
9	1	1	532	2.25	647	4.25	123.8
	2	1	521	2	554.5	4	329.5
10	1	1.25	439.8	2.5	605.5	4.625	131.8
	2	1	271	2.5	654.5	2.5	294
11	1	1.25	544.5	2	628.8	4.75	82.5
	2	1	421.5	2.5	344.5	5	75
12	1	1	492.8	2.375	523.5	4.25	119.5
	2	1	504.5	2.5	599	3.5	347
13 (Neg)	0	1	496	2.33	528.5	4.92	106.7

[a]Disease scale 0-7, 0 = no disease, 7 = dead

Table 5: Fungicide Treatment Description for Chickpea Study Richland, MT

Treatment #	Fungicide	Rate/ac
1	Priaxor	6.0 oz
	Preference	0.5% v/v
2	Endura	6.0 oz
3	Proline 480 SC	5 oz
	Induce	0.125% v/v
4	Serenade Optimum	16 oz
	Propulse	10.05 oz
	Induce	0.125% v/v
5	Propulse	8 oz
	Induce	0.125% v/v
6	Delaro	12 oz
	Induce 90	0.125% v/v
7	Delaro	12 oz
	Induce	0.125% v/v
	Serenade Optimum	16 oz
8	Proline 480 SC	5 oz
	Induce	0.125% v/v
	Serenade Optimum	16 oz
9	Quadris Flowable	6 oz
	Induce	
10	Bravo Weather Stik	32 oz
11	Elatus	4.76 oz
	Induce	
12	AG Copp 75*	2 lb
13	Untreated Control	

Optimum Seeding Rate and Seeding Date for Dryland Winter Camelina

EARC, Sidney, MT

Chengci Chen, Reza Keshavarz Afshar, Rebecca Garza, Calla Kowatch-Carson, Thomas Gross, Ronald Brown, Benton Carr

Mean Values of Camelina Measured Variables As Influenced By Seeding Date, Seeding Rate, and Cultivar. When F Test Was Significant, LSD (P<0.05) Was Used To Separate The Means. EARC, Sidney, MT

Treatments	Biomass lb/ac	Grain Yield lb/ac	Oil %	HI	Oil Yield lb/ac	Plant/ft2	Silicle Plant^{-1}	Seed Silicle^{-1}	1000 seed W g
15-Sep	**8122a**	**2189a**	35.02	**0.27ab**	**766a**	**7.8b**	**228 a**	11.6	**1.205 a**
29-Sep	**7123b**	**1841b**	35.3	**0.26b**	**649b**	**11.5a**	**139 b**	11.8	**1.147 b**
13-Oct	**7450b**	**2102a**	34.72	**0.28ab**	**729a**	**11.8a**	**156 b**	11.8	**1.153 b**
Bison	7449	1981	34.24	0.26	**676b**	10.3	161	11.6	**1.247 a**
Joelle	7662	2102	35.77	0.27	**750a**	10.6	185	11.9	**1.089 b**
R1 (5 lb/ac)	7460	2036	35.08	0.27	713	**9.6**	179	11.6	1.187
R2 (7.5 lb/ac)	7642	2077	35.16	0.27	729	**10.6**	182	11.7	1.165
R3 (10 lb/ac)	7571	2013	34.79	0.26	699	**11.2**	158	11.9	1.15

Location: EARC irrigated farm (crop was rain-fed and did not receive any supplemental irrigation)
Soil type: Savage Silty Clay
Previous crop: 2015 (hailed safflower)
Residual soil N: 45 lb N/ac
Planted: 14 Sep, 28 Sep, 13 Oct 2015

Harvested: July 11, 2016
Applied fertilizer: No fertilizer applied
Herbicide: Glyphosate was applied prior to planting. No post-planting herbicide was used.
Precipitation April – August 2016: 9.74 in
Precipitation September 2015 – August 2016: 14.55 in

Seeding date: Sep 15, Sep 29, Oct 13
Seeding rate: 5, 7.5, 10 lb/ac
Varieties: Joelle and Bison
Experimental design: Split plot factorial with four replicates (main plots were seeding date and subplots were seeding rate×variety).

Results:

The results indicated that seeding date significantly affected yield, biomass, oil, and yield components (except silicle plant^{-1}). No significant difference was found between two varieties except in oil yield and seed weight; Joelle out yielded Bison in oil yield. Seeding rate in the range of 5 to 10 lb/ac had no significant effect on either of the response variables. The results showed that earlier seeding led to a higher biomass, seed yield, and oil yield. A negative relationship was found among the yield components; earlier seeding caused a significant reduction in final plant stand, which was completely compromised by higher silicle plant^{-1} and average seed weight. Briefly, earlier seeding was favorable for winter camelina. Moreover, 5 lb seed per ac seems reasonable for winter camelina in this environment.

Irrigated Alfalfa Variety Trial **WREC, Nesson Valley, ND**

Conventional Varieties		Yield	2016 Yield			
Cultivar	Company	2015 tons/a	1st cut	2nd cut	3rd cut	2016 total
			----------tons/a----------			
Persist III	Millborn	2.6	3.7	3.8	2.7	10.2
FSG 329	Allied	2.5	3.5	3.6	2.8	9.9
4A420	Dow	3.0	3.5	3.6	2.5	9.6
Crave	Legend	3.1	4.0	3.2	2.3	9.5
HybriForce-3400	Dow	2.8	3.5	3.4	2.6	9.5
Vernal	Millborn	2.6	3.7	3.2	2.6	9.5
DG4210	Dyna-Gro	2.0	3.6	3.2	2.6	9.4
CW103012	Dow	2.1	3.3	3.3	2.8	9.4
Phirst Extra Hybrid	Millborn	2.4	3.8	3.1	2.4	9.3
55V50	Pioneer	2.3	3.1	3.6	2.4	9.1
55Q27	Pioneer	3.0	3.4	3.2	2.3	8.9
LegenDairy	Croplan	3.0	3.3	3.0	2.5	8.8
CWA 114030	Dow	2.8	2.8	3.4	2.6	8.8
Ladak II	Allied	2.3	3.2	3.3	2.3	8.8
CW105006	Dow	2.6	3.1	3.5	2.1	8.7
8420	Integra	2.6	3.0	3.2	2.5	8.7
54B66	Pioneer	2.6	3.2	3.2	2.2	8.6
HIGH MEAN		3.1	4.0	3.8	2.8	10.2
LOW MEAN		1.9	2.8	3.0	2.1	8.6
EXP MEAN		2.6	3.4	3.3	2.5	9.2
C.V. %		28.4	13.3	10.8	14.2	-
LSD 5%		1.0	0.6	0.5	0.5	-

Roundup Ready Varieties		Yield	2016 Yield			
Cultivar	Company	2015 tons/a	1st cut	2nd cut	3rd cut	2016 total
			----------tons/a----------			
Stratica	Croplan	3.2	3.6	4.2	2.5	10.3
Presteez	Croplan	3.8	3.7	4.0	2.5	10.2
MegaMaxx	Legend	3.5	3.6	4.1	2.3	10.0
DKA44-16	Monsanto	3.4	3.7	3.9	2.4	10.0
DKA40-51	Monsanto	3.4	3.6	3.9	2.4	9.9
54QR04	Pioneer	3.6	3.5	3.9	2.1	9.5
428	Allied	3.3	3.3	3.8	2.3	9.4
8444	Integra	3.0	2.9	3.2	2.2	8.3
HIGH MEAN		3.8	3.7	4.2	2.5	10.3
LOW MEAN		2.4	2.9	3.2	2.1	8.3
EXP MEAN		3.3	3.5	3.9	2.3	9.7
C.V. %		22.0	10.6	8.2	9.4	-
LSD 5%		n.s.	0.5	0.5	0.3	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft
Planted: 5/25/2015

Hay cut.

Hay raked.

Hay dried.

Baler ready.

RAIN.

Dryland Cool and Warm Season Cover Crop Evaluation EARC, Sidney, MT

Darrin Boss, Yesuf Mohammed, Chengci Chen, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown and Benton Carr

Dryland Cool and Warm Season Cover Crops, Fresh and Dry Biomass Yield EARC, Sidney, MT

Cover Crop Type*	Cover Crop Entry	Fresh Biomass (lb/ac)	Dry Biomass (lb/ac)
Cool Season Cover Crops Planted: Apr. 14 Harvested: June 19	Ground Hog Radish	2294	489
	Purple Top Turnip	3513	592
	Arvika Pea	9040	1519
	Otana Oat	5836	1669
	DKL 30-42Canola	4455	1004
	Baldy Spineless Safflower	5779	598
	Hairy Vetch	4175	732
	Alsike Clover	1115	310
	Triticale, spring	3125	1096
	Omega Flax	3608	484
	Cool Season	5824	1548
	Warm Season	1612	446
	Diversity - Early (Cool and Warm)	4428	1210
	Alternative - Cool	2851	574
	Mean	4118	876
	CV (%)	57	27
	LSD (0.05)	3943	400
Warm Season Cover Crops Planted: June 7 Harvested: Aug. 1	Ground Hog Radish	4770	722
	Purple Top Turnip	2493	748
	Sorghum - CARC	6663	1938
	Golden German Millet	6994	1723
	Peredovik Sunflower	13707	2254
	Sheyenne Soybean	3840	987
	SSNS-1 Faba Bean	3311	640
	Frontier Chickpea	4019	1109
	Loreto Black Bean	4273	930
	Indian Corn	11691	2183
	Berseem Clover	2180	622
	Teff	3942	1358
	Cool Season	5412	1634
	Warm Season	7079	1871
	Diversity - Late (Cool and Warm)	6962	1939
	Alternative - Warm	4816	1258
	Mean	5759	1369
	CV (%)	47	38
	LSD (0.05)	4572	880

*In this experiment, some of the warm season cover crops were tested in early planting and the cold season crops were also tested in the warm season as well as shown in this table. Because of poor stand, probably due to low seed rate, the CV were very high.

Sustainable Irrigation Management for Sugarbeet EARC, Sidney, MT

Chengci Chen, Reza Keshavarz Afshar, Bart Stevens, William Iversen, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown, Benton Carr

Background:
Sugarbeet requires a considerable amount of water (10-18 inch of irrigation water based on weather condition) during the growing season. Improper irrigation management can negatively affect root yield and sucrose content/purity. Excess irrigation water can also cause nitrate leaching and groundwater contamination. In the sprinkler-equipped field, excessive irrigation also increases fuel/electricity cost for irrigation.

Materials and Methods:

Location: EARC irrigated farm located in Sidney, MT
Soil Type: Savage Clay Loam
Planting date: May 4, 2016
Harvest date: Sep 19, 2016
Seeding rate: 1.09 seed/ft^2 (5.5 inches between plant and 24 inches between rows)
Cultivar: American Crystal S360
Previous crop: Barley
Applied fertilizer: 120-20-20 lb/ac N-P-K
Herbicide: 48 ounces/ac roundup
Fungicide: One application of Minerva-Duo
Precipitation May – September 2016: 9.5 in
Precipitation September 2015 – August 2016: 14.55 in

Experimental Design:
The experiment was conducted in split-plot arrangement based on a randomized complete block design with four replications. Main plots were irrigation cutoff time (last irrigation 15 days before harvest vs. 30 days before harvest). Subplots were irrigation levels (irrigation based on 100% crop evapotranspiration [ET 100], 66% crop evapotranspiration [ET 66], and 33% crop evapotranspiration [ET 33]). Crop evapotranspiration was calculated on a daily basis according to the modified FAO Penman-Monteith method.
Aboveground biomass at harvest, crop stand, root yield, sucrose percent, impurity value, SLM, and recoverable sucrose yield was measured. Based on the depth of irrigation water applied in each treatment and root yield/extractable sucrose yield, Irrigation Water Use Efficiency (IWUE) was calculated.

Data were analyzed using Proc GLM of SAS. When F test showed a significant effect, LSD ($P<0.05$) was employed to separate the means.

Results:
Total irrigation water used in each treatment is shown in Fig.1. As shown in the figure, 33 and 66% less irrigation water were used in ET66 and ET33 treatments, respectively. This can clearly show that 33 and 66% less energy (diesel fuel or electricity depending on the power source of the sprinkler) were used for sugarbeet irrigation. Only half of the experimental plots were irrigated on September 6, meaning that half of the plots received one less irrigation.

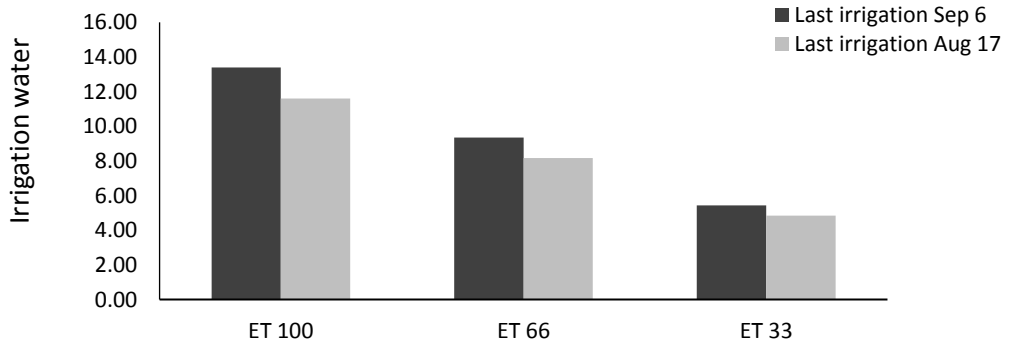


Fig. 1: Total Irrigation Water Used for Each Treatment During Sugarbeet Growing Season

Statistical analysis showed that time of irrigation cutoff and irrigation level had a significant effect on sucrose percent and IWUE (Table 3). It was notable that reducing irrigation water to 66 and 33% of the crop evapotranspiration did not affect plant growth, root yield, and sucrose yield. Whereas irrigation water depth had no significant effect on root yield, sucrose percent followed an increasing trend (from 18.3% to 18.8%) in response to lowering irrigation water depth (Table 3). Although the impurity value and SLM showed a slight increase in response to lowering irrigation water depth, the difference between irrigation treatments in this regard was not statistically significant. Extractable sucrose yield showed a positive response to lowering the irrigation depth, however, the response was not statistically significant. The positive response of root and sucrose yield to deficit irrigation caused a significant improvement in IWUE (for both, root yield and extractable sucrose yield). We also noted that one more irrigation during September (15 days before harvest) had a positive effect on plant aboveground biomass, root yield, and extractable sucrose yield. It should be noted that this experiment took place in a field with water table as shallow as 4 feet. Therefore, a partial contribution of the high water table to the soil moisture within the root zone is possible, which was not quantified in this experiment. So, response to irrigation management could vary depending on soil condition.

These results are important because they show the high potential for water, energy, and money savings in sugarbeet production through optimization of irrigation management. Specifically, optimum irrigation management is likely to be even more important in near future considering the scenarios of climate change.

Table 1: Main Effects of Irrigation Cutoff Time and Irrigation Level on Sugarbeet Measured Variables.

EARC, Sidney, MT

Treatments		Aboveground Biomass lb/ac	Sucrose %	Plants per ac	Root YLD ton/ac	Raw Sugar YLD lb/ac
Irrigation Cutoff	Sep 6	**6768a**	18.5	33893	38.3	14210
	Aug 17	**6050b**	18.9	34031	36.7	13834
Irrigation Level	ET 100	6700	**18.3b**	34226	37.1	13668
	ET 66	6479	**18.9a**	33671	37.1	14010
	ET33	6049	**18.8a**	34031	38.1	14320

Significantly different means are separated using LSD test at P<0.05 and are shown by different letters.

Table 2: Main Effects of Irrigation Cutoff Time and Irrigation Level on Sugarbeet Measured Variables.

EARC, Sidney, MT

Treatments		Impurity Value	SLM	Extraction %	Extractable Sucrose YLD lb/ac	IWUE ton/in	IWUE lb ext Sucrose/in
Irrigation Cutoff	Sep 6	0.592	0.888	0.952	13564	5.0	**1755b**
	Aug 17	0.601	0.902	0.952	13172	5.1	**1829a**
Irrigation Level	ET 100	0.595	0.892	0.951	13015	**3.0c**	**1056c**
	ET 66	0.559	0.839	0.955	13406	**4.3b**	**1552b**
	ET33	0.632	0.948	0.950	13595	**7.4a**	**2654a**

Significantly different means are separated using LSD test at P<0.05 and are shown by different letters.

Nitrogen Management in Sugarbeet under Strip-Till and No-Till Practices

EARC, Sidney, MT

Chengci Chen, Reza Keshavarz Afshar, Bart Stevens, William Iversen, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown, Benton Carr

Main Effect of Tillage and Nitrogen on Sugarbeet Measured Variables **EARC, Sidney, MT**

Treatments		Aboveground Biomass lb/ac	Plant per ac	Sugar %	Root YLD ton/ac	Sucrose YLD lb/ac	Impurity Value	SLM	Extractable Sucrose lb/ac
Tillage	CT	3418b	24756a	17.4	26.9	9510	0.65	0.97	8743
	ST	3503b	22148b	17.1	28.3	9620	0.68	1.01	8837
	NT	4469a	26358a	17.5	27.4	9577	0.65	0.97	8351
Nitrogen	N 50	4036	24799	17.5	28.6	10009	0.65	0.98	9147
	N 100	3974	25851	17.5	26.8	9312	0.64	0.97	8756
	N 150	3778	23650	17.1	26.3	8994	0.66	1.00	8125
	N 200	3485	23705	17.3	28.7	10000	0.66	0.99	8737
CV (%)		18.7	17.9	5.3	20.9	19.1	13.1	13.0	18.0

Different letters following the values indicate there are significant differences.

Location: EARC irrigated farm located in Sidney, MT
Soil Type: Savage Clay Loam
Planting date: May 6, 2016 (reseeding on June 3)
Harvest date: Sep 19, 2016
Seeding rate: 1.09 seed/ft^2 (5.5 inches between plant and 24 inches between rows)
Cultivar: American Crystal S360
Previous crop: Spring wheat
Soil residual N to 4 ft: 23 lb NO3/N
Applied fertilizer: Nitrogen was applied based on the experimental treatment. 20 lb/ac 11-52-0 and 40 lb/ac potash were used.
Herbicide: 48 ounces/ac roundup
Fungicide: One application of Minerva-Duo
Precipitation May – September 2016: 9.5 in
Precipitation September 2015 – August 2016: 14.55 in
Irrigation water depth used through the sugarbeet growing season: 14 inch

Experimental design:

The experiment was conducted in a split plot arrangement based on a randomized complete block design with four replications. Main plots were tillage systems (conventional tillage or CT, strip tillage or ST, no-till or NT). Subplots were nitrogen rate (0, 50, 100, 150 lb nitrogen per ac supplied with 46-0-0). Data were analyzed using Proc GLM of SAS. When F test showed a significant effect, LSD ($P<0.05$) was employed to separate the means.

Comment:

Due to an unexpected problem in the irrigation system, the plots were not irrigated properly. So, plant establishment was not favorable. Plots were reseeded on June 3. Because of this, the average yield in this experiment was much lower than our other experiments in the same field.

Results:

Tillage had a significant effect only on aboveground biomass and plant stand. Interestingly, aboveground biomass and plant stand were higher in no-till compared to conventional tillage and strip tillage. As mentioned previously, due to problems with irrigation system at the time of seed germination and establishment, it seems that better moisture availability in NT soil at this time led to better establishment in this treatment. No significant difference was found between tillage systems in terms of root yield, sucrose percent, sucrose yield and SLM. This is highly important since NT can provide economic benefits (lower cost, less labor, less fuel consumption) as well as ecosystem services (less soil erosion, soil compaction, etc.) and yet produce yields similar to conventional tillage. No significant response was observed to increasing nitrogen rate. This shows that more efforts are needed to optimize nitrogen fertilization for sugarbeet under various tillage practices.

Intercropping of Sugarbeet with Barley, Lentil, and Camelina to Improve Yield and Establishment — EARC, Sidney, MT

Chengci Chen, Reza Keshavarz Afshar, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown, Benton Carr

Experimental Design:
The experiment was conducted in split plot arrangement based on a randomized complete block design with four replications:

Main Plot: Intercropping Treatment
- Sugarbeet sole cropping (no intercropping)
- Barley at 60 lb/ac ($6/ac) + SB
- Barley at 30 lb/ac ($3/ac) + SB
- Lentil at 45 lb/ac ($18/ac) + SB
- Lentil at 22.5 lb/ac ($9/ac) + SB
- Camelina at 3 lb/ac ($6/ac) + SB

(Values in parenthesis are seed cost of the companion crop)

Subplot: Companion Crop Termination Time
- Sugarbeet V3 growth stage (May 26)
- Sugarbeet V4 Growth stage (June 2)

Data was analyzed using Proc GLM of SAS. When F test showed a significant effect, LSD ($P<0.05$) was employed to separate the means.

Results:
The results are shown in above table. Intercropping had neither positive nor negative impact on sugarbeet establishment and yield. Intercropping with barley at high density can cause a notable reduction in sugarbeet establishment. Considering the seeding cost for the companion crop, it seems that camelina has the potential to be used for this purpose. Further research is needed to optimize cover cropping for sugarbeet production in this cropping system. The results showed that the companion crop should be terminated no later than sugarbeet V3 growth stage.

Effect of Intercropping and Companion Crop Termination Time on Sugarbeet Stand and Yield

EARC, Sidney, MT

Treatment	Cover Crop Dry w lb/ac	Sugar-beet Stand/ac	Sucrose %	Root YLD ton/ac	Sucrose YLD lb/ac	Impurity Value	SLM	Extraction %	Extractable sucrose YLD lb/ac
Intercropping									
SB sole	-	31400	16.4	39.2	12900	0.68	1.02	0.94	12099
SB + Bar 60	383	28223	15.8	34.8	10966	0.73	1.09	0.93	10207
SB + Bar 30	235	29222	16.2	38.6	12501	0.71	1.07	0.93	11680
SB + Len 45	130	31400	16.2	38.1	12295	0.70	1.06	0.93	11488
SB + Len 22.5	55	32489	16.1	40.0	12852	0.73	1.09	0.93	11980
SB + Cam 3	225	30220	16.2	37.0	12016	0.73	1.09	0.93	11206
Termination time									
V3	127	30553	16.2	38.9	12622	0.70	1.05	0.93	11804
V4	283	30432	16.1	37.0	11888	0.73	1.09	0.93	11083
ANOVA (P Values)									
Rep	0.0139	0.3808	0.0755	0.3948	0.5536	0.2545	0.2461	0.1355	0.5695
Intercropping (a)	<.0001	0.1101	0.1123	0.2991	0.1366	0.4258	0.4693	0.3062	0.1144
Termination time (b)	<.0001	0.8929	0.2112	0.1523	0.0965	0.1456	0.1287	0.1393	0.0799
a*b	0.0010	0.7464	0.8605	0.7504	0.7239	0.8821	0.8692	0.9095	0.7056
CV (%)	23.5	10.1	2.6	12.1	11.8	8.4	8.3	0.7	11.8

Error terms are not displayed in ANOVA table.

Location: EARC irrigated farm located in Sidney, MT
Soil Type: Savage Clay Loam
Planting date: May 3, 2016
Harvest date: Sep 19, 2016
Seeding rate: 1.09 seed/ft^2 (5.5 inches between plant and 24 inches between rows)
Cultivar: American Crystal S360
Previous crop: small grain
Applied fertilizer: 120-20-20 lb/ac N-P-K
Herbicide: 48 ounces/ac roundup (as explained later in experimental details)
Fungicide: One sprinkler of Minerva-Duo
Precipitation April – August 2016: 9.74 in
Precipitation September 2015 – August 2016: 14.55 in

Sugarbeet *Cercospora* Fungicide Trial — EARC, Sidney, MT

Frankie Crutcher, Sherry Turner, Chengci Chen

Effect of Fungicide Treatment on Disease, Yield & Sugar Content of Sugarbeet — EARC, Sidney, MT

Fungicide Treatment	Disease Severity[a]	Disease Incidence[b]	Adj. Yield (ton/ac)	Sucrose %
untreated control	1.05 A	64.50 A	40.66 A	16.65 A
Inspire XT	0.40 B	34.50 B	42.20 A	16.79 A
CX-10250	1.06 A	60.25 A	40.84 A	16.92 A
alternate	0.49 B	36.75 B	39.11 A	17.06 A
Minerva Duo	0.61 AB	46.00 AB	42.11 A	16.87 A
Mean	0.72	48.40	40.98	16.86
LSD	0.5	20.1	5.0	0.7
CV(%)	45.5	27.0	7.9	2.5

Letters in common did not differ significantly according to a t-test at a significance level of 5%

[a] Disease severity was measured on a scale of 0-10, where 10 is 50% severity. 100 leaves for each plot were evaluated

[b] Disease incidence was measured by the percentage of leaves sampled with lesions

Variety: ACH5498
Planted: May 5, 2016
Harvested: September 19, 2016
Soil Type: Sandy Loam
Previous Crops: MISC oil seed and onion
Residual Soil N to 3 ft: 77.7 lb/ac
Residual Soil P to 6 in: 22 ppm
Applied Fertilizer: 100-20-20
Irrigated (sprinkler) on May 20 0.82", June 17 1.00", June 23 1.45", July 6 1.78", July 18 1.78", August 5 2.28", September 6 1.36"
Herbicides: 24g Roundup-Quest May 19 and June 15
Precipitation April – September, 2016: 13.85 in
Observation dates: 7/19/2016, 7/25/2016, 7/28/2016, and 8/10/2016
Observed *Cercospora beticola* on 8/10/2016
Treatments: 1. Untreated Control; 2. Inspire XT at 7fl oz/ac; 3. CX-10250 at 4.5oz/100gal; 4. CX-10250 at 4.5oz/100gal alternated with Inspire XT at 7fl oz/ac; 5. Minerva Duo at 16 oz/ac
Date of first application: 8/12/2016
Date of second application: None applied

Results:

The weather conditions after the first application did not favor disease and therefore, only a single fungicide application was applied. Although disease severity was low, the non-treated control had significantly greater disease incidence and severity compared to the other treatments. The two fungicide treatments, Inspire XT and Minerva Duo, were the most effective at controlling *Cercospora*. On its own, CX-10250 was not able to prevent disease to the extent of the fungicide treatments. The incidence and severity of *Cercospora* had no significant effects on yield and sugar content. It is our intention to repeat this study next year with at least two fungicide applications.

Sugarbeet Spent Lime Greenhouse Study **EARC, Sidney, MT**

Maninder Walia and Chengci Chen

Sugarbeet Spent Lime Greenhouse Trial (Field 1 soil-previously amended) **EARC, Sidney, MT**

Lime Rate (t/ac)	Aboveground ht./plant	Belowground ht./plant	Aboveground Dry wt./plant	Belowground Dry wt./plant
	(cm)	(cm)	(g)	(g)
0	18.42	13.46	4.04	5.90
4	19.81	13.46	3.88	5.34
10	19.26	13.96	3.61	5.49
15	17.96	11.91	3.65	4.76
Mean	18.86	13.19	3.80	5.37
CV	4.1	9.9	4.5	9.8
LSD (5%)	1.20	NS	0.26	NS

Location: EARC
Field 1: Mike Steffan
Soil sampling date: 5-2-2016
Spent lime was added in field 3 years prior to soil sampling also.
Planted: 5-27-2016
Harvested: 8-10-2016
NS = nonsignificant

Sugarbeet Spent Lime Greenhouse Trial (Field 1 soil-not previously amended) **EARC, Sidney, MT**

Lime Rate (t/ac)	Aboveground ht./plant	Belowground ht./plant	Aboveground Dry wt./plant	Belowground Dry wt./plant
	(cm)	(cm)	(g)	(g)
0	22.83	13.08	5.05	7.68
4	23.4	13.83	4.78	6.88
10	24.66	13.82	4.97	7.12
15	23.15	12.8	4.86	6.93
Mean	23.51	13.39	4.92	7.15
CV	5.2	5.9	7.0	7.5
LSD (5%)	NS	NS	NS	NS

Location: EARC
Field 1: Mike Steffan
Soil sampling date: 5-2-2016
Planted: 5-27-2016
Harvested: 8-10-2016
NS = nonsignificant
No spent lime was previously added to the field.

COWBOY LOGIC

If the gate's open, close it. Just make sure you're on the right side of it before you do.

Sugarbeet Spent Lime Greenhouse Trial (Field 2-soil previously amended) **EARC, Sidney, MT**

Lime Rate (t/ac)	Aboveground ht./plant	Belowground ht./plant	Aboveground Dry wt./plant	Belowground Dry wt./plant
	(cm)	(cm)	(g)	(g)
0	14.46	14.35	3.55	4.25
4	14.33	13.47	2.86	3.21
10	15.89	14.63	3.40	3.73
15	14.9	13.8	2.98	3.40
Mean	14.89	14.06	3.20	3.65
CV	6.20	6.5	26.5	27.9
LSD (5%)	NS	NS	NS	NS

Location: EARC
Field 2: David Reidel
Soil sampling date: 5-3-2016
Spent lime was added in field 3 years prior to soil sampling also.
Planted: 5-27-2016
Harvested: 8-10-2016
NS = nonsignificant

Sugarbeet Spent Lime Greenhouse Trial (Field 2-soil not previously amended) **EARC, Sidney, MT**

Lime Rate (t/ac)	Aboveground ht./plant	Belowground ht./plant	Aboveground Dry wt./plant	Belowground Dry wt./plant
	(cm)	(cm)	(g)	(g)
0	13.69	12.25	2.91	3.20
4	14.85	12.65	3.04	2.39
10	14.88	13.75	2.89	3.24
15	15.44	13.16	2.94	3.52
Mean	14.71	12.95	2.94	3.09
CV	4.6	8.2	6.5	27.0
LSD (5%)	1.05	NS	NS	NS

Location: EARC
Field 2: David Reidel
Soil sampling date: 5-2-2016
Planted: 5-27-2016
Harvested: 8-10-2016
NS = nonsignificant
No spent lime was previously added in the field.

Farmer (fahr-mer):
noun
1. A person who is outstanding in his field.

Sugarbeet Spent Lime Greenhouse Trial (Field 3-soil previously amended) **EARC, Sidney, MT**

Lime Rate (t/ac)	Aboveground ht./plant	Belowground ht./plant	Aboveground Dry wt./plant	Belowground Dry wt./plant
	(cm)	(cm)	(g)	(g)
0	13.96	16.33	2.70	2.75
4	13.54	15.94	2.63	2.54
10	14.21	15.31	2.61	2.57
15	11.69	14.98	2.50	2.57
Mean	13.35	15.64	2.61	2.61
CV	6.5	4.2	4.8	8.2
LSD (5%)	1.33	NS	NS	NS

Location: EARC
Field 3: Ryan Bell
Soil sampling date: 5-4-2016
Spent lime was added in field 3 years prior to soil sampling also.
Planted: 5-27-2016
Harvested: 8-10-2016
NS = nonsignificant

Sugarbeet Spent Lime Greenhouse Trial (Field 3-soil not previously amended) **EARC, Sidney, MT**

Lime Rate (t/ac)	Aboveground ht./plant	Belowground ht./plant	Aboveground Dry wt./plant	Belowground Dry wt./plant
	(cm)	(cm)	(g)	(g)
0	13.96	14.47	2.54	2.63
4	14.27	13.52	2.61	2.63
10	13.81	15	2.67	2.89
15	15.44	14.84	2.90	2.96
Mean	14.37	14.46	2.68	2.78
CV	4.7	7.4	5.2	5.5
LSD (5%)	1.05	NS	0.216	0.237

Location: EARC
Field 3: Ryan Bell
Soil sampling date: 5-4-2016
Planted: 5-27-2016
Harvested: 8-10-2016
NS = nonsignificant
No spent lime was previously added to the field.

You say "Raised in a Barn" like it's a BAD thing?

Sugarbeet Spent Lime Greenhouse Trial (Field 4-soil previously amended) **EARC, Sidney, MT**

Lime Rate (t/ac)	Aboveground ht./plant	Belowground ht./plant	Aboveground Dry wt./plant	Belowground Dry wt./plant
	(cm)	(cm)	(g)	(g)
0	18.35	13.65	3.73	4.85
4	17.48	13.48	3.56	4.33
10	17.1	12.68	3.45	4.36
15	18.71	13.37	3.80	4.80
Mean	17.91	13.29	3.64	4.58
CV	6.6	6.1	5.5	12.3
LSD (5%)	NS	NS	NS	NS

Location: EARC
Field 4: Rod Bell
Soil sampling date: 5-5-2016
Spent lime was added in field 3 years prior to soil sampling also.
Planted: 5-27-2016
Harvested: 8-10-2016
NS = nonsignificant

Sugarbeet Spent Lime Greenhouse Trial (Field 4-soil not previously amended) **EARC, Sidney, MT**

Lime Rate (t/ac)	Aboveground ht./plant	Belowground ht./plant	Aboveground Dry wt./plant	Belowground Dry wt./plant
	(cm)	(cm)	(g)	(g)
0	16.73	12.39	3.64	5.09
4	17.15	12.89	3.59	4.47
10	17.5	13.69	3.73	5.16
15	17.63	14.17	3.99	5.56
Mean	17.25	13.28	3.74	5.07
CV	4.1	9.6	2.5	10.9
LSD (5%)	NS	NS	0.15	NS

Location: EARC
Field 4: Rod Bell
Soil sampling date: 5-5-2016
Planted: 5-27-2016
Harvested: 8-10-2016
NS = nonsignificant
No spent lime was previously added to the field.

Life will change without our permission. It's our attitude that will determine the ride.

Sugarbeet Spent Lime Greenhouse Trial (Field 5-soil previously amended) **EARC, Sidney, MT**

Lime Rate (t/ac)	Aboveground ht./plant	Belowground ht./plant	Aboveground Dry wt./plant	Belowground Dry wt./plant
	(cm)	(cm)	(g)	(g)
0	16.08	11.75	3.69	4.60
4	17.08	14.38	3.69	4.32
10	18.85	14.02	3.75	4.70
15	18.56	12.08	3.40	4.53
Mean	17.65	13.06	3.63	4.54
CV	5.9	12.1	8.7	16.1
LSD (5%)	1.60	NS	NS	NS

Location: EARC
Field 5: Don Steinbeisser, Jr.
Soil sampling date: 5-6-2016
Spent lime was added in field 3 years prior to soil sampling also.
Planted: 5-27-2016
Harvested: 8-10-2016
NS = nonsignificant

Sugarbeet Spent Lime Greenhouse Trial (Field 5-soil not previously amended) **EARC, Sidney, MT**

Lime Rate (t/ac)	Aboveground ht./plant	Belowground ht./plant	Aboveground Dry wt./plant	Belowground Dry wt./plant
	(cm)	(cm)	(g)	(g)
0	17.71	15.02	3.82	4.83
4	18.38	14.1	3.77	4.87
10	19.58	15.06	4.01	5.82
15	20.13	13.88	3.84	5.50
Mean	18.95	14.52	3.86	5.25
CV	6.7	9.3	5.6	9.6
LSD (5%)	NS	NS	NS	0.78

Location: EARC
Field 5: Don Steinbeisser, Jr.
Soil sampling date: 5-6-2016
Planted: 5-27-2016
Harvested: 8-10-2016
NS = nonsignificant
No spent lime was previously added to the field.

When life puts you in tough situations, don't say "Why Me?", just say, "Try Me!!"

Dryland Crop Performance Comparisons - Williston, ND 2016[†]

Gautam Pradhan and Kyle Dragseth

Crop	Type	Variety	Yield 3 Yr Avg. (bu/a)	Market Price ($/bu)	Gross Return ($/a)	+ or - Barlow ($/a)
HRS Wheat[‡]		Barlow	38.6	4.37	168.68	0.00
HRW Wheat		Jerry	48.7	2.85	138.80	(29.89)
Durum Wheat		Joppa	33.2	6.75	224.10	55.42
Barley	(Feed)	Conlon	61.9	1.80	111.42	(57.26)
	(Malt)	ND-Genesis	62.8	4.85	304.58	135.90
Oats		Jury	74.3	1.92	142.66	(26.03)
Corn		Average*	52.7	2.56	134.94	(33.74)
Flax		Average*	22.9	7.90	181.15	12.47
Soybeans	(Conventional)	Sheyenne	25.6	9.25	236.80	68.12
Field Peas	(Green)	Arcadia	39.4	6.00	236.22	67.54
	(Yellow)	CDC Amarillo	43.7	6.00	262.20	93.52
			(lb/a)	**($/CWT)**		
Canola RR		Average*	2175.0	16.00	348.00	179.32
Safflower		MonDak	1915.0	17.00	325.55	156.87
Sunflower	(Oil)	Camero II	1795.0	14.50	260.28	91.59
Lentils	(Medium green)	CDC Richlea	1746.0	30.00	523.80	355.12
	(Small green)	Eston	1503.0	28.00	420.84	252.16
	(Small red)	CDC Red Rider	1774.0	28.00	496.72	328.04
Chickpeas	(Large kabuli)	CDC Frontier	2090.0	47.00	982.30	813.62
	(Small Kabuli)	B-90	1757.0	44.00	773.08	604.40

[†]The market price was obtained on 11/22/2016 from grain elevators in and around Williston.

[‡]The Wheat price was adjusted for protein premium by using a linear equation obtained by plotting wheat market prices against percent proteins. In case of durum, the terminal rate was used.

*Average of several varieties and/or types within the crop.

Sustainable Agroecosystem for Soil Health in the Northern Great Plains (Williston, ND - 2016)

Don Tanaka, Gautam Pradhan, Jim Staricka, Jerry Bergman, Audrey Kalil, Dimitri Fonseka, Kyle Dragseth, Clair Keene, Austin Link, Emma Link, David Weltikol, Cameron Wahlstrom

This long term dryland research project was initiated in 2013 with the objectives of developing agricultural systems that improve soil health, crop production, precipitation use, and economic sustainability of no-till dryland farming systems in the Northern Great Plains of the USA. In this no-till dryland research project, there are five fixed and six dynamic rotations. Every year, each phase of every fixed rotation has been included. The experimental design is randomized complete block with four replications. The plot size is 60 x 200 ft. The crop sequences and agronomic practices followed in 2016 are given in Table 1.

Experimental Details

- Treatments:
  - 5 Fixed Rotations and 6 "Dynamic" Rotations.
  - Each phase of every rotation included each year (fixed rotations).
- Field Design:
  - Randomized Complete Block; 4 Replications.
  - Individual plots are 60 by 200 feet. Total area (including roadways and borders) is 40 acres.
- All plots are No-Till.

The 5 Fixed Rotations

2013	2014	2015	2016	2017
Durum	Fallow	Durum	Fallow	Durum
Durum	Durum	Durum	Durum	Durum
Durum	BP1*	Pea	Corn	Safflower
Durum	HRWW/ BP2	Pea/BP3	Corn	Safflower
……Perennial Grass Mix with Pollinator Plants……				

* BP1 = Biological primer 1; BP2 = Biological Primer 2; BP3 = Biological Primer 3; HRWW = Hard Red Winter Wheat.

What are the Biological Primers?

- Biological Primer 1 (BP1) is a full season cover crop mix, seeded between June 1st and June 20th. Pearl millet (3.5)†, Sorghum × Sudan (3.5), Turnip (1.0), Radish (2.0), Berseem clover (1.0), Sunflower (2.0), Soybean (15.0), Cowpea (10.0), Flax (1.0), Hairy vetch (3.0), Mammoth red clover (1.0), Phacelia (2.0), and Italian ryegrass (3.0).
- Biological Primer 2 (BP2) is a cover crop mix seeded after winter wheat but before August 10th. Turnip (1.0), Radish (2.0), Kale (1.0) Lentil (5.0), Oats (30.0), Sweet clover (1.0), and Buckwheat (2.0)
- Biological Primer 3 (BP3) is a cover crop mix seeded after pea. Triticale (40.0), Hairy vetch (2.0), Common alfalfa (2.0), Mammoth red clover (2.0), Turnip (1.0), and Radish (2.0).

†The figures in brackets are the seeding rates in lb/a.

"Dynamic" Rotations

- Crops in the dynamic rotations will be determined each year based on weather and market conditions and using the following tools:
  - The USDA-ARS Crop Sequence Calculator (An interactive program for viewing crop sequencing information and calculating returns; www.mandan.ars.usda.gov)
  - The NDSU Projected Crop Budgets for Northwest North Dakota (www.ag.ndsu.edu/publications/farm-economics-management).
- The crops will include a mix of cool-and warm-season grasses and broadleaves.
- Each year durum will be grown in one of the rotations to serve as a comparison.

The Dynamic Rotations To Date

2013	2014	2015	2016	2017
Durum	HRWW*	Lentil	HRWW	*TBD*
Corn	Soybean	Durum	*Corn*	*TBD*
Soybean	Sunflower	Barley	*Pea*	*TBD*
Safflower	Barley	Pea	*Durum*	*TBD*
Sunflower	HRSW	HRWW	*Lentil*	*TBD*
Pea	Durum	Safflower	*Barley*	*TBD*

* HRSW = Hard Red Spring Wheat; HRWW = Hard Red Winter Wheat; *TBD* = to be determined.

Measurements

- Crop Performance: leaf chlorophyll, canopy temperature, grain yield, protein or oil content; grain nitrogen and phosphorus; total dry matter; straw production; straw carbon, nitrogen, and phosphorus; crop water use.
- Soil Quality: infiltration; aggregate stability; bulk density; organic matter amount, plant-available levels of nitrogen, phosphorus, potassium and other nutrients; pH; salinity.
- Pests: diseases, insects, weeds.
- Soil microbial parameters: To be determined.

Results

Yield, quality, and economic returns from cash crops under different crop rotations

The annual precipitation at the experimental site from October 2015 to September 2016 was 14.4 inches and the growing season precipitation from April to September 2016 was 12.7 inches, which were 2.9 and 2.0 inches higher than the average of the last 25 years, respectively.

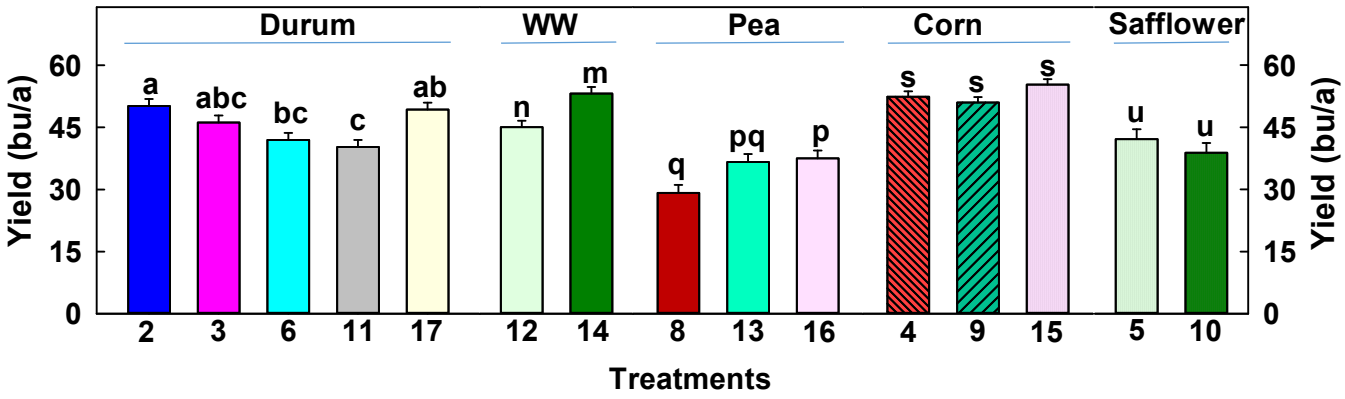
There were significant effects of treatments (crop rotation) on yields of durum ($p < 0.01$), winter wheat ($p = 0.01$), and pea ($p < 0.05$), but not on other crops (Fig. 1). Durum yields were similar among the Treatment 2 (Fallow-Durum-Fallow-Durum), 17 (Safflower-Barley-Pea-Durum), and 3 (Durum-Durum-Durum-Durum). Lack of precipitation in the fall and winter of 2015-2016 resulted in moisture stress by durum in early spring (May). However, as the treatment 2 has fallow component the revenue generated under this crop rotation shall be considered half of the normal return. These treatments had 6-10 bushels more yield per acre than the treatment 11 (Pea/BP2-Corn-Safflower-Durum).

Regarding winter wheat, the treatment 14 (Durum-WW-Lentil-WW) yielded about 8 bushels more grain per acre than treatment 12 (Corn-Safflower-Durum-WW/BP2) (Fig. 1).

For pea yields, the treatment 16 (Soybean-Sunflower-Barley-Pea) yielded 8 bushels more grain per acre than treatment 8 (Safflower-Durum-BP1-Pea) (Fig. 1).

Averaged across the treatments, the corn and safflower yields were 52.9 and 40.5 (1,539 lbs/a) bushels per acre, respectively. The barley, lentil, BP1, and perennial mix yields were 59 bushels, 2120 lbs, 3034 lbs, and 3113 lbs per acre, respectively. There were no significant treatment effects on grain quality (protein and oil) of harvested crops, so data are not presented.

Fig. 1. Crop yields under Different Crop Rotations†.



† Please refer Table 1 for treatment descriptions. Safflower yield has been converted @ 38 lbs/bu. basis.

Table 2 shows the economic returns from cash crops in 2013, 2014, 2015, and 2016 under different crop rotations, and the average net return from each crop rotation/treatment. As the five-year crop rotation has not yet been completed, the information is a report of observed results and is not intended to be used by producers in making financial decisions.

Table 2. The Economic Returns from Different Crop Rotations.

Rotations		Treatments	2013		2014		2015		2016						Avg Net Return From Last 4 yrs
#	Type	#	Crop	Net Return* ($/a)	Crop	Net Return* ($/a)	Crop	Net Return* ($/a)	Crop	Yield (bu or lb/a)	Price† ($/bu or lb)	Revenue ($/a)	Direct Cost‡ ($/a)	Net Return* ($/a)	($/a)
I**	Fixed	1	Durum	24.60	Fallow	-24.58	Durum	-9.14	Fallow	0.00	0.00	0.00	23.35	-23.35	-8.12
	Fixed	2	Fallow	-19.76	Durum	46.15	Fallow	-23.09	Durum	50.14	6.75	169.21	161.60	7.61	2.73
II	Fixed	3	Durum	202.15	Durum	202.15	Durum	64.28	Durum	46.18	6.75	311.73	161.60	150.13	154.68
III	Fixed	4	Durum	202.15	BP1	-58.46	Pea	68.62	Corn	58.20	2.55	148.40	159.21	-10.81	50.37
	Fixed	5	BP1***	-63.09	Pea	175.16	Corn	-36.61	Safflower	1,601.88	0.17	272.32	155.44	116.88	48.09
	Fixed	6	Pea	422.30	Corn	30.21	Safflower	-6.08	Durum	41.96	6.75	283.26	161.60	121.66	142.02
	Fixed	7	Corn	163.09	Safflower	54.89	Durum	8.54	BP1	0.00	0.00	0.00	48.88	-48.88	44.41
	Fixed	8	Safflower	280.96	Durum	145.15	BP1	-48.88	Pea	29.19	6.00	175.15	137.81	37.34	103.64
IV	Fixed	9	Durum	202.15	WW/BP2	64.57	Pea/BP3	71.20	Corn	56.66	2.55	144.49	159.21	-14.72	80.80
	Fixed	10	SW/BP2	56.26	Pea/BP3	211.64	Corn	-58.70	Safflower	1,476.03	0.17	250.93	155.44	95.49	76.17
	Fixed	11	Pea/BP2	372.20	Corn	14.82	Safflower	-44.11	Durum	40.26	6.75	271.74	161.60	110.14	113.26
	Fixed	12	Corn	163.09	Safflower	42.82	Durum	-10.37	WW/BP2	45.04	2.88	129.70	144.73	-15.03	45.13
	Fixed	13	Safflower	280.96	Durum	145.15	WW/BP2	-29.24	Pea/BP3	36.65	6.00	219.89	137.81	82.08	119.74
V	Fixed	20	Per. Mix#	-166.57	Per. Mix	-8.26	Per. Mix	-8.26	Per. Mix	3,113.61	0.03	93.41	8.26	85.15	-24.48
VI	Dynamic	14	Durum	202.15	WW	55.72	Lentil	496.99	WW	53.17	2.88	153.12	144.73	8.39	190.81
VII	Dynamic	15	Corn	163.09	Soybean	16.64	Durum	98.17	Corn	57.22	2.55	145.91	159.21	-13.30	66.15
VIII	Dynamic	16	Soybean	203.17	Sunflower	121.10	Barley	7.55	Pea	37.51	6.00	225.09	137.81	87.28	104.77
IX	Dynamic	17	Safflower	280.96	Barley	108.56	Pea	88.12	Durum	49.29	6.75	332.73	161.60	171.13	162.19
X	Dynamic	18	Sunflower	133.95	SW	-36.48	WW	-22.49	Lentil	2,120.24	0.30	636.07	145.22	490.85	141.46
XI	Dynamic	19	Pea	412.65	Durum	226.15	Safflower	23.82	Barley	59.14	4.8	283.86	158.64	125.22	196.96

†The market prices were obtained from grain elevators in and around Williston on November 22, 2016. ‡The direct costs were calculated from the farm records and the estimations given in the 'North Dakota 2016 Projected Crop Budgets - North West' by Andrew Swenson. *Net Return = Revenue - Direct cost. **This crop rotation has fallow component; therefore, the revenue obtained was divided by two. ***BP1 = Biological Primer 1; BP2 = Bio. Primer 2, BP3 = Bio. Primer 3; SW = Spring Wheat; WW = Winter Wheat. #Per=Perennial; in 2013, 2014, and 2015, the hay production from Perennial Mix were not estimated that resulted into a negative net return.

Water use efficiency of durum in different crop sequences

At the time of planting, soil water content in the plots planted to durum in 2016 ranged from 8.76 to 12.23 inches in the top 4 feet of soil (Table S1). This variation was related to the previous crop in the rotation and to what extent it had depleted soil water during the previous growing season. There was less variation in the amount of water in the soil at harvest time than at planting time. The variation in soil water depletion was even less. Crop water use by durum, calculated as soil water depletion plus rain, ranged from 10.91 to 12.17 inches (Table S1).

Water use efficiency (WUE), calculated as bushels of durum produced per inch of water, ranged from 3.7 to 4.2 bu/in. with an r^2=67% (Note: r^2 is a statistical measure that in this case represents the percentage of yield variation that can be explained by crop water use). The WUE calculation assumes that grain will be produced with any amount of available water, i.e., no water is needed to grow the plant before grain is produced. It is more reasonable to assume that the crop will consume some amount of water before grain is produced. This can be estimated by preforming a statistical procedure called “linear regression”. A linear regression performed on this data indicated that 5.45 inches of water was needed to grow the durum crop and 7.4 bushels of grain was produced for each additional inch of water (r^2=86%). These values are similar to those obtained from this study last year (5.05 inches and 7.5 bu/in). The precision of the equation was less this year than last year and may be simply year-to-year randomness.

Table S1: 2016 Durum crop water use, yield, and water use efficiency.

Trt	2015 Crop	2016 Crop	Water in top 4 ft of soil (inches)		Soil water depletion	Rain	Crop water use	Yield	Water use efficiency
			Apr 22†	Jul 27					
					inches	*inches*	*inches*	*bu/a*	*bu/in*
2	Fallow	Durum	12.23	7.73	4.50	7.67	12.17	50.14	4.12
3	Durum	Durum	10.76	6.45	4.31	7.67	11.98	46.18	3.85
6	Safflower	Durum	9.02	5.55	3.48	7.67	11.15	41.96	3.77
11	Safflower	Durum	8.76	5.53	3.24	7.67	10.91	40.26	3.69
17	Pea	Durum	10.49	6.38	4.11	7.67	11.78	49.29	4.19

† Soil water measurement date closest to planting date.

Disease and insect incidences

All crops were scouted every 3-4 weeks for disease during the growing season. In safflower, Alternaria leaf spot (*Alternaria carthami*) and bacterial blight (*Pseudomonas syringae*) were observed at high incidence in late June. In durum and winter wheat disease incidence and severity were low. Tan spot and wheat streak mosaic virus were both observed but there did not appear to be a major treatment effect. Fusarium Head Blight was not observed in either durum or winter wheat. Holcus leaf spot (*Pseudomonas syringae*) was observed in corn at high incidence in all plots at the end of June. Northern corn leaf blight (*Exserohilum turcicum*) was observed on 30-80% of plants at the end of July. The pea plots suffered some cutworm damage at the beginning of the season. Mild Ascochyta was observed on peas beginning in early June, along with up to 30% incidence of bacterial blight.

Weeds in the cropping sequence study

Observations of weeds present in the cropping sequence study were made in late July. Green foxtail was the most common weed in durum and was also observed in barley. In some durum plots, Russian thistle was seen at moderate densities. The pea and lentil crops had high to very high densities of horseweed, also known as marestail. Horseweed was a commonly observed weed in pea and lentil crops throughout the MonDak in 2016. Lack of rainfall during pre-emergence applications in May coupled with abundant rains in early June likely contributed to poor weed control in many fields this year. Russian thistle was also present in pea and lentil but its distribution was more variable than the horseweed. Some volunteer cover crops from the 2015 BP1 mixture were present in the pea. The most noticeable volunteer was sunflower and a few red clover and hairy vetch plants were also observed. Generally, few weeds were seen in the perennial mix, however a few small patches of Canada thistle were identified.

Fusarium Head Blight and DON Accumulation in Durum Varieties

Dr. Audrey Kalil, John Rickertsen, Dimitri Fonseka, Austin Link and Emma Link

Introduction

Fusarium Head Blight (FHB) or scab, is a disease of durum wheat (*Triticum durum*) caused by the fungal pathogen *Fusarium graminearum*. This pathogen reduces grain quality by producing a toxin, Deoxynivalenol (DON), which when ingested is harmful to humans and livestock. Durum varieties are all generally considered susceptible to FHB compared to Hard Red Spring Wheat. It is well known that FHB disease levels and DON varies greatly among locations in humidity, temperature and amount of rainfall. Therefore, the goal of this project was to assess FHB disease and DON levels in the same durum varieties grown at several locations in western North Dakota to identify the varieties that consistently accumulate the least DON under different environmental conditions.

Methods

Variety trials were conducted at four locations: NDSU Williston Research Extension Center (WREC), Hettinger Research Extension Center (HREC), Crosby and Arnegard. Trials were set up in a randomized complete block design, with 5 x 14 ft. plots and at least three replicated plots per variety. To maximize disease potential, trials did not receive fungicide treatment at flowering which is standard for control of FHB. At the soft dough growth stage, Feekes 11.2, all plots were rated for FHB incidence and severity by examining 30 heads per plot. Grain from each plot was analyzed for DON using the Reveal Q+ mycotoxin extraction protocol and AccuScan II GOLD reader (Neogen). Results presented are an average of data from three replications per variety.

Results

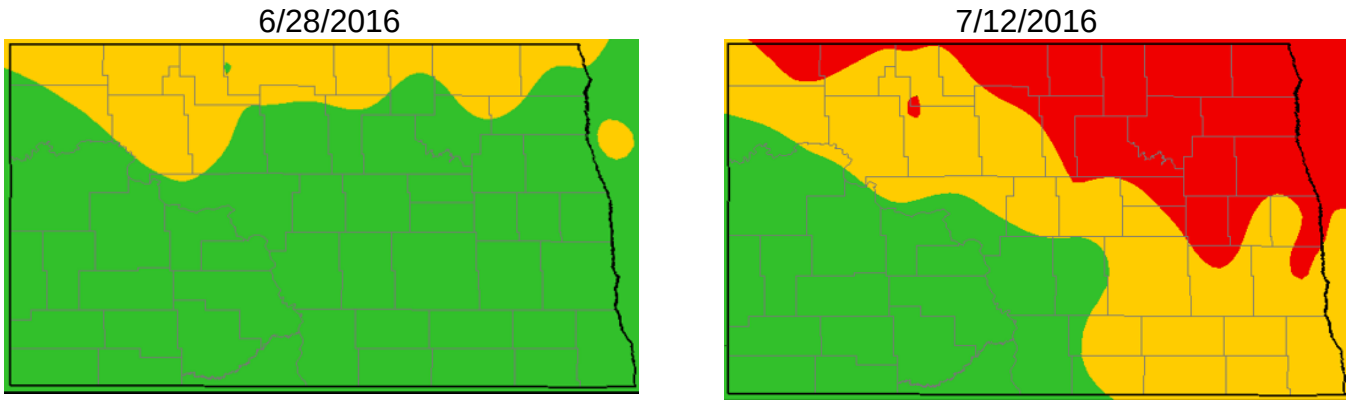


Figure 1. NDSU Small Grains Disease Forecasting Model
Fusarium Head Blight risk based on susceptible Hard Red Spring Wheat varieties is presented for 6/28/2016 and 7/12/2016. Green indicates low risk, yellow indicates moderate risk and red indicated high risk. Predicted risk became high for the Crosby area starting 7/7/2016 for susceptible varieties. Predicated risk remained low for Hettinger and Arnegard. Predicated risk for Williston became moderate for VS varieties starting 7/11 and moderate for S varieties starting 7/15.

Variety	Scab Rating	Williston WREC			Hettinger HREC			Arnegard, ND			Crosby, ND		
		SV (%)	INC (%)	DON (ppm)	SV (%)	INC (%)	DON (ppm)	SV (%)	INC (%)	DON (ppm)	SV (%)	INC (%)	DON (ppm)
Alkabo	MS	12	6	< 0.3	5	3	< 0.3	5	3	< 0.3	8	19	6.4
Carpio	M	13	1	< 0.3	2	3	< 0.3	7	1	< 0.3	8	19	4.9
Divide	MR	5	4	< 0.3	3	3	< 0.3	5	1	< 0.3	10	20	6.1
Joppa	M	9	7	< 0.3	6	12	< 0.3	11	3	< 0.3	10	18	4.3
Lebsock	MS	7	10	< 0.3	5	5	< 0.3	5	2	< 0.3	10	21	3.8
Mountrail	S	9	12	< 0.3	11	18	< 0.3	5	5	< 0.3	12	29	3.3
Tioga	MS	9	3	< 0.3	5	8	< 0.3	0	0	< 0.3	8	23	5.5
Mean		9.1	6.2	NA	5.3	7.4	NA	5.4	2.1	NA	9.4	21.3	4.9
LSD (5%)		NS	5.5	NS	7.4	13.9	NS	NS	NS	NS	3.9	NS	1.4

Planted: 5/2 (Williston), 4/4 (Hettinger), 4/28 (Crosby), 5/9 (Arnegard)
Approximate flowering date: 6/28 (Williston), 6/20 (Hettinger), 7/5 (Crosby), 7/12 (Arnegard)
SV = FHB severity measured as the percent of the head exhibiting bleaching
INC = FHB incidence measured as the number of heads out of 30 per plot exhibiting FHB symptoms

Conclusions

While FHB symptoms were observed at all locations DON levels were below the detectable threshold of 0.3 ppm at Williston, Hettinger and Arnegard. Risk for FHB was considered low for all these locations during flowering by the NDSU Small Grains Disease Forecasting Model. FHB disease incidence and DON accumulation were higher on average at the Crosby site where FHB risk was predicted to be moderate to high during flowering and in the subsequent week. At the Crosby site, FHB disease was highest in Mountrail however DON levels were lowest in this variety. DON accumulation was highest in Alkabo. Differences between varieties planted at the Crosby site in DON accumulation are considered significant ($\alpha = 0.05$) when they differ by 1.4 ppm or more. Given that Crosby was the only site where we observed significant DON accumulation in the seed we cannot draw any preliminary conclusions about site specific performance of these varieties. This trial will be repeated next year to get a more complete picture of variety performance across seasons.

Common sense isn't as common as you might think.

Improving Management of Early Blight in MonDak Gold Potatoes

Dimitri Fonseka, Audrey Kalil, Tyler Tjelde, Justin Jacobs, and Jerald Bergman

Introduction

Early blight, caused by the fungus *Alternaria solani,* is an important chronic foliar disease of potato present every growing season in North Dakota. Primary damage is attributed to premature defoliation of potato plants, resulting in tuber yield reduction. The pathogen may also cause dry rot of tubers, further reducing quality and shelf life of marketable potatoes. Damage to the tubers during harvest exacerbates the dry rot and should be prevented. Frequent application of protectant fungicides from early in the growing season until vine-kill is essential to manage early blight, but these are insufficient under high inoculum pressure and conducive environmental conditions. Therefore, the application of locally systemic and translaminar fungicides in rotation with protectant fungicides is important. The objective of this study was to improve control of early blight in MonDak Gold potatoes via imposition of a new fungicide spray schedule and to evaluate the role of harvest damage in worsening of tuber dry rot symptoms.

Methods

A non-replicated demonstration trial was conducted at the Nesson Valley Irrigated station in the 2016 season. The existing fungicide spray regime used in 2015 served as the control (A). The new spray schedule (B) design was based on fungicide testing results from the NDSU potato pathology group. The field was split into two equal sections and each half received either treatment A or B. Early blight foliar disease severity was rated visually on the same 10 plants at five locations within each treatment every 10 days for 10 weeks starting at row closure. Disease was assessed by estimating percentage of foliage showing chlorotic or necrotic lesions and senescent foliage typical of *A. solani* infections. Area under the disease progressive curve (AUDPC) was calculated by multiplying the average of pairs of disease severity observations by time. This provides a quantitative summary of total amount of disease over the season (higher AUDPC value = more disease). A representative leaf sample was collected from each treatment to verify pathogen infection. Laboratory culture plates confirmed the presence of the fungus. To evaluate harvest damage to tubers, samples from both treatments were collected from hand-harvested and mechanically harvested bins. Mechanically harvested samples had two sub samples with tubers being collected before and after entering the clod hopper. Tubers were cured by exposing them to temperatures between 50 and 60°F and 95% RH for 10 days in dark. After curing, the storage temperature was dropped to about 40 and 45°F.

Results

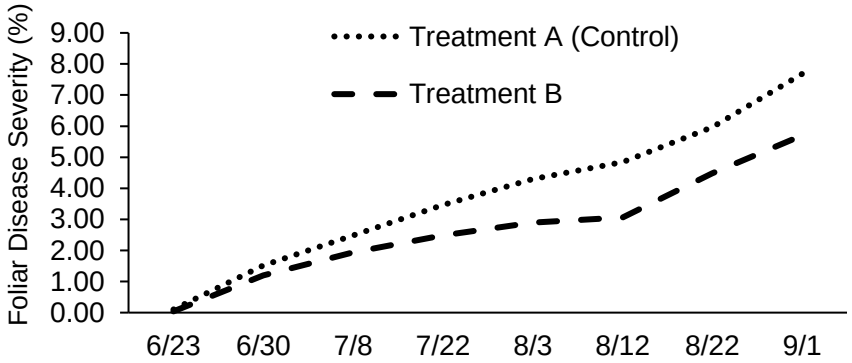


Figure 1. Early blight disease severity progress
Early blight foliar disease severity is plotted by time at each observation time point. Area under the line for each treatment is equal to the AUDPC.

Spray Schedule		Rate	Foliar Disease Severity (%)								AUDPC
			6/23	6/30	7/8	7/22	8/3	8/12	8/22	9/1	
A	Bravo WS (1) Bravo WS (2,9) Manzate (3) Quadris (7)	0.75 pt/a 1.5 pt/a 1 qt/a 15.5 fl oz/a	0.10	1.52	2.48	3.46	4.30	4.84	5.96	7.68	275.14
B	Bravo WS (1) Bravo WS (2,4,6,8,9) Headline + Manzate (3) Endura + Manzate (5)	0.75 pt/a 1.5 pt/a 9 fl oz/a + 2 qt/a 3 oz/a + 2 qt/a	0.04	1.20	1.94	2.48	2.90	3.06	4.48	5.70	197.11

Table 1. Foliar disease severity could potentially be reduced with modified fungicide schedule
Planted: May 02, 2016 Harvested: October 14, 2016
Spray Schedule: 1 = 6/22, 2 = 7/1, 3 = 7/7, 4 = 7/15, 5 = 7/22, 6 = 7/27, 7 = 8/2, 8 = 8/15, 9 = 8/19
AUDPC = Area Under the Disease Progressive Curve
Foliar Disease severity data was based on 10 plants at 5 locations in the field for each treatment (n = 50)

Conclusion

In this demonstration trial, we observed a slight reduction of early blight foliar symptoms under the new spray regime (B) compared to the control (A) starting from July 22nd through September 1st. A lower AUDPC value also indicates less total early blight foliar disease over the growing season for the new spray regime (B). It should be noted that disease pressure was low, so it remains to be seen if such a slight reduction in disease will have any impact on yield or storability. For example, a rating of 90% for disease severity corresponds to a potential 20-30% yield reduction. The first post-harvest tuber disease severity analysis was conducted on November 11th. Dry rot was not observed in stored tubers from any of the treatments. Further evaluations will be conducted to determine tuber infection caused by the dry rot phase of the pathogen.

Establishing a Pea and Lentil Scouting Program in Northwest North Dakota for Improved Disease and Insect Pest Management

Dr. Audrey Kalil, Dr. Janet Knodel, Dr. Julie Pasche, Dr. Kim Zitnick-Anderson, Taheni Jbir, Adam Carlson and Grower Participants

Introduction

In the 2016 growing season a pea and lentil scouting program funded by the Northern Pulse Growers Association was initiated. The goals of the program were threefold:

1. Identify important disease and insect pests by scouting pea and lentil fields in Williams, Burke, Divide, Mountrail and McKenzie counties for disease and insect pests.

2. Provide information of pest populations and disease outbreaks in the weekly *Crop and Pest Report* published by NDSU Extension Service and maps on the NDSU IPM website.

3. Identify pathogens causing root rot and provide disease samples to Dr. Julie Pasche's pulse pathology group in Fargo for ongoing research efforts.

Methods

To determine the extent of seed lot contamination with Pea Seed-borne Mosaic Virus (PSbMV), saved pea and lentil seed was collected from producers and sent to the NDSU Plant Diagnostic Laboratory to assess for contamination with PSbMV. During the growing season, pea and lentil fields were scouted for diseases including root rots, bacterial blight, ascochyta blight, downy mildew, white mold, powdery mildew and viruses, among others, and insect pests. Insect pests scouted for were cutworms, grasshoppers, lygus bugs and pea aphids. Fields were located in Williams, Divide, Mountrail, Burke and McKenzie Counties. There were a total of 36 pea fields and 52 lentil fields included in the survey. The scout used standard scouting practices developed by ND Extension Specialists. This involves walking a "W" pattern in the field, and examining 10 plants at 5 sites in the field for diseases and insects. Scouts use visual counts for cutworms and pea aphids, and a 15-inch sweep net for grasshoppers and lygus bugs. Root rot sampling consisted of collecting 5 plants samples from 5 different locations in the field, for a total of 25 plants analyzed per field.

Highlighted Results – PSbMV and Lentil Root Rot

The results presented reflect a small fraction of the data collected. To view all the mapped data collected during this survey please visit the NDSU IPM website: https://www.ag.ndsu.edu/ndipm and click on the "Lentil" and "Pea" links near the center of the page. Insect and disease summary articles were also published in the September 15, 2016 edition of the *Crop and Pest Report*.

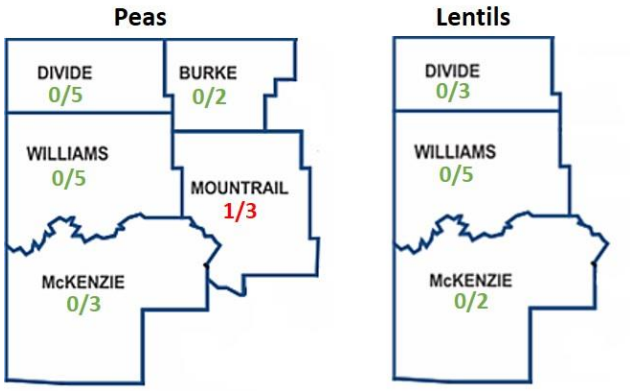


Figure 1. Pea Seed-borne Mosaic Virus. Number of PSbMV infected pea and lentil seed lot samples over total samples tested from NW ND counties. Only one positive sample (red) was identified.

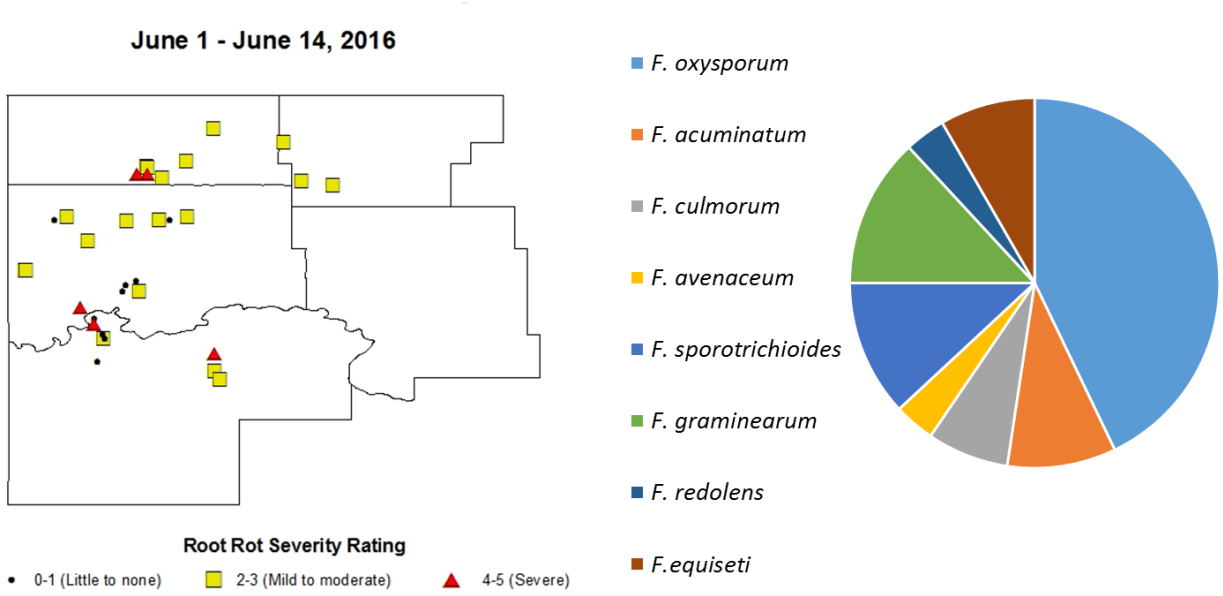


Figure 2. Lentil Root Rot. Map above left: Root rot severity in lentils NW ND from June 1 – June 14. Severity is rated from a scale of 1-5 where 0-1 indicates little to no root rot (black dot), 2-3 indicates moderate root rot (yellow square) and 4-5 indicates severe root rot (red triangle). Chart above right: *Fusarium* species isolated from root rot samples collected in lentil fields. Almost half of the samples contained *Fusarium oxysporum*.

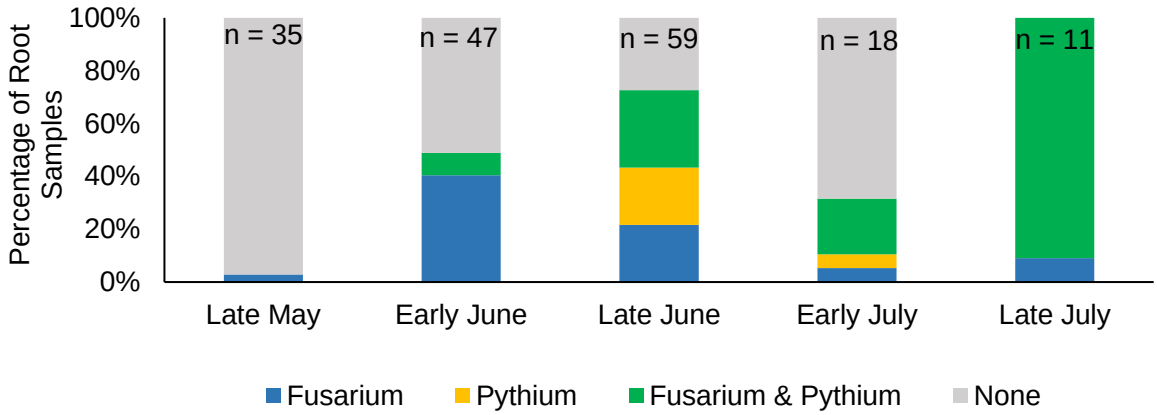


Figure 3. Percent of root rot pathogens isolated from lentil root rot samples. At each time point (May – July) the root samples were assessed for root rot pathogens (n = number of samples) which resulted in no pathogens found (light gray), *Fusarium* spp. alone (blue), *Pythium* spp. alone (yellow) or co-isolation of both *Fusarium* spp. and *Pythium* spp. from the same root (green). *Rhizoctonia solani* was not found in any samples and *Aphanomyces* was only identified in one sample (data not shown).

Conclusions

Levels of foliar disease in peas and lentils were generally low (ascochyta/mycosphaerella, anthracnose, botrytis gray mold, powdery mildew, stemphylium, bacterial blight). Near maturity, white mold was identified sporadically at low to moderate levels in Divide and Williams Counties. Cutworms were common and found in ~50% of fields surveyed but below economic threshold levels. Aphid, grasshopper and lygus bug populations also did not reach economic threshold levels. Significant root rot was observed in lentil mid-season. *Fusarium* and *Pythium* species were the primary pathogens isolated from symptomatic lentil roots. Pea root samples were generally collected early in the season and did not exhibit root rot. Some later season pea root samples, however, exhibited symptoms and *Fusarium* and *Pythium* species were isolated. We would like to extend our gratitude and appreciation to all the growers who participated in the pulse scouting program this year.

2016 Integrated Pest Management Crop Scouting Results

Dr. Audrey Kalil, Dr. Janet Knodel, Dr. Andrew Friskop, Dr. Sam Markell, Taheni Jbir and Grower Participants

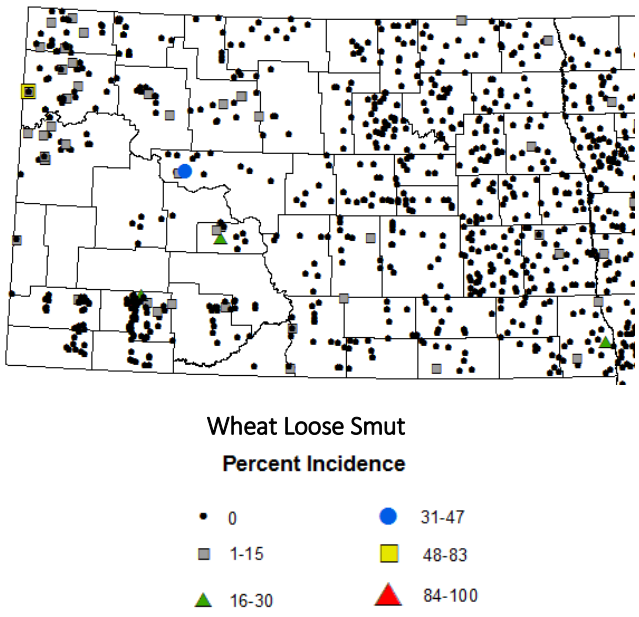
Introduction

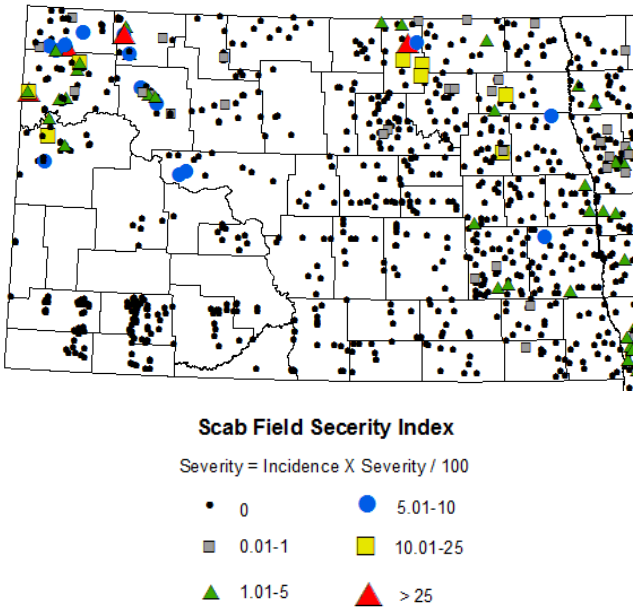
Integrated Pest Management (IPM) is a method to manage diseases and insect pests of field crops that combines biological, cultural, physical and chemical tools to maximize economic returns and environmental protection. To help growers manage disease and insect pests, the NDSU extension IPM team has developed an annual IPM scouting program. The data the North Dakota IPM scouts collect helps determine whether pest economic thresholds have been or likely will be reached. An economic threshold is when a pest population or disease has reached a high enough level that producers should act to prevent economic losses. The data generated by these scouts can also be used in forecasting models to help determine the level of risk for an insect pest or disease. Forecasting models are available for wheat midge, small-grain diseases, potato late blight and sclerotinia in canola through NDSU. The IPM scout based out of the Williston Research Extension Center is responsible for data collected in Burke, Divide, McKenzie, Mountrail and Williams Counties.

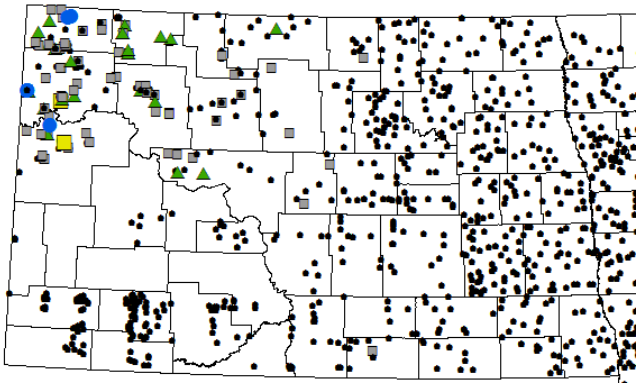
Methods

The IPM scout surveys winter wheat, spring wheat, durum, barley, soybean, and sunflower fields. At each field location diseases and some insect pests are scouted on ten plants at five locations within the field for a total of 50 plants per field. The five locations are selected by walking a 'W' pattern in the field where each location is approximately 100 meters apart. Percent disease incidence is calculated using the following equation: (# diseased plants/50) * 2. For some diseases severity ratings are taken as well, which measures the surface area of the plant exhibiting disease symptoms either on a percent plant tissue affected basis or using a numerical rating scale. Grasshopper and wheat stem sawfly populations are measured using a sweep net in the ditches adjacent the fields. Bean leaf beetle of soybean is measured using a sweep net at five locations within the field. Results are published at the NDSU IPM website as maps https://www.ag.ndsu.edu/ndipm or in articles in the NDSU Crop and Pest Report https://www.ag.ndsu.edu/cpr.

Selected Results: All mapped data is available online at the NDSU IPM website

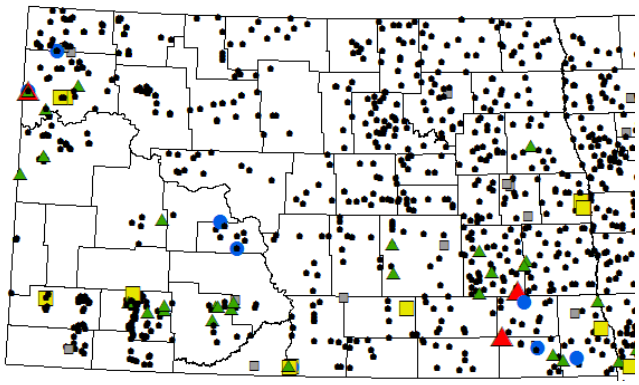






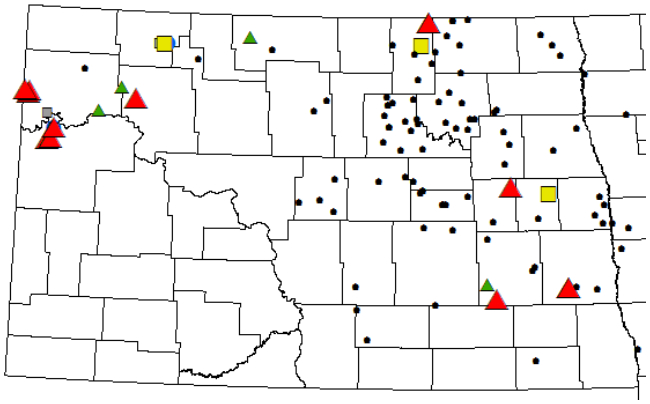
Wheat Streak Mosaic Virus
Percent Incidence

0
1-15
16-30
31-47
48-83
84-100



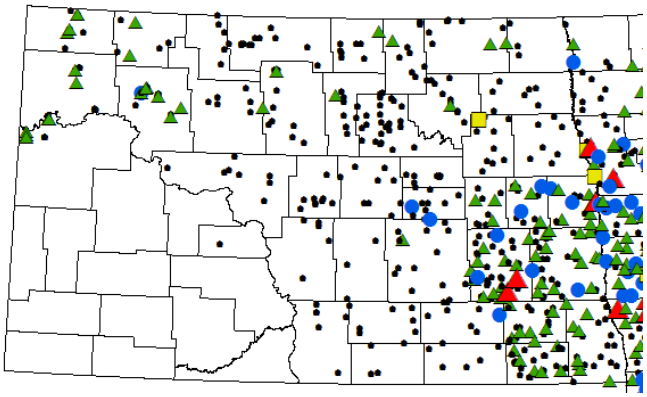
Wheat Stripe Rust
Percent Incidence

0
1-5
6-15
16-25
26-50
>50



Barley Thrips
Average per stem

0
1
2-3
4-5
6-8
>8



Soybean Aphids
Percentage of plants infested with more than one aphid

0
1-25
26-50
51-75
76-100

Conclusions

Based on IPM maps, loose smut appeared to be more common in wheat in NW ND than in other parts of the state. Loose smut is a seed borne disease and use of a certified disease free seed source as well as seed treatment with a systemic fungicide will help with management of this pathogen. Fusarium head blight was most severe in NW and NE ND this season. Recommended FHB management practices include crop rotation out of small grains and/or corn, planting tolerant varieties and fungicide treatment at flowering with effective triazole class fungicides. Wheat Streak Mosaic Virus (WSMV) was very common this year in NW ND. To manage this disease, it is necessary to eliminate the green bridge by managing grassy weeds and modifying planting dates of winter wheat following wheat. There are no products that can eliminate the virus in the plant and management of the mite that transmits the virus is not cost effective. Stripe rust was found in NW ND this year but was not wide spread. High populations of barley thrips were observed in fields this season. Chemical treatment for barley thrips must be made before the heading stage is complete and the spray decision should be based on the economic threshold. Soybean aphids were found in all NW counties this year; however, populations were low. We wish to extend our thanks to the growers who allowed us to scout their fields for this year's IPM scouting survey.

Evaluating the Effect of Crop Rotation and Tillage on Rhizoctonia Root and Crown Rot Disease in Sugarbeet

Dr. Audrey Kalil, Dr. Bart Stevens, Dimitri Fonseka and Lyn Soldberg-Rodier

Introduction

Rhizoctonia root and crown rot is a devastating disease of sugarbeet in North Dakota and Montana. Small grain crops such as wheat and barley, which are not susceptible to *Rhizoctonia solani* AG 2-2 IV and IIIB causing disease in sugarbeet, are typical rotational crops with sugarbeet in theory suited to suppressing populations of this pathogen in the soil. However, diversifying rotations to include susceptible crops such as soybean and corn may have economic benefits. Available literature quantifying the effect of such a rotation on the accumulation of this pathogen in the soil is lacking, especially where a non-susceptible crop (barley) is included in the year before sugarbeet, rather than a susceptible crop. Tillage is also recommended to reduce soil populations of *R. solani*, however, the use of no-till in our region has reduced erosion and increase soil organic matter. Our project seeks to quantify the effect of a crop rotation including corn and soybean and no-till on populations of *Rhizoctonia solani* AG2-2 in field soil using recently available molecular techniques and correlate these values with crown rot disease incidence and severity.

Experimental Design

Each rotation treatment was randomly assigned to one of forty 14.6 m- × 61 m plots arranged in a RCB design with five replications. Main plots are split into two 7.3 m x 30.5 m subplots to evaluate the effect of tillage on each cropping system. No-till planting is accomplished with a custom-built no-till drill (for barley and soybean) or a no-till row crop planter (for corn and sugarbeet). Heavy residue following corn is shredded using a rotary mower on tilled subplots. Tillage consists of two passes with a disk harrow (10 cm deep), two pass with soil ripper (20 cm deep) and two passes with a packer-mulcher seed bed conditioner. All tillage is performed in the spring to minimize the risk of wind erosion. Split-plots were split in 2016 for fungicide treatments. Half of the split-plot received seed treatment containing penthiopyrad and a foliar spray when soil temperature neared 18°C for control of Rhizoctonia crown and root rot and the other half did not. Both halves of the split plot received fungicide seed treatment for control of *Pythium.*

- Rotations (main plot)
  - Sugarbeet-barley
  - Sugarbeet-corn-soybean-barley
- Tillage (split-plot)
  - No-till
  - Tilled
- Fungicide (split-split-plot)
  - With (+) fungicide for *R. solani* AG2-2
  - Without (-) fungicide for *R. solani* AG2-2

Foliar disease severity was evaluated on 20 plants from a randomly selected row in each sugar beet plot on 7/8/2016. The severity rating is the number of wilted leaves over the total number of leaves per plant. Root rot ratings were collected at harvest based on a 0-7 disease severity scale. All beets in a ten-foot-long area in two randomly selected rows a plot were rated. One ten-foot stretch was towards the front of the plot, the other towards the back. In total 20-40 beets per plot were rated for a minimum of 100 beets a treatment. LSD was calculated based on the average disease severity for each replicate of each treatment (n = 5).

Year 1 Results

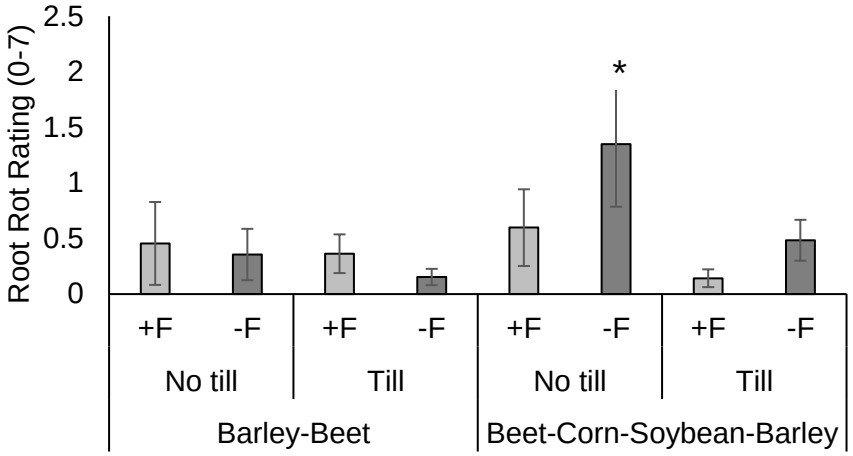


Figure 1. Root rot disease severity in different split-split plots (+/- F (fungicide treatment), till vs no-till, 2-year rotation vs 4-year rotation. Statistical significance indicated by asterisks as ($p < 0.05$).

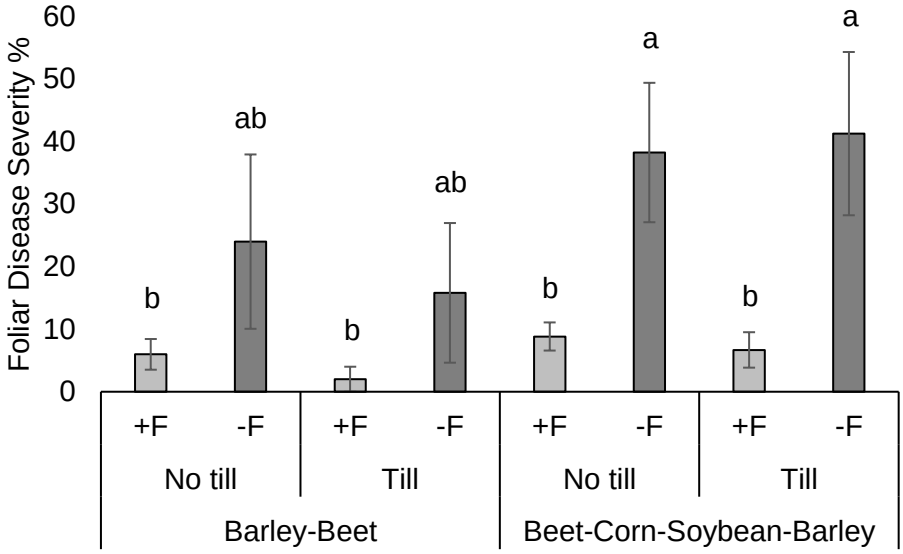


Figure 2. Foliar disease severity in different split-split plots (+/- F (fungicide treatment), till vs no-till, 2 year rotation vs 4 year rotation. Statistical differences indicated by lowercase letters. Similar letters indicate similar levels of disease severity ($\alpha = 0.05$).

Conclusions

Quantitative analysis of *Rhizoctonia solani* AG2-2 soil populations from field samples is still pending, however, first year root rot disease severity data indicates no difference between agronomic treatments that received fungicide treatment (**Fig 1**). There was a significant increase in root rot severity in the non-fungicide treated, no-till, four-year rotation treatment (**Fig 1**). No till and four year rotations including *Rhizoctonia solani* AG2-2 host crops corn and soybean did not appear to increase levels of crown rot symptoms (**Fig 2**). The only treatments with significantly higher levels of disease were those split-split plots not treated with fungicides in the four-year rotation but they were not significantly different from their counter parts in the two-year rotation (**Fig 2**).

Effects of Cropping Sequence, Ripping, and Manure on Pipeline Reclamation in Western North Dakota

Austin Link, Chris Augustin, James Staricka, Kevin Sedivec, Thomas DeSutter, Emma Link, Gautam Pradhan, Kyle Dragseth, and Jerald Bergman

Soil disturbance during the construction of pipelines, roadways, and well pads has become a serious issue in western North Dakota. Mixing of topsoil and subsoil and heavy equipment traffic often results in varying degrees of increased compaction, decreased water infiltration and holding capacity, erosion, reduced beneficial soil organisms, and subsidence. Reclamation of pipelines in a cropland setting has not been extensively researched and little is known about the best management practices for restoring soil fertility, structure, and crop performance. During the spring of the 2015, installation of a water pipeline was completed at the NDSU, Williston Research Extension Center. WREC took advantage of this opportunity by initiating a long-term experiment with five annual crop rotations and two perennial covers in pipeline, roadway (parallel to pipeline), and undisturbed (control) areas to determine best cropping sequences under dryland no-till conditions that reclaim severely disturbed cropland. Penetrometer readings and soil fertility tests will be recorded to assess changes in physical and chemical soil properties. Crop performance data will be collected for all annual cropping sequences and perennial sequences. Data will be collected annually and results will be analyzed after each cropping sequence has been completed (1, 2, and 4 years). Upon the completion of the 4-year sequence, all sequences will be cropped to wheat for 2 years, which will be used as one measurement of reclamation success. If soil health and crop performance have not improved satisfactorily after one 4-year sequence, the study will repeat the sequences a second time. In addition to cropping sequence, ripping/manure will be tested as the subplot in a split plot design. The results of this study will help improve long-term reclamation strategies for landowners dealing with reduced crop performance due to pipeline installations.

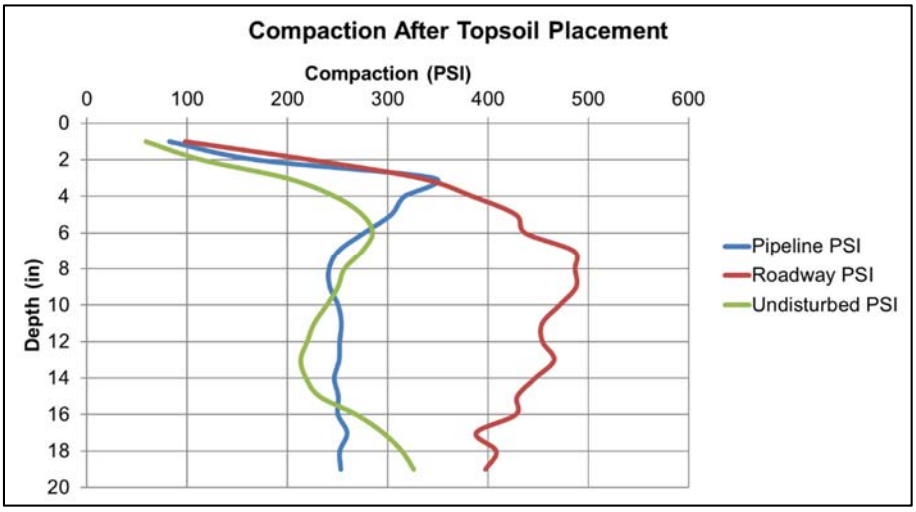


Figure 1. Compaction (PSI) > 250 PSI restricts root growth and compaction > 300 PSI ceases root growth and development.

Undisturbed - Ripped	Road - Ripped	Pipeline - Ripped
Undisturbed - Ripped/Manure	Road - Ripped/Manure	Pipeline - Ripped/Manure
Undisturbed - Min. Tillage	Road - Min. Tillage	Pipeline- Min. Tillage

Figure 2. Current cropping sequence treatment (main plot) with future ripped, ripped/manure, and minimum tillage treatments (sub plots) across undisturbed, road, and pipeline study areas.

Dryland and Irrigated Horticultural Crops

Research Update

By: Kyla Splichal

Williston Research Extension Center Field Day 2016. Photo taken by Justin Jacobs.

Horticulture in 2016

The year 2016 brought many changes to the Williston Research Extension Center; and the horticulture program was no exception. Aside from the always changing weather patterns, our most notable change was in our staff. WREC has gained a few new faces, along with a pathology program, which came in handy for all the tree diseases we saw this year! And while we added some wonderful new people this year, we also felt the loss of three staff members whose lives took them on to something new. For myself in the horticulture program, 2016 marked a solo endeavor, but that goes without saying how much Kim will be missed!

The program started off with most of the same projects from the previous year, with the addition of two exciting new trials, both of which were funded through the NDDA Specialty Crop Block Grant Program. The first, a collaborative grant with Dr. Todd West, NDSU Woody Plant breeder, will evaluate the hardiness of 40 tree species over the 2016 and 2017 growing seasons. The second, a tri-fold collaboration between NDSU, WREC and Dakota College at Bottineau will be looking at high tunnels and their effectiveness at extending the season to enhance the local foods market.

And speaking of season extension, our last spring frost occurred on May 15th and our first 30° nighttime temperature occurred on September 13th, with a killing frost occurring a month later. Our growing degree day accumulation from May 1st to September 26th was 2289, a bit short from last years 2500. Our rainfall totals according to NDAWN from April to October was 13.64” with September having over 5” of that total, which worked out nicely for anyone trying for a fall grass establishment.

All America Selection flower bed. Photo taken by Kyla Splichal

All-America Selection Garden

This year's All America Selection gardens really put on a show! The flowers made us smile with their colors all summer long, and the produce kept us busy harvesting from May to September. In total, 803 pounds of produce was harvested from the WREC gardens, most of which were AAS varieties. We look forward each year to the selections in which AAS has deemed winners and top performers in their class.

As you peruse the gardening magazines this winter in pursuit of something fun to try, be sure to look for the AAS logo. You won't be disappointed!

Garlic

Bulbs from Cheshok Red, German Porcelain, Inchelium Red, Kettle River Giant, Italian Loicano, Silver Rose and Elephant were saved from the 2015 harvest, and divided into cloves for the 2016 harvest. The varieties were planted into the high tunnel on September 16, 2015 and the results are as follows:

Garlic					**WREC- 2016**	
	------- 2014 -------		----- 2015 -------		----- 2016 -----	
	Yield	Harvested	Yield	Harvested	Yield	Harvested
Cultivar	--- lb ---	Bulbs	--- lb ---	Bulbs	--- lb ---	Bulbs
Northern White	2	17	2.2	11	--	--
Cheshok Red	4.6	31	4	21	2.0	10
Inchelium Red	--	--	--	--	2.1	8
Kettle River Giant	--	--	0.4	1	3.0	11
Italian Loiacano	--	--	0.6	8	1.7	9
Silver Rose	--	--	0.4	8	0.7	3
German Porcelain	0.6	13	1	8	1.3	8
Elephant	--	--	1.2	2	3.9	8
Planted: September 16, 2015					**Harvested:** July 11, 2016	
Previous Crop: Various Brassicas						

On September 20, 2016 all seven varieties were planted in garden bed #16 for 2017 evaluation.

Grapes

Grape Cultivar Trial						WREC - 2016
Variety	2014	2015	2016	3 yr. avg.		
	--------- total pounds ---------				Brix[1]	pH[2]
Valiant	115.4	20.6	54.3	63.4	17.8	3.3
King of the North	44.4	8.2	45.1	32.6	21.8	3.2
La Crescent	26.6	4.2	54.1	28.3	24.6	3.3
Frontenac N. Vyd.	26.2	2.0	50.5	26.2	25.2	3.1
Baltica	9.0	5.0	17.5	10.5	25.0	3.6
Sabrevois	6.6	0.2	10.2	5.7	22.4	3.5
Frontenac Gris	*	7.0	35.5	---	24.2	3.1
Somerset Seedless	1.8	*	9.7	---	19.4	3.6
Total	230.0	47.2	276.9			
* did not yield						
[1] Brix is a unit of measure for the sugar concentration in a liquid						
[2] pH is used to determine grape ripeness based on acidity level						

Hops

Hop cones. Photo taken by Kyla Splichal

In the fall of 2014, WREC was awarded a USDA Specialty Crop Block grant which allowed for expansion of hop variety research and establishment of a new hop yard. As a result of collaborative efforts with Dr. Harlene Hatterman-Valenti in Fargo, a similar hops variety trial was established in Absaraka, ND. This season marks the conclusion of this grant award.

This year, we started training the hop bines on May 23rd. The bines were trained onto four different string treatments randomized across the three reps. The treatments are as follows: double stranded natural baling twine, single strand synthetic baling twine, single strand landscape rope and single strand braded sisal. Observations of the hop growth in relation to the string treatments seemed to suggest that the hops struggled to hang on to the synthetic twine, while the natural-made string treatments degraded at the soil level over the course of the season.

In some cases, the hops became detached from the synthetic twine, from the wind for example, and they would attempt to re-attach themselves at any point on the string which would cause noticeable loops and shortened bine height. (See Figure 1). In the case of the natural string treatments, degradation would cause the string to break off at the soil level, and without the string being securely anchored down, the bine would sway rather loosely causing some of the

bines to snap off at the base. (See figure 2). The industry standard for stringing a commercial hop yard is with coir - a type of strand made from the husk of the coconut. This is the same type of material sold on a roll that is used to line metal flower baskets. It is durable and long-lasting.

The hop cone harvest started August 25th and continued through September 8th using a Hopster 5P mechanical harvester. We cut the bines down from the trellis and harvested directly in the field. Data from this hops variety trial allows us to compare varieties for adaptation to Western North Dakota. Hops is a perennial crop and will continue to be grown, strung and harvested in the upcoming seasons. See tables for harvest information.

Figure 1. Photo taken by Tyler Tjelde

Figure 2. Photo taken by Kyla Splichal

Hops Variety Information — WREC-2016

Variety	Origin[1]	Brew Usage[2]	Typical Beer Style	Typical Alpha Acid Ranges	2015 Tested Alpha Acid	2016 Tested Alpha Acid	2015 Hop Storage Index[3]	2016 Hop Storage Index[3]	2016 Harvested Moisture
				---------- % ----------					---%---
Brewer's Gold	UK	B	Ale	8-10	3.2	7	0.25	0.26	71.3
Cascade	DM	A	American Pale Ale	5-7	3.1	3.7	0.21	0.20	73.0
Centennial	DM	D	American Pale Ale	9.5-11	6.3	10.8	0.24	0.25	72.0
Challenger	UK	D	English Ale	6.5-9	8.9	14.2	0.24	0.25	71.3
Galena	DM	B	English Ale	10-15	6.2	8.5	0.21	0.21	74.7
Glacier	DM	D	American Pale Ale	5.5	4.2	4.2	0.24	0.23	70.0
Mt. Hood	DM	A	Lager	4-7	3.0	3.1	0.22	0.21	74.0
Newport	DM	B	Barley Wine	13-17	2.4	6.7	0.25	0.25	73.5
Nugget	DM	B	Barley Wine	12-14	3.6	12.6	0.22	0.22	70.7
Spalt Select	GE	A	Bock	3-6.5	3.0	2.6	0.26	0.27	68.5
Willamette	DM	A	English Style Ale	4-6	2.0	3.0	0.26	0.27	72.3
Zeus	DM	B	Pale Ale	20	1.2	3.9	0.26	0.23	77.5
								Mean	72.4
								C.V. (%)	3.6
								LSD (10%)	3.7

[1]DM = Domestic, UK = United Kingdom, GE = German as reported by Hopunion LLC

[2]A = Aroma, B = Bittering, D = Dual purpose as reported by Hopunion LLC

[3]HSI is a non-dimensional number calculated by measuring the adsorption of an alkaline methanolic hop extract at two different wavelengths using UV spectrophotometric analysis. Normal range is from 0.25 for fresh hops and 2.5 for fully oxidized hops.

Hops Variety Yields — WREC-2016

Variety	2015 Reported Yield for Idaho[4]	2015 Reported Yield for Oregon[4]	2015 Reported Yield for Washington[4]	2015 Yield	2016 Yield	2 year Average
	---------- Pounds/Acre ----------					
Challenger	Not Reported	Not Reported	Not Reported	2539	2429	2484
Galena	Not Reported	Not Reported	1968	1846	1857	1851
Cascade	1633	1994	1936	1626	1930	1778
Nugget	Not Reported	1888	1927	1281	1031	1156
Newport	Not Reported	Not Reported	Not Reported	1162	928	1045
Centennial	Not Reported	1352	1145	1041	1149	1095
Willamette	Not Reported	1226	1007	1036	1138	1087
Glacier	Not Reported	Not Reported	996	878	1401	1140
Brewer's Gold	Not Reported	Not Reported	Not Reported	632	1874	1253
Zeus	2909	Not Reported	2819	397	1967	1182
Mt. Hood	Not Reported	1276	1069	339	477	408
Spalt Select	Not Reported	Not Reported	Not Reported	177	1195	686
			Mean	1079	1448	1264
			C.V. (%)	38.5	36.7	--
			LSD (10%)	584	830	--

[4]USDA-NASS report prepared by Hop Growers of America

Juneberries

Juneberry fruit cluster. Photo taken by Kyla Splichal

Juneberry (*Amelanchier alnifolia)* is a shrub native to North Dakota that is of particular importance to Native Americans. This treasured prairie fruit was a staple in their diet and was used for many cultural rituals, hence the other common name, Serviceberry. Currently, all cultivars in both Canada and the U.S. are selections taken from native populations from Michigan to Alberta as no formal breeding work has been conducted on this crop. Identification of superior native plants in the first step towards plant improvement.

As part of a Specialty Crop Block Grant in collaboration with Dr. Harlene Hatterman-Valenti, WREC received funding to plant 300 juneberry shrubs in a variety selection trial. She and fellow NDSU researchers surveyed North Dakota for unique and potentially superior native juneberry plants, and propagated the selections through tissue culture. The juneberry selection trial was planted on July 17 – 18, 2012.

Each year, the shrubs have been evaluated for winter survival, spring frost damage, summer growth, disease resistance, and productivity.

This season, the plants began to break bud the whole month of April. They flowered at the start of May, harvest began on June 20th and went until mid-July. Supplemental watering by drip irrigation tape began in May with the system start up and tapered off after harvest.

See harvest table for more information.

Bud break. Photo taken by Kyla Splichal

Juneberry flower. Photo taken by Kim Holloway

Juneberry Cultivar Trial **WREC - 2016**

Variety	Height	Width	Days to 50% Budbreak[1]	Days to 50% Flowering[2]	Days to 1st Harvest[3]	Days to 2nd Harvest[4]	Total Yield	Average weight of 50 berries	Diameter in mm	Brix	pH	CAR[5]	ENT[6]	PM[7]
	--- meters ---		------ Calculated from Bud Break Date --------				lbs	-- gms --	--- Average of 10		----	------- % of shrub ------		
1-2	1.3	1.6	2.4	15.2	70.0	80.0	8.3	41.0	10.4	12.9	4.4	6.4	30.0	65.0
1-4	1.2	1.4	6.0	14.8	69.8	81.3	9.5	45.2	11.1	12.5	4.5	7.0	10.5	62.0
1-5	1.2	1.7	5.2	16.4	70.2	77.3	11.5	43.8	10.8	13.7	4.4	5.7	17.2	54.0
1-6	1.3	1.4	5.2	16.2	70.6	80.7	11.5	39.0	10.9	12.8	4.4	11.8	16.3	67.5
1-7	1.0	1.4	7.2	19.0	71.0	83.7	8.8	35.6	10.5	14.0	4.5	33.3	43.8	69.0
5-1	1.3	1.2	6.8	27.3	74.3	90.3	1.7	39.8	10.5	14.9	4.0	55.0	68.3	18.8
9-1	1.2	1.7	8.4	23.2	74.4	89.0	3.7	46.0	11.2	14.3	4.3	45.2	18.3	49.2
12-1	1.2	1.2	6.6	26.6	74.6	90.3	2.0	27.4	9.2	13.9	4.1	34.0	76.0	46.0
15-2	1.3	1.1	3.6	24.8	74.6	88.7	1.5	28.4	9.3	14.8	4.1	24.3	54.0	33.3
16-1	1.1	1.3	4.0	23.8	73.6	86.3	3.8	30.8	9.8	15.8	4.4	61.2	44.0	41.3
17-2	1.0	1.2	1.4	17.6	68.0	77.7	2.0	26.6	9.6	15.6	4.3	18.0	44.0	63.8
18-1	1.5	1.5	5.4	26.0	77.4	93.3	2.7	28.0	9.5	12.5	4.2	42.2	34.0	29.0
41-1	1.2	1.3	2.8	22.4	74.8	91.7	3.5	30.4	10.2	14.4	4.2	34.0	61.3	83.8
48-2	1.3	1.7	6.8	15.0	68.8	82.0	12.8	38.3	10.4	14.0	4.5	14.0	27.0	51.7
71-1	1.5	1.6	5.6	24.8	75.8	89.7	2.4	38.2	10.6	14.6	4.2	56.0	30.0	21.6
Buffalo	1.4	1.4	3.7	20.5	69.4	83.3	5.1	37.3	10.7	13.2	4.2	15.3	86.3	40.0
Honewood	1.5	1.1	6.8	20.5	70.3	80.0	8.5	43.3	11.9	12.8	4.4	55.0	50.0	10.0
Kelner	1.4	1.6	7.4	23.8	72.6	86.3	4.6	63.8	12.6	14.1	4.0	37.0	20.7	11.6
Parkhill	1.3	1.4	8.0	21.0	74.0	88.5	2.5	39.5	10.7	16.7	4.4	35.3	10.3	58.3
Regent	1.1	1.6	6.4	14.8	66.8	79.3	9.0	39.0	10.7	12.8	4.4	1.0	19.0	80.0
Mean	1.3	1.4	5.5	20.7	72.0	85.0	5.8	38.1	10.5	14.0	4.3	29.6	38.0	47.8
C.V. (%)	17.7	19.4	68.4	20.3	5.3	4.3	0.1	28.7	9.1	11.4	4.2	---	---	---
LSD (P=0.1)	0.2	0.3	3.9	4.4	4.0	5.0	3.3	11.5	1.0	1.7	0.2	---	---	---

Planted: July 2012

[1] Days from bud break to date of when 50% of shrub reached bud break. [2] Days from bud break to date of when 50% of shrub reached flowering.

[3] Days from bud break to date of 1st harvest date. [4] Days from bud break to date of 2nd harvest.

[5] CAR = Cedar Apple Rust. [6] ENT = Entomosporium Leaf and Berry Spot. [7] PM = Powdery Mildew.

Master Gardener Pollinator Garden

This year, Williams County was the recipient of one of the 2016 Extension Master Gardener Pollinator Garden Grants that was facilitated at WREC. The purpose of these gardens are to provide Master Gardeners with projects, build a habitat that will nourish pollinators, and to create a public teaching garden that can be jointly utilized by Master Gardeners and Extension Agents to encourage members of the general public to build home pollinator gardens.

Master Gardener's from WREC planting the pollinator garden. Left to right: Audrey Kalil, Haley Becker, Emma Link and Taheni Jbir. Photo taken by Kyla Splichal.

Perennial Trials

This trial was established in collaboration with NDSU Extension Horticulturist Dr. Esther McGinnis which aims to evaluate the cold hardiness of new cultivars of both *Echinacea* (14 varieties) and *Heuchera* (16 varieties). On June 4th, 2015 the trial was planted and evaluated in the fall for aesthetic qualities for the landscape which included ratings of ornamental value and pest incidence. This spring, the trial was evaluated for winter survival, spring growth, ornamental value and pests.

Echinacea coneflower planting. Photo taken by Kyla Splichal

***Echinacea* Coneflower Trial**						**WREC - 2016**
	Plant Size		Flower	Ratings[1]		
	--- Inches ---		Count	Spring Growth	Pest	Ornamental
Cultivar	Height	Width	# in bloom	--- 1 to 5 ---	--- 1 to 10 scale ---	
Ruby Star	15.5	15.5	25.7	3.3	8.3	5.3
Sombrero Coral	19.3	16.2	44.0	3.0	6.7	4.7
Hot Papaya	16.5	16.4	5.1	2.3	8.3	5.5
Pixie Meadowbrite	14.9	18.6	59.1	1.8	7.5	4.0
Cleopatra	10.0	12.3	16.7	1.7	8.3	6.0
Pow Wow White	14.8	16.7	45.7	1.3	8.0	7.0
Supreme Cantelope	7.9	8.8	0.8	1.3	8.5	3.3
Purple Emperor	14.3	12.8	33.0	1.0	6.5	6.8
Salsa Red*	--	--	--	0.5	--	--
White Swan*	--	--	--	1.0	--	--
Fatal Attraction*	--	--	--	1.5	--	--
Butterfly Kiss*	--	--	--	1.3	--	--
Julia*	--	--	--	2.0	--	--
Piccolino*	--	--	--	0.3	--	--
Mean	14.1	14.6	28.8	1.6	7.8	5.3
LSD 10%	9.50	6.24	48.94	1.49	3.28	3.43

Planted: June 04, 2015 **Spacing:** 3' on center

[1]**Rating Scale:** 1 being low, 10 being high. Spring Growth Rating 1 being low, 5 being high.

* These varieties had poor winter survival and could not be included in statistical analysis.

***Heuchera* Coral Bells Trial**							**WREC - 2016**
	Plant Size		Inflorescense	Flower	Ratings[1]		
	Height	Width	Height	Count	Spring Growth	Pest	Ornamental
Cultivar[2]	--- Inches ---			# in bloom	--- 1 to 5 ---	--- 1 to 10 scale ---	
Stainless Steel	12.0	17.9	26.3	85.5	5.0	10.0	9.9
Berry Smoothie	6.6	13.5	2.8	0.3	5.0	7.0	5.0
Obsidian	10.0	17.9	23.0	36.8	4.5	10.0	10.0
Frosted Violet	9.3	15.4	21.4	34.5	4.5	7.5	6.9
Plum Pudding	8.8	17.5	22.3	32.5	4.5	10.0	10.0
Caramel	5.4	10.0	0.0	0.0	4.5	5.0	4.6
Crimson Curls	7.6	17.1	18.6	7.5	4.3	10.0	10.0
Midnight Rose	10.5	18.4	24.3	34.8	4.3	7.5	7.5
Apple Crisp	5.0	9.8	11.6	46.0	3.3	7.5	7.5
Lime Marmalade	5.9	11.6	10.6	6.8	3.0	7.5	5.3
Cherry Cola	6.9	12.3	11.3	18.8	2.5	10.0	9.3
Zipper	7.8	15.4	3.3	0.8	2.5	10.0	9.6
Miracle	6.1	12.9	13.3	7.5	2.5	10.0	7.5
Marmalade	5.9	11.8	7.5	2.8	2.3	7.5	6.5
Autumn Leaves	3.5	7.0	4.8	3.5	1.0	7.5	3.8
Mean	7.4	13.9	13.4	21.2	3.6	8.5	7.6
LSD 10%	3.95	7.87	7.32	18.85	1.23	4.43	3.94

Planted: June 04, 2015 **Spacing:** 2' on center

[1]**Rating Scale:** 1 being low, 10 being high. Spring Growth Rating 1 being low, 5 being high

[2]The variety 'Fire Alarm' was not included in results for Williston and Absaraka trials because of poor survival after transplanting

Heuchera coral bells planting. Photo taken by Kyla Splichal

Tree Trial

Western Tree Trial. Photo taken by Kyla Splichal

On May 19-20th WREC along with the NDSU Woody Plant research team planted 20 different tree species as part of a Western Tree Trial. Under the direction of Dr. Todd West, NDSU, WREC, and the cities of Dickinson, Bismarck, Minot and Williston received funding from the USDA Specialty Crop Block Grant to study the hardiness of commercially available tree species which may or may not be suitable for planting in western North Dakota.

The purpose of this project is to provide updated tree species and/or cultivar information to North Dakota commercial nursery crop producers and retailers by evaluating potential woody species to enhance, diversity and increase the inventory of usable landscape plants for USDA hardiness zones 3-4. This trial will also help enhance and expand the ND Tree Selector program (http://www.ag.ndsu.edu/tree-selector/).

Laying out the trial. From left to right: Rojee Pradhan and Emma Link. Photo taken by Gautam Pradhan.

A total of 80 trees were planted at WREC into an existing alfalfa field this spring, with another 80 to be planted and evaluated next growing season. Each tree was fitted with a 20-gallon capacity watering bag, and were watered once a week. The trees will be evaluated on establishment, winter and drought hardiness, soil adaptation, pest susceptibility, aesthetic characteristics and survival in Western North Dakota.

Check back next year for a complete listing of cultivars, as well as evaluation information.

Irrigated

Sweet Potatoes

Sweet potato trial row coverings from left to right: black plastic, landscape fabric and uncovered bare soil. Photo taken by Tyler Tjelde.

Sweet potatoes are a perennial vine that produces a fleshy, sweet-tasting, starchy root belonging to the morning glory or *Convolvulaceae* family. WREC has been testing sweet potatoes since 2010 and for the past two seasons, testing has been done on ground coverings and their effects on soil temperatures. Since sweet potatoes are a root crop that thrive in warmer climates, this evaluation was conducted to see if soil coverings would have any effect on growth and yield. The treatments that were chosen were black woven landscape fabric, black plastic and bare soil as the check. The treatments were laid out with soil sensors with two leads buried 4" below the soil surface on June 2nd. Two varieties of sweet potato, Georgia Jet and Beauregard, were chosen based of previous years' performance. The trial was set up in a randomized complete block design with four replications and three treatments.

The sweet potatoes were planted as slips every twelve inches on June 7th. Soil temperature data was collected every 15 minutes. As a result of a light frost on early morning of September 13th, the vines were cut off at the ground level to reduce any compounds that translocate into the roots that cause decay. They were harvested, graded and cured in the following weeks.

The harvest data indicates that there were no significant differences detected between the treatments, however there was a significant difference between the yields of the two varieties.

Irrigated Sweet Potato Trial										**WREC-Nesson Valley 2016**	
				USDA Grades					2016	2015	2 year
Variety	Treatment	Number Planted	Stand Count	US No. 1	Petite	US No. 2	Commercial	Cull	Yield	Yield	average
				cwt/A							
Beauregard	Bare	12	8.0	40.4	18.2	13.1	1.7	129.9	203.2	118.1	160.7
	Fabric	12	9.5	53.8	27.1	17.4	30.3	68.1	196.8	452.8	324.8
	Plastic	12	9.3	86.9	23.1	11.2	36.1	49.8	207.0	332.2	269.6
Georgia Jet	Bare	18	12.8	52.9	22.2	37.5	10.6	52.2	175.3	126.4	150.8
	Fabric	18	14.8	86.1	22.1	57.8	29.6	62.5	258.1	203.8	230.9
	Plastic	18	14.8	110.0	22.2	25.8	55.0	69.7	282.7	118.2	200.4
Mean			11.5	71.7	22.5	27.1	27.2	72.0	220.5	225.2	222.9
C.V. (%)			14.7	37.8	38.5	95.8	58.8	69.3	34.4	--	--
Planted: 6/7/2016										**Harvested**: 9/15/2016	
Previous Crop: Soybeans											
Plot size: 38 ft^2 / 52 ft^2											
Soil: Lihen Fine sandy loam; pH 7.7, O.M. 3.2%, 23 lbs N, 33 ppm P and 369 ppm K											
Fertilizer: 200 lbs of 46-0-0 applied on April 1st. 100 lbs of 46-0-0 applied on June 28th.											
Rainfall: 6.23" from June 7th to September 15th.											
Irrigation: 12.65" from June 9th to September 14th.											

High Tunnel

Funding from the USDA Specialty Crop Block Grant through the North Dakota Department of Ag, allowed WREC to purchase and build a 26'x96' Rimol high tunnel for cut flower and vegetable research. This grant award is a collaborative effort between NDSU, WREC and Dakota College at Bottineau. The goals of this research endeavor were to identify high-yielding traditional and non-traditional crops for production in North Dakota high tunnels for each of the three locations so that growers near these locations can determine when to plant and what

High tunnel constructed at Nesson Valley along Highway 1804. Photo taken by Tyler Tjelde

pest management issues to expect. A second goal was to develop a communication center for ND high tunnel growers. A Facebook page titled North Dakota High Tunnels has been set up for anyone interested in seeing the progress of this project, reading about high tunnel production, or posting their own inquiries. https://www.facebook.com/groups/NDHighTunnels/. A listserv through NDSU has also been set up for those who would like more information. To subscribe, please contact Kyla Splichal (kyla.splichal@ndsu.edu).

The crops that were chosen as traditional were tomatoes, peppers and cucumbers. The non-traditional crops in this trial were cut flowers for the fresh market. Two varieties of dahlia, three varieties of lisianthus, two varieties of snapdragon and two varieties of delphinium were selected to be studied in two trial locations-one inside the high tunnel and one adjacent to the high tunnel in a field. There were nine varieties each of slicing tomatoes, bell peppers and cucumbers.

The trial at WREC was planted at the end of May and beginning of June. It began producing around July 5th and continued into the fall. The bell peppers produced until November 22nd with about 180 pounds from the high tunnel alone. The tomatoes from the high tunnel produced 325 pounds until November 10th. The cucumbers began producing later in July and went until around Labor Day when disease pressure became too high. Approximately 625 pounds of cucumbers were harvested during that time. Three of the cultivars were pickling cucumbers, the rest were slicing.

Cut flowers. Multi-colored snapdragons, red dahlias and purple lisianthus. Photo taken by Kyla Splichal.

Irrigated Onion Variety Trial — WREC - Nesson Valley 2016

Variety	Seed Source	Days to Maturity*	2014 Yield	2015 Yield	2016 Yield	3 Year Average	<2 1/4"	2 1/4 - 3"	3 - 4"	Culls	Single Center	Total
			---------- cwt/A ----------				Average Number Bulbs/Plot Row				---- % ----	--Bulb/A--
Crockett	Bejo	118	980	657	1047	895	8	23	12	17	70	220610
Sedona	Bejo	118	743	579	1345	889	6	22	16	5	80	213130
Delgado	Bejo	115	560	685	1166	804	5	19	20	6	40	193521
Hamilton	Bejo	118	694	713	902	769	5	19	13	12	63	177760
Calibra	Bejo	115	440	556	1203	733	7	12	14	10	30	206836
Trailblazer	Takii	100	213	334	518	355	10	16	5	8	17	155127
Grand Perfection	Takii	125+	-----	-----	1231	-----	3	15	23	7	77	190241
Traverse	Takii	105	-----	-----	976	-----	2	16	19	8	30	183229
Gunnison	Bejo	110	703	-----	951	-----	2	13	16	4	27	172728
Centerstone	Takii	110-115	-----	-----	883	-----	1	12	17	5	53	146869
Milestone	Takii	105-110	-----	-----	772	-----	0	11	15	4	20	124117
Mean			619	587	1000	741	4	16	15	8	46	180379
C.V. (%)			-----	-----	16.3	-----	76.7	45.4	48.4	38.0	32.0	12.8
LSD (P= 0 .1)			-----	-----	229.7	-----	4.8	10.4	10.4	4.3	20.8	32581

Planted: 4/21/2016 **Harvested**: 8/29/2016

Soil: Lihen fine sandy loam soil; pH=7.7; 3.2 O.M.; 23 lb. N; 33 ppm P and 369 ppm K.

Planting: 5 row cone seeder at 7 ½" spacing. The three center rows of each plot was thinned to 3-4" between bulbs.

Fertilizer: 197 lbs of 46-0-0 applied 4/1/2016

Weed/Pest Control: All seed pelleted with differing formulations of insecticide and fungicide per seed company. Section 2EC 6 oz/A on June 6th; Moxy 1.5 pt/A on June 8th; and Prowl H_2O 2pt/A on June 27th. Hand weeded as needed.

Rainfall: 8.47" from April 21st to August 29th 2016.

Irrigation: 11.35" from May 17th to August 24th 2016.

Harvest: The center row was hand harvested from each plot August 29th, weighed and counted in the field. Onions were graded in the lab on September 6th & 7th and shown as Average Number Bulbs/Plot Row. The thinned adjacent rows were harvested by hand, weighed and counted to calculate total plot weights, cwts, bulb count, bulbs per acre

* Days to Maturity reported from seed company.

Effects of Max-In Boron on Sugarbeet Production.

Tyler Tjelde

Introduction

Max-In Boron is being tested in sugarbeets to identify applicable timings for increased sugar concentration. The research was conducted at the Nesson Valley Irrigation Research and Development Project to test the effects of one pint per acre of Max-In Boron applied to sugarbeets.

Experimental Design and Methods

The experimental design is a Randomized Complete Block Design (RCBD) with four replications. Each plot will be 30ft. by 100 ft. with Max-In Boron treatments randomized for each plot. The treatments consist of four treatments: 1)no application, 2)last herbicide (glyphosate) application + 1st week August, 3)last herbicide (glyphosate) application + 3rd week August, and 4)last herbicide (glyphosate) application + 1st week September. Sugarbeets will be planted and beets will be monitored for visual differences during the season for plant growth following application treatments. Max-In Boron will be applied at one pint per acre per treatment and tank mixed with last herbicide application of glyphosate. Subsequent treatment applications will be applied alone. Ten gallons of water will be applied per application. Root sampling will occur in early August, and early September and at harvest (late September). Samples will be analyzed at Sidney Sugars laboratory and samples will be statistically analyzed for treatment differences.
All cultural practices (tillage, fertilizer, planting populations, chemical, and fungicide applications) will be the same for the sugarbeets in the trial to minimize the effects of variables other than Max-In Boron application treatment timings.

Year 1 Results

Table 1. Effects of Max-In Boron on Sugarbeet Production

Treatment	Application Date	sample 1 (Aug 11)		sample 2 (Sept 8)		sample 3 (Sept 21)	
		sugar	recoverable sugar	sugar	recoverable sugar	sugar	recoverable sugar
		%	lbs/a	%	lbs/a	%	lbs/a
1	no application	12.7	3102	15.2	6782	17.0	9128
2	7/18 and 8/5	12.2	2892	15.2	7346	16.2	8130
3	7/18 and 8/25	12.6	2687	16.1	6486	17.4	9680
4	7/18 and 9/7	12.0	2700	15.5	6776	16.9	9386
LSD 5%		n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
LSD 10%		n.s.	n.s.	0.9	n.s.	1.0	727

Conclusion

Response to Max-In Boron was not significant when comparing the application treatments to the check application. Significant differences did occur ($P<0.10$) between percent sugar in samples 2 and 3 and recoverable sugar in sample 3 (Table 1). The differences did not directly reflect upon the benefits of applying Max-In Boron to the check (no application) treatment. Sample 1-3 were taken on August 11, September 8 and September 22 respectively. This trial will be performed again in 2017 to determine if application timing does factor in on sugarbeet production.

Effects of Sugarbeet Factory Spent Lime on Crop Production in a 4-Year Crop Rotation of Wheat, Sugarbeet, Barley, Potato, Wheat, and Sugarbeet.

Tyler Tjelde, James Staricka, Justin Jacobs, and David Schmidt

Introduction

Sidney Sugars contracts on average 30,000 acres of sugarbeets yearly. Each year there is approximately 16-18 thousand tons of spent lime produced as a by-product of the beet sugar purification process. There is approximately 75 years of the spent lime available at the Sidney Sugars facility. Is this a product that can be utilized to improve soil health, increase nutrients in the soil, and/or improve crop production? Research has been conducted in eastern ND and western MN demonstrating the benefits of lime on the soil and crop production. Some of the benefits reported from this work are long term control of Aphanomyces and addition of phosphorus and other micro nutrients. No negative responses from the lime were determined. How will this lime affect the sugarbeet production and how will other rotational crops be affected by the addition of lime to the soil? Will the results differ in western ND where the soil pH is upper 7 – low 8, compared to eastern ND and northwestern MN where pH is low 7.

Methods and Experimental Design

The study will be conducted at the Nesson Valley Irrigation Research Site (48°09'75" N, 103°06'32" W), approximately 28 miles east of Williston, ND. The soil type is a Lihen sandy loam (sandy, mixed, frigid Entic Haplustoll), consisting of very deep, somewhat excessively or well drained, nearly level soil that formed in sandy alluvium, glacio-fluvial, and eolian deposits in places over till or sedimentary bedrock (Soil Survey of Williams County, ND 1991).

The experimental design is a Randomized Complete Block Design (RCBD) with four replications. Each plot will be 25 ft. by 75 ft. with lime rates randomized for each plot. The treatments consist of six lime rates (0, 2.5, 5, 10, 15, 20) tons per acre applied only once for the duration of the project. Prior to lime application soil sampling was conducted on each plot. Analysis will include Nitrogen, Phosphorus, Potassium, Sodium, Calcium, Magnesium, Sulfur, EC, pH, and organic matter. Lime application occurred in spring 2016 for each plot at the treatment rate. Lime was incorporated using a mulcher prior to planting wheat.

Wheat was planted May 3 and after emergence plant growth observed to identify any differences between treatments. Plant heights prior to harvest and yields were measured from each plot and data statistically analyzed. Soil sampling occurred following harvest of each plot.

Year 1 Results

Effects of Spent Lime on durum wheat show no significant differences in yield between treatments (Table 1). Significant differences ($P<0.05$) between protein and test weight were observed among treatments but the relationship between treatments does not reflect the addition of spent lime. Plant growth was not influenced by the addition of spent lime.

Soil samples had not been analyzed by time this report was prepared. When the results are received, the data will be analyzed to compare soil chemical properties on six treatments.

Table 1. Irrigated Durum — **WREC - Nesson Valley 2016**

Treatment Spent Lime	Plant Height	Protein[1] 2016	Test Weight	Yield 2016
tons/a	inch	%	lb/bu	bu/a
0	39	16.4	56.3	66.1
2.5	39	16.4	56.9	64.2
5	39	16.1	57.1	64.8
10	39	16.5	56.5	63.4
15	39	16.2	57.4	67.3
20	39	16.6	56.8	63.0
Mean	39.0	16.4	56.8	64.8
C.V.%	-	1.5	0.6	8.4
LSD 5%	-	0.31	0.45	n.s.

Planted: 5/3/2016 — Harvested: 8/16/2016

Protein[1] = reported on an as is moisture basis

Soybean Plant Population and Row Spacing for Semi-Arid Western North Dakota

***Gautam Prasad Pradhan**, Jerald W. Bergman, James A. Staricka*
Emma Link, Austin T. Link, Kyle Dragseth and David Weltikol
Email: gautam.pradhan@ndsu.edu

Importance of the research project

North Dakota is the fourth largest soybean growers in the nation. Recently, the state has a tremendous increase in soybean acreage (209% more in 2015 from 1.85 million acres in 2000), which is due to increases in acreage in all parts of the state including the western region. The western ND has exceptionally drier climate than the eastern part. It receives about 15 inches of precipitation annually as compared to 21 inches in the east, and average annual evapotranspiration is 5 inches higher than the east. There is a need of a soybean production management guideline suitable for no-till dryland soybean producers of western ND. This research was conducted under no-till dryland condition to find out a suitable soybean plant population and row spacing that has a higher grain yield, quality, and farm income; has favorable morpho-physiological traits; and higher water use efficiency.

Materials and methods

A RR2Y soybean variety (LS03R560) with a maturity group of 0.3 was planted at Williston Research Extension Center on June 3, 2016 using SRES (Seed Research Equipment Solutions) precision planter (Picture 1). The row spacing of 7½, 15, 22½, and 30 inches were maintained as main plots and the plant population of 90, 120, 150, and 180 thousand/acre were considered sub plots (Picture 2). The canopy temperature and normalized difference vegetation index (NDVI) were measured weekly from the R1 stage using a FLIR® E60 Thermal Imaging camera and a Trimble GreenSeeker® Handheld Crop Sensor, respectively. Soil moisture was recorded four times in the season from each plot using a Neutron Moisture Meter. The crop was harvested on October 13, 2016 using a plot combine and biomass were collected four days before harvest.

Results

The annual precipitation at the experimental site from October 2015 to September 2016 was 14.4 inches and the growing season precipitation from June to September 2016 was 6.7 inches. The preliminary results showed that the plant stand (plant number ft-2) increased linearly as per the increase in plant population (Fig. 1a). The plants at row spacing of 22½ and 30 inches were about 1 to 1½ inches taller than at row spacing of 7½ and 15 inches (Fig. 1b). The plant population of 90 thousand per acre and the row spacing of 7½ inches had the highest number of branches per plant than other corresponding treatments (Fig. 1c, 1d). The effects of plant population and row spacing on pod number were similar as on the branch number per plant (Fig. 2a, 2b). The plant populations of 90, 120, and 150 thousand per acre had a higher grain yield than the 180 thousand population (Fig. 2c,); and the row spacing of 7½ inches had the highest grain yield than other row spacing (Fig. 2d). The effect of plant population on grain yield was evident at 7½, 15, and 22½ inches row spacing, but not at 30 inches (Fig. 3); grain yield was generally higher at 7½ inch irrespective of population rate; and within 7½ inches row spacing, the plant populations of 90 and 150 thousand per acre had a higher grain yield than the 180 thousand population.

Summary

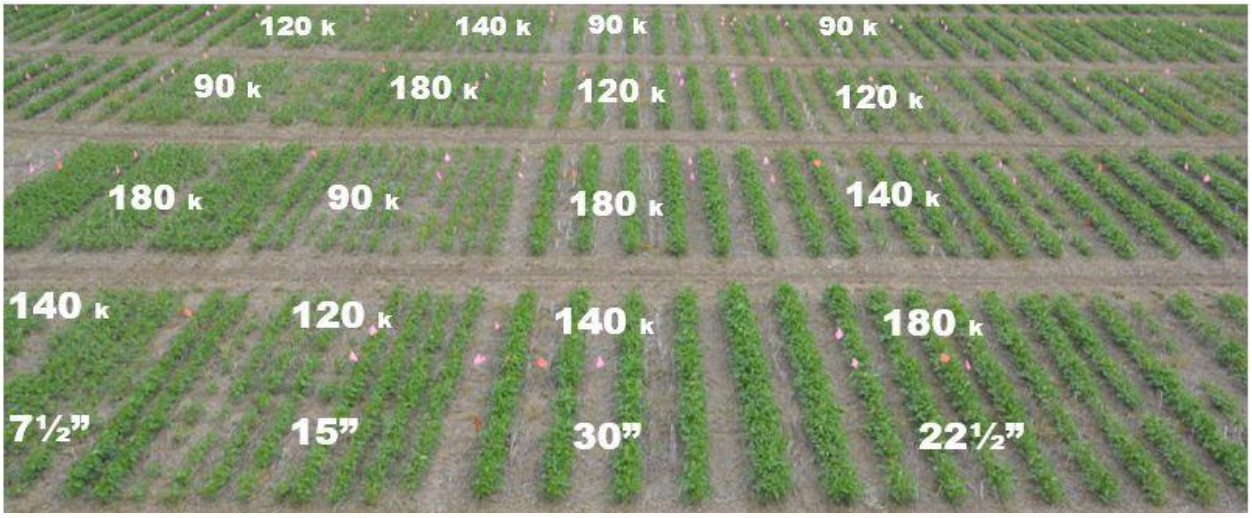
The growth and yield results mentioned above showed that a row spacing of 7½ inches with plant population of 90 thousand per acre is more suitable than other planting geometry for no-till dryland soybean production in western ND. However, the data on physiology, quality, and soil moisture will be assessed to find out whether this combination is better than others in increasing water use efficiency and farm income of the soybean producers. The experiment will be repeated next year to validate the findings.

Acknowledgements

We would like to thank the North Dakota Soybean Council for the financial support. Mention of trademark or proprietary product does not constitute a guarantee or warranty of the product by NDSU Williston Research Extension Center and does not imply its approval to the exclusion of other products which may also be suitable.

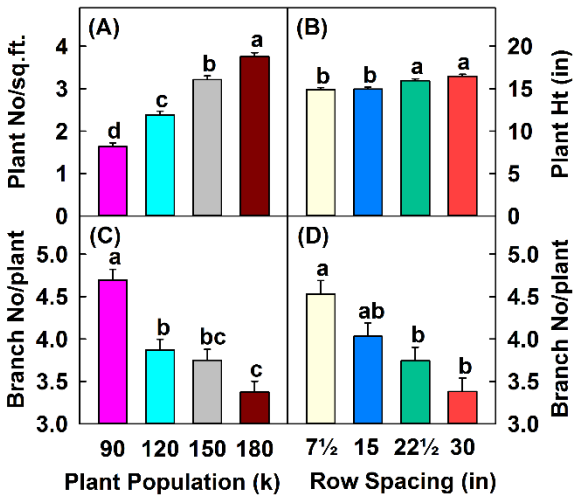
Picture 1. Planting soybean using a SRES (Seed Research Equipment Solutions) precision planter.

Picture 2. An Aerial view of the replication two of the experimental plot†.



†k stands for thousand.

Figure 1. Soybean growth*.



*k stands for thousand.

Figure 2. Soybean yield.

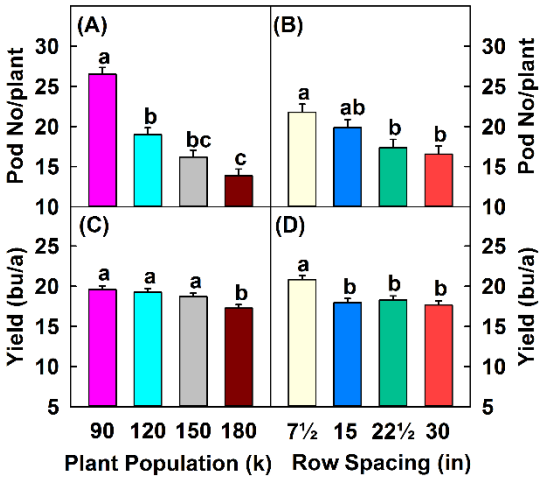
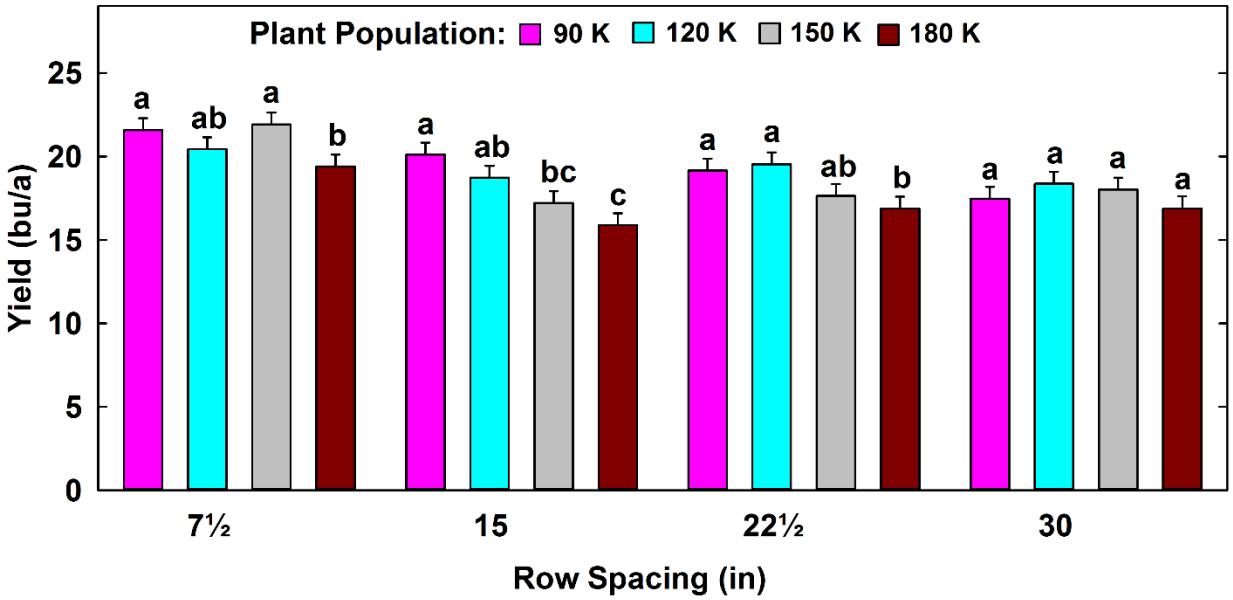


Figure 3. Interaction effect of plant population and row spacing on soybean yield.



Biofortification of Spring Wheat and Durum with Zinc and Iron to Improve Yield and Nutritional Quality — EARC, Sidney, MT

Chengci Chen, Reza Keshavarz Afshar, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown, Benton Carr

Table 1: Effect Of Zn And Fe Foliar Application On Dryland Durum Measured Variables EARC, Sidney, MT

Treatment	Height cm	Yield bu/ac	Biomass lb/ac	HI	Test W lb/bu	Protein %	Grain Zn ppm	Grain Fe ppm	Straw Zn ppm	Straw Fe ppm
Control	74.8	38.5b	5190	0.45b	64.0	8.9	19.4b	32.8b	6.7b	254.0b
Zn application	73.5	41.7a	4615	0.55a	64.1	9.0	24.4a	33.8b	26.5a	394.3a
Fe application	75.0	38.2b	5074	0.45b	64.1	8.8	21.5b	142.0a	7.3b	366.3a
Level of significance	ns	*	ns	**	ns	ns	*	*	*	*
CV (%)	4.5	3.8	5.5	6.3	0.44	2.62	13.6	33	52	15

*: significant at *P*≤0.05; ns: non-significant

Table 2: Effect Of Zn And Fe Foliar Application on Dryland Spring Wheat Measured Variables EARC

Treatment	Height cm	Yield bu/ac	Biomass lb/ac	HI	Test W lb/bu	Protein %	Grain Zn ppm	Grain Fe ppm	Straw Zn ppm	Straw Fe ppm
Control	70.3	55.4	6879	0.48	63.9	10.8	17.2b	35.8	5.6b	287.3
Zn application	71.5	56.1	6496	0.52	63.5	10.8	25.6a	39.0	23.8a	337.0
Fe application	70.3	54.8	6733	0.49	63.7	10.9	18.4b	40.0	9.1b	318.8
Level of significance	ns	ns	ns	ns	ns	ns	*	ns	*	ns
CV (%)	2.2	4.6	8.7	8.3	0.29	1.1	18.5	10.1	52.2	21

*: significant at *P*≤0.05; ns: non-significant

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Fallow
Residual soil N: 28 lb N/ac
Planted: April 3, 2016
Variety: Jappa (durum) and Velva (spring wheat)
Harvested: July 25, 2016
Herbicide: Full Deck; Discover
Fungicide: Avaris
Precipitation April – August 2016: 9.74 in
Precipitation September 2015 – August 2016: 14.55 in

The experiment included control (no Zn or Fe application), one-time foliar application of Zn, and one-time foliar application of Fe. Zink (Zink sulfate monohydrate containing 35.5% zinc) and Fe (Ferros sulfate heptahydrate (FeSO4) containing 20% Fe) were sprayed at the rate of 0.9 lb/ac active ingredient at Feekes 10.1 growth stage.

Results:

Zn and Fe deficiencies are considered one of the most important micronutrient deficiencies in humans. A big proportion of Montana wheat products are exported to other countries including developing countries in Asia, therefore improving the quality of the product through biofortification with micronutrients such as Zn and Fe could impact the marketability of Montana's wheat in international markets.

Our results showed that Zn application significantly increased durum yield by 191 lb/ac, but had no significant effect on protein, and test weight (Table 1). Fe application showed no significant effect on yield and biomass of durum compared to control.

Application of Zn significantly increased Zn concentration in grain and straw. Grain Zn concentration increased from 19.4 ppm in control plants to 24.4 ppm in Zn-treated plants, which means 25% increase. The increase in straw Zn concentration was even greater; Zn application increased Zn concentration in the straw by 235%. It shows that foliar application of Zn enhanced Zn concentration in vegetative tissues but most of it could not translocate to the grain. Since Zn application increased durum yield as well as its grain Zn concentration, it seems that there is a good potential for application of this micronutrient.

Zn application also increased Zn concentration in spring wheat grain and straw without significant effect on grain yield and protein (Table 2).

Improvement of Yield and Quality of Spring Wheat through Nitrogen Management

EARC, Sidney, MT

Chengci Chen, Reza Keshavarz Afshar, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown, Benton Carr

The Experimental Treatments:

A: two sources of nitrogen fertilizer (urea and SuperU [an enhanced-efficiency nitrogen fertilizer containing urease and nitrification inhibitors])
B: two rates of nitrogen (40 and 80 lb/ac)
C: two methods of application (banding and broadcasting)

In banding treatment, fertilizers were placed 4 inches away from the seeding rows on April 14, 2016, whereas, in broadcasting treatment, fertilizers were manually broadcasted on soil surface on May 20, 2016.
The experiment was conducted in a factorial arrangement based on a randomized complete block design with four replications.

Results:

Effect of nitrogen management on spring wheat yield and other variables are shown in Table 1. Application method only had a significant effect on grain protein content. Grain protein was significantly higher when nitrogen was broadcasted. No difference was found between urea and SuperU in terms of wheat yield and quality. Increasing rate of nitrogen from 40 to 80 lb/ac significantly improved grain yield, biomass, and protein by 11, 10, and 11%, respectively. Fig. 2 shows that when N was banded, no significant difference was found between 40 and 80 lb/ac of nitrogen fertilizer in terms of grain protein. However, when nitrogen was broadcasted, increasing rate of N from 40 to 80 lb/ac significantly improved grain protein. It seems that nitrogen leaching in banded treatments was high, therefore lower amount of N were available in the soil at the late growth stage in this treatment which limited protein concentration.

Conclusion:

As a conclusion, it seems that pre-plant application of N is not efficient for spring wheat production in this environment. Therefore, N application is likely to be used more efficiently if used later during growing season. However, application of a high rate of N at once also seems to be inappropriate because high postharvest residual N could be a waste of money as well as a threat to the environment. Therefore, it seems that removal of pre-plant N application and applying N in two or more splits (depending on the crop demand) could enhance NUE in this environment. In future works, we will evaluate how nitrogen management can lead to higher yield and quality in spring wheat.

"The truth of the matter is that you
always know the right thing to do.
The hard part is doing it."

Gen. Norman Schwarzkoff

Table 1: Effect of Nitrogen Management on Spring Wheat Measured Variables

Treatments		Height cm	Grain yield bu/ac	Biomass lb/ac	HI	Test W lb/bu	Protein %
Application method	Banding	71	56.2	6701	0.50	63.3	9.9b
	Broadcasting	71	54.7	6189	0.54	63.4	10.7a
Fertilizer	SuperU	71	55.1	6599	0.51	63.4	10.3
	Urea	71	55.8	6291	0.54	63.4	10.3
Nitrogen rate	N40	71	52.4b	6138b	0.51	63.7a	9.8b
	N80	72	58.4a	6753a	0.53	63.1b	10.9a

Different letters following the values indicate there are significant differences.

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Fallow
Residual soil N: 28lb N/ac
Planted: April 3, 2016
Variety: Velva
Harvested: July 25, 2016
Herbicide: Full Deck; Discover
Fungicide: Avaris
Precipitation April – August 2016: 9.74 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2015 – August 2016: 14.55 in

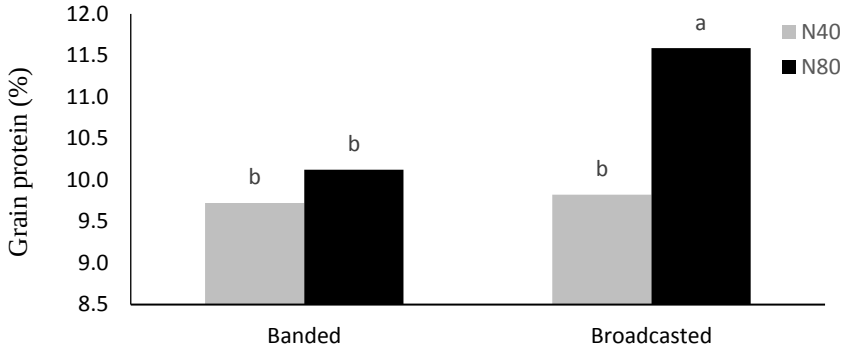


Fig. 1: Interaction Effect of Application Method and Nitrogen Rate on Spring Wheat Protein

"He who would look with contempt
upon the farmer's pursuit is not
worthy the name of a man."

Henry Ward Beecher

Yield and Quality of Hard Red Spring Wheat in Response to Nitrogen and Sulfur Application

EARC, Sidney, MT

Chengci Chen, Reza Keshavarz Afshar, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown, Benton Carr
Collaborator: Gautam Pradhan, NDSU Williston Research Extension Center

The Experimental Treatments:

A: Five rates of nitrogen fertilizer (0, 60, 100, 140, 180 lb/ac N minus soil initial N)
B: Three rates of sulfur (0, 10, 20 lb/ac S)

Fertilizers (urea and ammonium sulfate) were banded 4 inch away of seed row at the time of planting.

Results:

As shown in Table 1, nitrogen had a highly significant effect on yield, test weight, and protein in HRSW. Effect of sulfur, however, was only significant on grain protein. The interaction of nitrogen and sulfur was also insignificant on all measured variables.

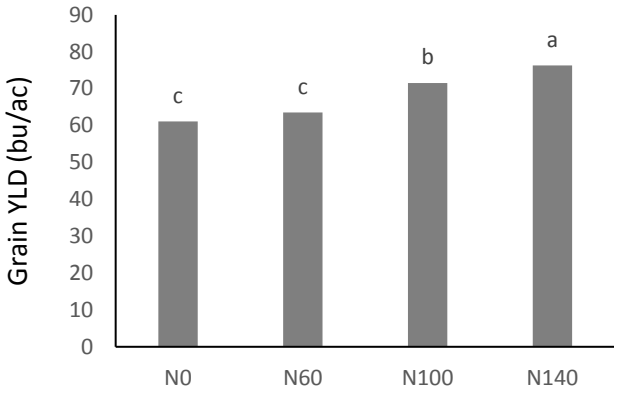
Response of grain yield and protein to increasing rate of nitrogen was linear plateau. No significant grain yield difference was found between N140 and N180 indicating that 140 lb/ac N (minus soil initial N) was sufficient for HRSW in this condition. Increasing rate of N, on the other hand, caused a reduction in test weight. (Fig. 1)

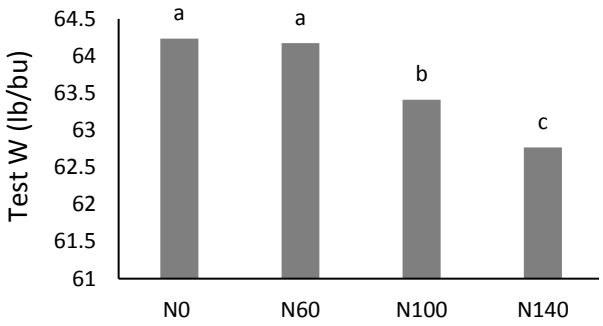
Grain yield and test weight did not show significant response to application of sulfur, which occurred regardless of the nitrogen rate. Application of sulfur however, caused a slight reduction in protein percent. This shows that the soil in this experiment had sufficient levels of sulfur. (Fig. 2)

Table 1: Probability Levels for the Effect of Nitrogen, Sulfur, and Their Interaction on Yield, Test Weight and Protein of HRSW in Dryland Eastern Montana

Source of Variation	DF	Grain YLD bu/ac	Test W lb/bu	Protein %
Nitrogen	4	<.0001	<.0001	<.0001
Sulfur	2	0.627	0.9085	0.0484
Nitrogen * Sulfur	8	0.7108	0.9826	0.7473
CV (%)		5.9	0.4	3.5

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Fallow
Residual soil N: 28lb N/ac
Planted: April 3, 2016
Variety: Velva
Harvested: July 25, 2016
Herbicide: Full Deck; Discover
Fungicide: Avaris
Precipitation April – August 2016: 9.74 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2015 – August 2016: 14.55 in





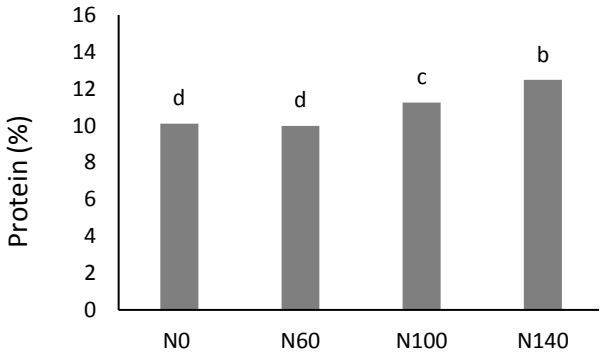
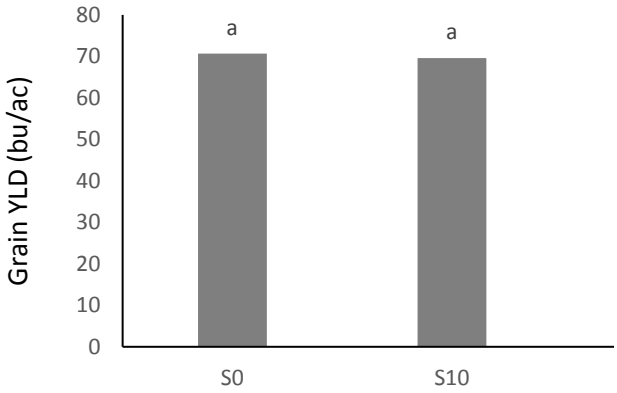
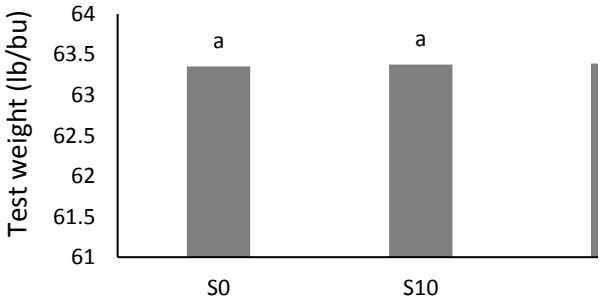


Fig. 1: Effect of Nitrogen Rate on Yield, Test Weight, and Protein in HRSW.





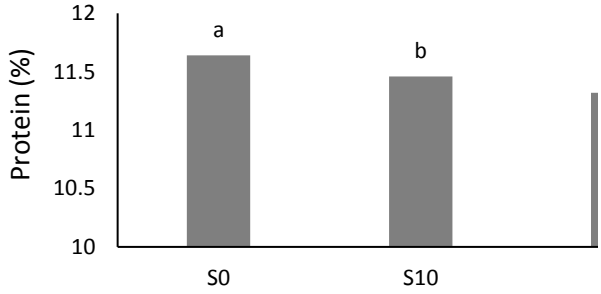


Fig. 2: Effect of Sulfur Application on Yield, Test Weight, and Protein in HRSW

The Performance of Hard Red Spring Wheat in Response to Sulfur, Nitrogen and Their Interaction

Gautam Pradhan, Jerald Bergman, James Staricka
Austin Link, Emma Link, and Kyle Dragseth
NDSU Williston Research Extension Center

Collaborators: Chengci Chen, MSU Eastern Agricultural Research center
Jasper Teboh, NDSU Carrington Research Extension Center

Importance of the research project

In recent years, producers of MonDak region (the western North Dakota and eastern Montana) have been observing sulfur (S) deficiencies in several crops including hard red spring wheat. The deficiency has arisen due to decrease in sulfate deposition through air pollution and impurities in fertilizers, herbicides, and pesticides. The extraction of soil S as a result of continuous cropping could be another reason for S limitation in the region. Currently, one of the serious challenges to S fertility management is that a soil test result is not a reliable source for the S recommendation, and there is evidence that S deficiency might occur even in soil with high organic matter content. Therefore, this study was conducted to determine a judicious management of S in combination with nitrogen (N) on no-till dryland spring wheat to realize maximum yields with better grain quality.

Materials and methods

A hard red spring wheat variety "Velva" was planted at Williston Research Extension Center (WREC), Williston on April 13th, 2016. The experiment was conducted under split plot design with four replications. The total soil N of 60, 100, 140, 180 lb/a, and a check (0 N) were considered as main plots and three sulfur rates of 0, 10, and 20 lb/a were treated as sub-plots. The treatments (a mixture of ammonium sulfate and urea) were broadcasted a day after seeding. The above ground biomass (ABM) were collected twice, once at booting stage and another few days before harvest. The canopy temperature and chlorophyll content were recorded weekly from heading stage using a FLIR® E60 Thermal Imaging camera and an atLeaf handheld chlorophyll meter, respectively. The experiment was harvested on August 6th, 2016.

Results

The annual rainfall at the experimental site was 13.0 inches (From September 2015 – August 2016) and growing season rainfall was 8.9 inches (From April – August, 2016). The effects of N, S, and N×S were not significant on plant stand and plant height. On an average, there were 10 plants per square feet and plants were 25 inches tall. From June 22 (booting stage) to July 6, 2016, when averaged across N treatments, S application increased atLeaf value by three to four units (Fig 1A, B, C). On July 20, the atLeaf values dropped to 15-23 units across S treatments (Fig. 1D), which showed that the plants were senescing.

When averaged across N treatments, S application increased ABM at booting stage by about 3.5 g. An increase in ABM was observed at N rate of ≥ 100 lbs/a only (Fig. 2). Similarly, S application increased spike number by 3-5 per sq. ft.; and the increase was observed at N rate of ≥ 60 lbs/a, but not at 0 and 180 lbs/a of N (Fig. 3). When averaged across N treatments, S application increased grain number by 3 units per spike (Fig. 4A), ABM at harvest by 7-8 g per sq. ft. (Fig. 5A), and grain yield by 3.8 bushel per acre (Fig. 5B). However, S application decreased 1000 grain weight by about 1.5 g (Fig. 4B). Effect of N treatments was not observed in these traits.

When averaged across N treatments, S application increased grain protein by 37-42 pounds per acre (Fig. 6A), but decreased test weight by 0.9 lb per bushel (Fig. 7A). When averaged across S treatments, a substantial increase in protein was observed at N rates of ≥ 100 lbs/a (Fig. 6B), and a decrease in test weight was observed at those N rates (Fig 7B). There was an effect of nitrogen fertilization on N content but not on S content of whole plant at booting, flag leaf, and grain. An increase

in N rate beyond 60 lbs/a increased N content (Table 1). There was an effect of sulfur fertilization on both N and S contents of measured plant parts. The S rate of 20 lbs/a increased N content significantly compared to no S application, however, S rate of 10 lbs/a was enough to increase significant amount of S content of all measured parts.

Summary

There was a significant effect of S fertilization on physiology, above ground biomass, spike number, grain number, thousand grain weight, grain yield, protein, test weight, and S and N contents of whole plant, flag leaf, and grains of Hard Red Spring Wheat; but effects of N and S×N were evident in some of the traits only. The application of sulfur increased per unit production of all above traits other than thousand grain weight and test weight. The experiment will be repeated in 2017 to validate the findings.

Acknowledgements

We would like to thank the Montana Wheat and Barley Committee for the financial support. The research was also conducted at Eastern Agricultural Research Center, Sidney, Montana. Mention of trademark or proprietary product does not constitute a guarantee or warranty of the product by North Dakota State University and does not imply its approval to the exclusion of other products which may also be suitable.

Fig. 1. Leaf Chlorophyll.

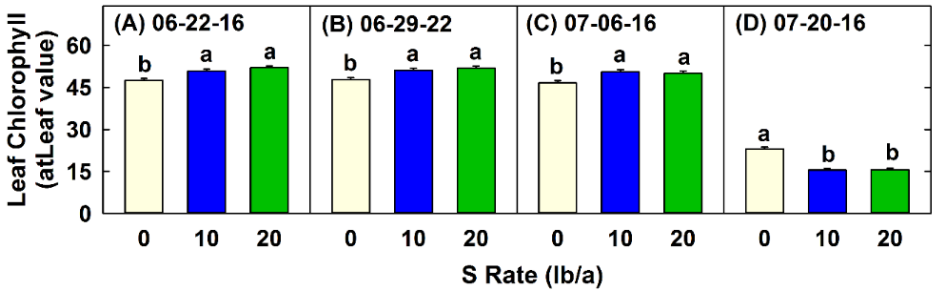


Fig. 2. ABM at booting stage.

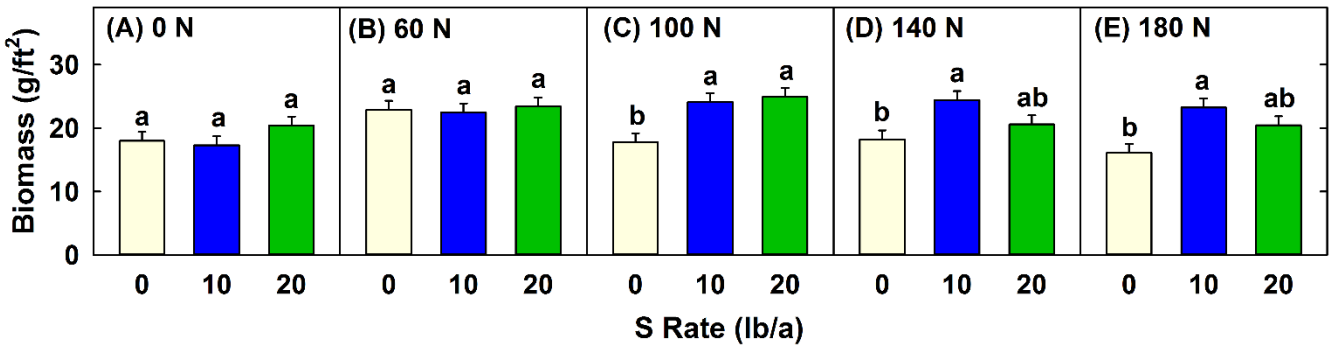


Fig. 3. Spike number.

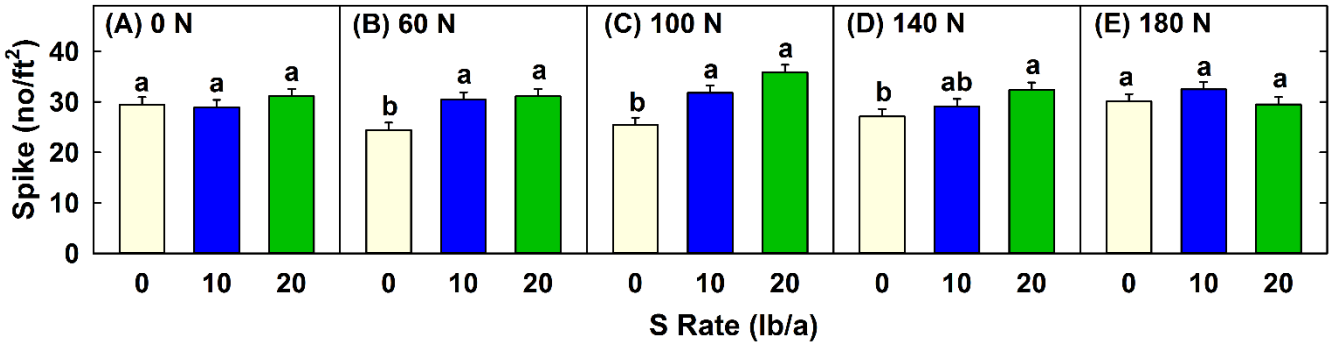


Fig. 4. (A) Grain number and (B) Grain Weight.

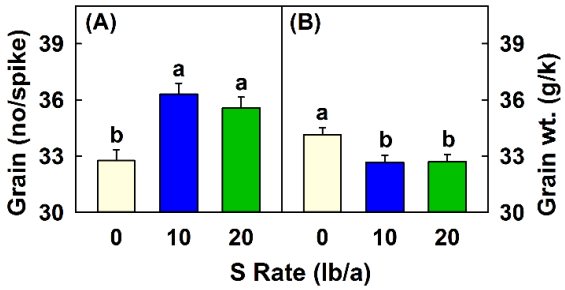
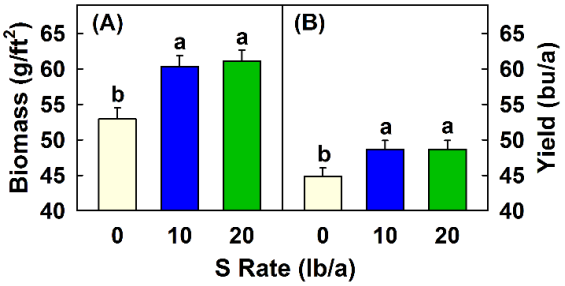
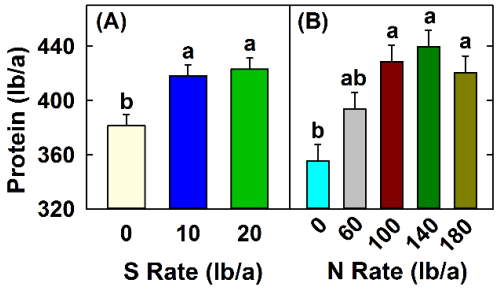


Fig. 5. (A) ABM at harvest and (B) Yield*.



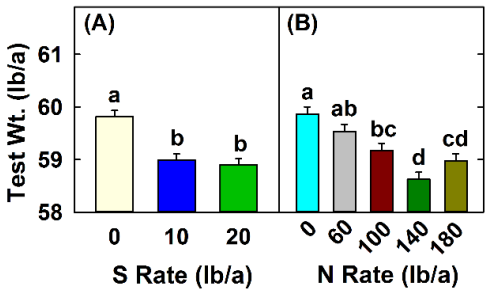
*Yield was adjusted at 13.5% moisture.

Fig. 6. Grain Protein*.



* Protein was adjusted at 12% moisture.

Fig. 7. Test Weight*.



*Test weight was adjusted at 13.5% moisture

Table 1. S and N contents of whole plant at booting, flag leaf, and grain.

N Rate (lbs/a)	Whole plant N (%)	Flag Leaf N (%)	Grain N (%)	Whole plant S (%)	Flag Leaf S (%)	Grain S (%)
0	2.57 C	4.27 B	2.33 B	0.20 A	0.29 A	0.14 A
60	2.63 C	4.15 B	2.41 B	0.19 A	0.28 A	0.14 A
100	3.09 B	4.69 A	2.65 A	0.22 A	0.30 A	0.15 A
140	3.29 AB	4.75 A	2.73 A	0.21 A	0.29 A	0.15 A
180	3.36 A	4.79 A	2.73 A	0.20 A	0.29 A	0.15 A
S Rate						
0	2.92 b	4.46 b	2.53 b	0.15 c	0.24 c	0.13 b
10	2.98 ab	4.50 ab	2.57 ab	0.22 b	0.30 b	0.15 a
20	3.07 a	4.63 a	2.60 a	0.24 a	0.32 a	0.15 a

Improvement of Yield and Quality of Durum through Nitrogen Management

EARC, Sidney, MT

Chengci Chen, Reza Keshavarz Afshar, Rebecca Garza, Calla Kowatch-Carlson, Thomas Gross, Ronald Brown, Benton Carr

The Experimental Treatments:

A: two sources of nitrogen fertilizer (urea and SuperU [an enhanced-efficiency nitrogen fertilizer containing urease and nitrification inhibitors])
B: two rates of nitrogen (40 and 80 lb/ac)
C: two methods of application (banding and broadcasting)

In banding treatment, fertilizers were placed 4 inches away from the seeding rows on April 14, 2016; whereas, in broadcasting treatment, fertilizers were manually broadcasted on soil surface on May 20, 2016.

The experiment was conducted in a factorial arrangement based on a randomized complete block design with four replications.

Results:

Nitrogen fertilizer plays an important role in high-yield and high-quality durum production. Optimum N fertilization can improve plant growth, biomass production, grain yield, and grain protein content. Inefficient use of N, on the other hand, is not economically feasible as well as creating environmental hazards. No significant difference was found between banded N and broadcasted N on grain yield, biomass, protein, and test weight in durum wheat (Table 1). Although grain yield was about 200 lb/ac greater when nitrogen was banded, but this yield difference was not statistically significant (Table 1). Similarly, no significant difference was observed between urea and SuperU in terms of grain yield, biomass, protein, and test weight. Response to nitrogen rate, however, was highly significant. Increasing nitrogen rate from 40 lb/ac to 80 lb/ac increased grain yield and total biomass by 18 and 19%, respectively, but did not improve grain protein.

Interestingly, the interaction of nitrogen rate and application method on grain protein was significant (Fig. 1). When nitrogen was banded, increasing rate of N from 40 to 80 lb/ac did not influence protein content. However, when N was broadcasted, a significant increase was observed from 8.7% to 10.3% in response to increasing rate of N. AS we mentioned in Materials and Methods, nitrogen banding took place on April 14 whereas nitrogen in broadcasting treatment was applied on May 20, about 26 days later. Weather data show that cumulative precipitation during this time at the experimental site was 3.97” which is notable and probably caused a heavy leaching of N in banding treatment. Because of that late-season nitrogen availability in banded treatments were low so no difference was found between N40 and N80 in terms of grain protein, whereas in broadcasted treatment, grain protein was much greater in N80 treatment.

Conclusion:

As a conclusion, it seems that pre-plant application of N is not efficient for durum production in this environment. Therefore, N application is likely to be used more efficiently if used later during growing season. However, application of a high rate of N at once also seems to be inappropriate because high postharvest residual N could be a waste of money as well as a threat to the environment. Therefore, it seems that removal of pre-plant N application and applying N in two or more splits (depending on the crop demand) could enhance NUE in this environment. In future works, we will evaluate how nitrogen management can lead to higher yield and quality in durum.

Table 1: Effect of Nitrogen Management on Durum Wheat Measured Variables EARC, Sidney, MT

		Height cm	Grain yield bu/ac	Test W lb/bu	Protein %
Application method	Banding	78	46.7	63.9	9.2
	Broadcasting	78	44.1	64.0	9.5
Fertilizer	SuperU	78	43.8	63.9	9.2
	Urea	78	46.9	64.0	9.5
Nitrogen rate	N40	76b	41.6b	63.9	8.9b
	N80	79a	49.1a	64.0	9.9a

Different letters following the values indicate there are significant differences.

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Fallow
Residual soil N: 28lb N/ac
Planted: April 3, 2016
Variety: Jappa
Harvested: July 25, 2016
Herbicide: Full Deck; Discover
Fungicide: Avaris
Precipitation April – August 2016: 9.74 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2015 – August 2016: 14.55 in

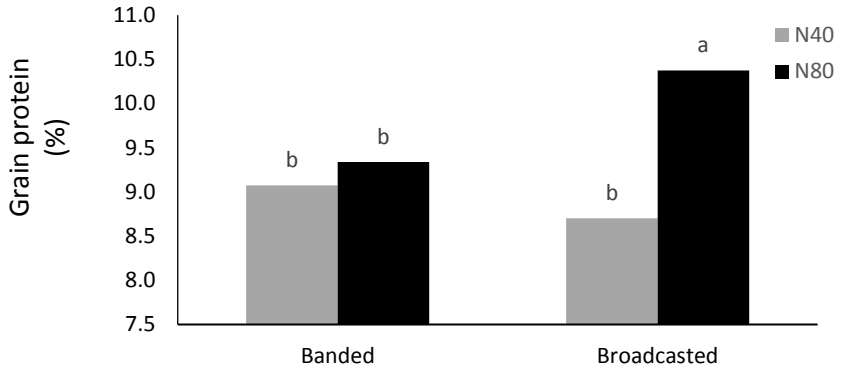


Fig. 1: Interaction Effect of Application Method and Nitrogen Rate on Durum Wheat Protein

"We need to make sure the Department of Agriculture is promoting farmers and ranchers."

Jerry Moran

Reduced Irrigation Amounts on Durum Wheat and Barley Production in Northwest North Dakota

James A. Staricka, Tyler J. Tjelde, and Jerald W. Bergman

Introduction: Irrigation is very important to agriculture in semi-arid regions such as western North Dakota. By providing water in times of deficient rainfall, irrigation improves the consistency of crop growth. Irrigation also allows the production of crops with water demands that exceed normal rain amounts. However, many challenges are facing farmers who irrigate. Increasing demands for water coupled with dwindling supplies are resulting in restrictions to water access. Increasing crop production costs and lower commodity prices are threatening economic sustainability. Improving irrigation management is critical. If irrigation amounts could be reduced without adversely affecting crop yield and quality, these challenges will be lessened. Water saved from reducing irrigation on land already being irrigated will allow additional land to be irrigated. The purpose of this project was to assess if irrigation amounts could be reduced on durum and barley while maintaining crop yield and quality.

Methods and Materials: This study was conducted by the North Dakota State University Williston Research Extension Center at its Nesson Valley Irrigation Research and Development Project site (N 48.163739°, W 103.104963°). The soil at the site is Lihen fine sandy loam (sandy, mixed, frigid Entic Haplustolls). Average annual precipitation is 15.9 inches and the average May 15 to August 15 precipitation is 8.0 inches. The two experimental crops (durum and barley) were grown as part of a 4-year crop rotation of durum–sugarbeet–barley–potato. The experimental design was a Randomized Complete Block Design (RCBD) with four replications of four treatments. Each plot was 50 by 60 ft. The treatments consisted of four irrigation amounts (100%, 67%, 33%, and 0%). Irrigation was applied with a linear-move overhead sprinkler system. The irrigator was fitted with a GPS-regulated variable rate control system that allowed for application of the different irrigation treatments. Irrigation amounts for the 100% treatment were determined to maintain the soil moisture level at field capacity. Irrigation amount determination was aided by soil moisture data (top 2 ft) collected weekly with a neutron depth moisture gauge and meteorological data obtained from the North Dakota Ag Weather Network (NDAWN [http://ndawn.ndsu.nodak.edu]). Rain gauges were placed within select plots to verify irrigation rates. All cultural practices other than irrigation amounts (tillage, fertilizer, planting populations, and fungicide applications) were the same for all treatments within a crop.

Results (Durum): The effect of reduced irrigation on durum performance varied from year to year. During the 7-year study period, seasonal rain amounts (May 15 – August 15) ranged from 5.5 to 11.3 inches (Figure 1). Irrigation amounts (100% treatment) ranged from 3.2 to 10.4 inches (Figure 1).

For durum, reducing irrigation had the greatest effect on yield, a lesser effect on grain protein, and the least effect on grain test weight.

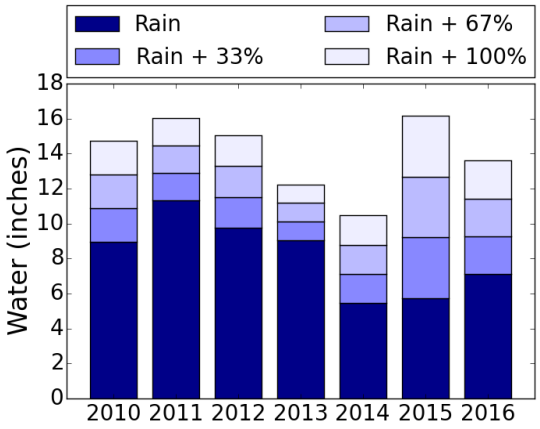


Figure 1: Rain + irrigation applied to durum.

Grain yield was unaffected five of seven years if irrigation was reduced to 67%, unaffected two of seven years if irrigation was reduced to 33%, and never unaffected if irrigation was eliminated (Table 1).

Table 1: Durum grain yield: Within a column, values in non-shaded cells are not significantly different from the 100% treatment (LSD 5%).

Irrigation	2010	2011	2012	2013	2014	2015	2016
	bushels / acre						
100%	80	33	81	101	78	77	94
67%	76	31	66	96	84	66	91
33%	66	33	62	92	56	57	84
0%	50	29	55	77	49	40	63

Grain protein was unaffected six of seven years if irrigation was reduced to 67%, unaffected four of seven years if irrigation was reduced to 33%, and unaffected two of seven years if irrigation was eliminated (Table 2).

Table 2: Durum grain protein: Within a column, values in non-shaded cells are not significantly different from the 100% treatment (LSD 5%).

Irrigation	2010	2011	2012	2013	2014	2015	2016
	%						
100%	14.3	16.6	15.0	15.1	15.7	16.0	15.9
67%	14.8	16.2	15.6	15.4	16.1	16.7	15.8
33%	15.7	16.4	15.9	15.7	17.3	18.6	15.6
0%	17.4	17.5	16.9	16.1	18.3	19.6	15.8

Grain test weight was unaffected seven of seven years if irrigation was reduced to 67%, unaffected five of seven years if irrigation was reduced to 33%, and unaffected four of seven years when if irrigation was eliminated (data not shown).

Results (Barley): The effect of reduced irrigation on barley performance varied from year to year. During the 7-year study period, seasonal rain amounts (May 15 – August 15) ranged from 5.5 to 11.3 inches (Figure 2). Irrigation amounts (100% treatment) ranged from 3.6 to 9.5 inches (Figure 2).

For barley, reducing irrigation had the greatest effect on yield, a lesser effect on grain protein and kernel plumpness, and the least effect on grain test weight.

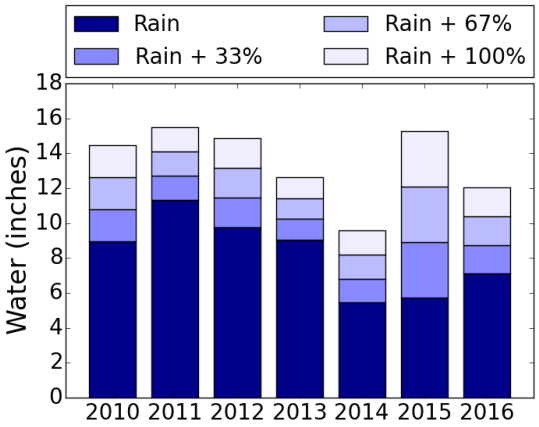


Figure 2: Rain + irrigation applied to barley.

Grain yield was unaffected seven of seven years if irrigation was reduced to 67%, unaffected four of seven years if irrigation was reduced to 33%, and unaffected one of seven years when irrigation was eliminated (Table 3).

Table 3: Barley grain yield: Within a column, values in non-shaded cells are not significantly different from the 100% treatment (LSD 5%).

Irrigation	2010	2011	2012	2013	2014	2015	2016
	bushels / acre						
100%	123	47	61	109	112	93	95
67%	108	50	58	100	106	92	98
33%	114	43	53	85	96	89	89
0%	107	40	52	74	81	76	95

Grain protein was unaffected six of seven years if irrigation was reduced to 67%, unaffected six of seven years if irrigation was reduced to 33%, and unaffected four of seven years if irrigation was eliminated (Table 4).

Table 4: Barley grain protein: Within a column, values in non-shaded cells are not significantly different from the 100% treatment (LSD 5%).

Irrigation	2010	2011	2012	2013	2014	2015	2016
	%						
100%	13.6	11.9	11.1	14.3	11.3	11.8	11.4
67%	14.1	12.5	12.0	14.1	11.3	11.5	11.5
33%	14.0	12.4	12.6	14.0	12.0	11.8	11.0
0%	14.3	13.3	12.8	14.5	12.0	12.5	11.6

Grain test weight was unaffected seven of seven years if irrigation was reduced to 67%, unaffected six of seven years if irrigation was reduced to 33%, and unaffected four of seven years when irrigation was eliminated (data not shown).

Kernel plumpness was unaffected six of seven years if irrigation was reduced to either 67% or 33% and unaffected four of seven years when irrigation was eliminated (data not shown).

Summary: The effects of reduced irrigation on durum and barley increased as the size of reduction increased. Durum was affected more by reduced irrigation than was barley. When reduced irrigation had an effect, it decreased grain yields, test weight, and kernel plumpness, and increased grain protein. With durum, farmers may receive a premium for greater protein content but this premium may not offset the loss from the accompanying reduced yield. With barley, increased protein levels may be disadvantageous as there is an upper limit imposed on protein in malting barley.

Our findings suggest that reducing irrigation by as much as one-third will not reduce the yield and quality of barley or the quality of durum, however, durum yield may be reduced some years. Water savings achieved by reducing irrigation amounts can help farmers comply with water restrictions or expand irrigated acreage without increasing total water demand.

NOTE: *This article was presented as a poster at the 2016 Joint International Meetings of the American Society of Agronomy / Crop Science Society of America / Soil Science Society of America. It has been modified to use standard American units of measure and to fit on standard size paper.*

Pre-emergence Herbicide Options for Safflower

Clair Keene

This study was conducted to evaluate pre-emergence herbicide options for use in safflower. Data related to crop safety and weed control were collected. This study was replicated by Dr. Caleb Dalley at the Hettinger REC, but no results from Hettinger are reported here because drought conditions compromised results from that location. Safflower was grown at the Williston REC under dryland conditions. Safflower variety Cardinal was used.

Pre-emergence Herbicide Options for Cardinal Safflower — **WREC, Williston, ND**

Herbicide	Rate	Visual injury 3 WAE†		Visual injury 5 WAE		Weed control 5 WAE	Plant height 6 WAE	Plant height 10 WAE	Yield		Test weight
		(%)*		(%)		(%)	(in)	(in)	(lb/a)		(lb/bu)
Prowl H2O	32 fl oz/a	18	d	21	a	58	19	21	1150	a	42.8
Zidua	2 oz/a	23	cd	29	a	69	19	22	1320	a	42.6
Zidua SC	3.25 fl oz/a	21	cd	26	a	80	19	22	1330	a	43.0
Zidua SC	7.0 fl oz/a	28	bcd	30	a	85	18	20	1470	a	42.8
Zidua SC	10.6 fl oz/a	29	bcd	34	a	88	18	21	1290	a	42.7
Outlook	10 fl oz/a	23	cd	21	a	65	19	22	1220	a	42.8
Outlook	20 fl oz/a	44	abc	29	a	78	17	22	1210	a	42.8
Spartan	3.5 fl oz/a	51	ab	30	a	66	20	22	1210	a	43.0
Spartan Charge	4.4 fl oz/a	59	a	33	a	67	19	22	1300	a	43.3
(Dual II Magnum & hand weed)¥	32 fl oz/a	18	d	20	a	100	19	22	1490	a	43.2
Untreated (weedy check)		4	d	18	a	0	17	20	500	b	42.7

Location: WREC, dryland — Planted: 5-13-16 — Herbicide applied: 5-16-2016

Soil pH=6.5-6.6; OM=1.7-2.0% — Harvested: 9-14-2016 — Soil type: Williams-Bowbells loam

Applied fertilizers in lb/a: N=80; P_2O_5=32; K_2O=0 — †WAE = weeks after emergence

*Scale: 0 = no injury observed, 100 = severe injury observed

¥ Weed free maintained by Dual II and hand weeding

At 3 weeks after emergence (WAE), Spartan Charge, Spartan, and the 20 oz rate of Outlook exhibited the highest injury levels. All other herbicide treatments exhibited similar injury ratings as the untreated check. Safflower in the three most injurious treatments at 3 WAE all showed lower levels of injury at 5 WAE. This may have been caused by a large amount of rainfall received in the week prior to the 5 WAE rating whereas prior to the 3 WAE rating, only small rain events occurred between planting and injury assessment.

Weed control ranged from 58% with Prowl H2O to 88% with Zidua SC at the 10.6 fl oz/a rate. The dry period between herbicide application in mid-May and substantial rainfall in early June likely confounded weed control results somewhat. Grassy weeds, especially green foxtail and stinkgrass, emerged in late June and early July, likely avoiding residual control. Safflower yield was similar across all herbicide treatments and the weed-free check. Only the untreated weedy check exhibited reduced yield.

Saline Seep Reclamation Research and Demonstration Project

Clair Keene, Jim Staricka, Kyle Dragseth, Jerry Bergman, and
Jane Holzer (Montana Salinity Control Association)

Background

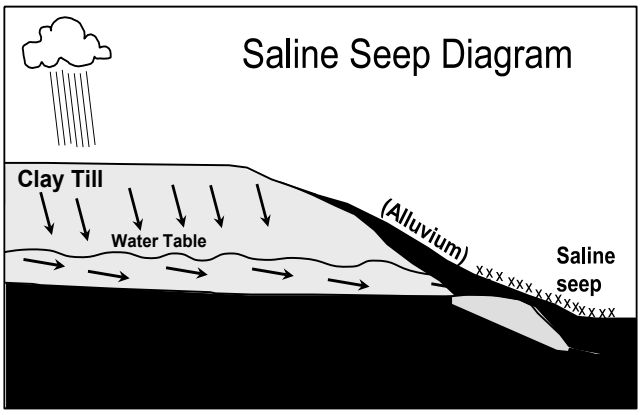
This reclamation project is a partnership between the WREC and Montana Salinity Control Association (MSCA) to conduct a saline seep investigation on land operated by WREC. The project is located in T154N R102W Section 36 of the Fifth Principle Meridian Public Land Survey System (PLSS).

The saline area currently appears as wet and weedy areas in the field; however, in dry years ground water and salts will wick upwards to evaporate and form a white salt-encrusted layer on the soil surface. Currently approximately one acre is noticeable; however, a larger area of crop growth has reduced production.

Investigation

Fieldwork: On August 18, 2014, ten shallow ground water monitoring wells were installed - nine recharge identification wells and one discharge area well. All of the wells were cased at the time of drilling with 2" PVC well casing, backfilled with pea gravel in the saturated zone and sealed with bentonite within the top five feet of the ground surface. Each well was surveyed for surface elevation in relation to the other wells. Ground surface elevations and well measurements to the water table are used to determine the direction of ground water flow and the location of the recharge area.

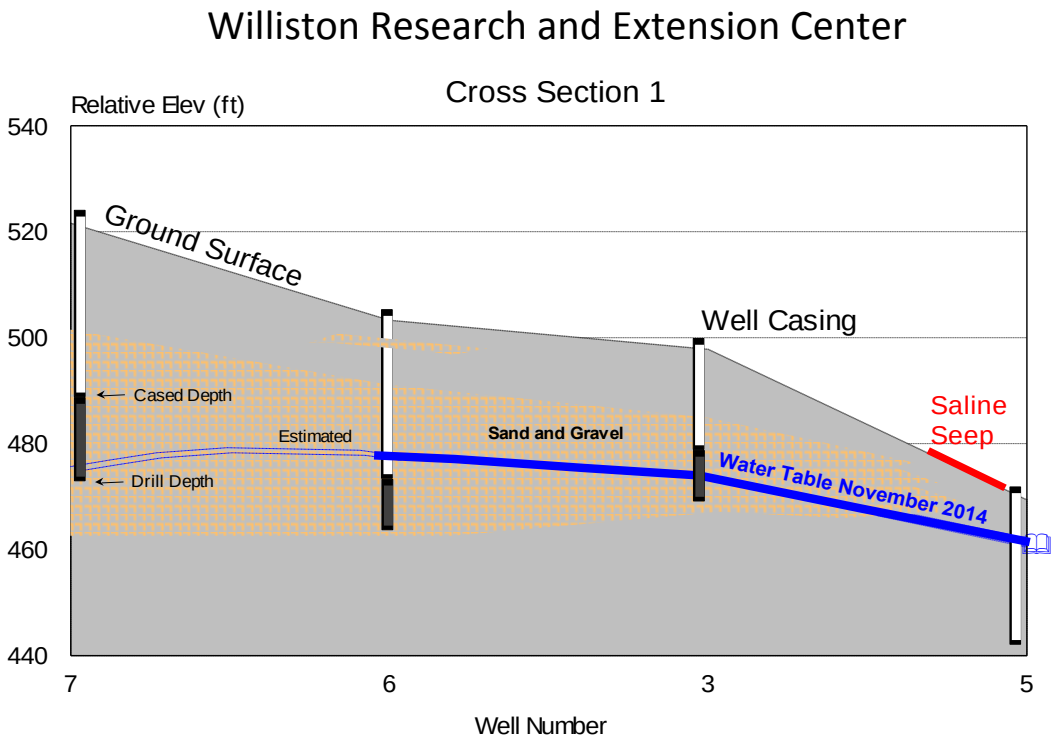
Soils: In the investigated area, the soil texture in the upper 0- to 5-foot soil profile is predominantly Clay or Sandy Clay Loam derived from Glacial Till left behind from the previous glacial periods. Glacial till in this area is mainly clay and clay loam soils.



Clay and Sandy Clay Loam have a water holding capacity of 2.0-2.2 inches of Plant Available Water (PAW) per foot of soil. Cereal grains and other annual crops typically root four feet deep or shallower. The total PAW can be estimated based on the soil type in the recharge area by using the average of 2.0 in. PAW/foot of moist soil for Clay soil multiplied by the four feet of rooting depth. Therefore, the top four feet of soil can store about 8 inches of water that is available to plants. When the soil profile is recharged or at moisture capacity, any excess soil moisture will leach below the rooting zone and recharge the water table. The sand and gravel layers hold less than one inch of PAW.

Geology: In this area, bedrock is the Bullion Creek Formation, also known as the Fort Union Formation in Montana. It is a clay shale, siltstone, and sandstone formation with numerous lignite layers. This formation extends hundreds of feet deep and is the semi-impermeable layer that perches, or holds, shallow ground water from local recharge and contributes salt to the ground water system (See Saline Seep Diagram). Bedrock was not encountered in any of the shallow wells installed at this site, but it would be present at a deeper depth. Lignite was also not found in the soil profile at this site.

Ground Water: The ground water flow direction at this site is south. Cropland north of the saline seep is contributing to the elevated water table causing the saline seeps. The difference in water table elevation from one well to another indicates the pressure-gradient influencing ground water flow (See Cross Section 1).



Investigation

In order to reclaim saline seeps, land-use changes in the recharge area must be made. In June 2016, an area of approximately 40 acres was planted to perennial forages in an attempt to lower the water table and reclaim the salt-affected area.

To assist area producers with future forage variety selection and evaluate currently available alfalfa varieties side-by-side in northwestern North Dakota, WREC partnered with forage seed company Alforex Seeds to establish a salt-tolerant forage variety trial in the area of the saline seep. One June 9, 2016, four varieties of alfalfa and two perennial grasses were seeded in a replicated trial in the most intense part of the saline seep. Check strips were planted to the north of the variety trial in non-saline conditions. Alfalfa varieties planted were Rugged, Magnum Salt, AFX 457, and PGI 427. Perennial grasses planted were AC Saltlander mix (50% AC Saltlander green wheatgrass, 24% slender wheatgrass, and 26% tall fescue) and Garrison creeping foxtail, a flood-tolerant species.

Results to date

To better understand the intensity of the saline conditions in the variety trial, grid soil sampling was conducted in October to map soil electrical conductivity (EC). Soil EC provides an indirect measure of soil salt content. These results will allow us to correlate soil EC, i.e. salinity, with forage performance metrics in the future. Figure 1. is a map of soil EC values created by interpolation between points sampled in the grid. Figure 2. Shows the plots in late July, notice bare areas in most intense part of the seep.

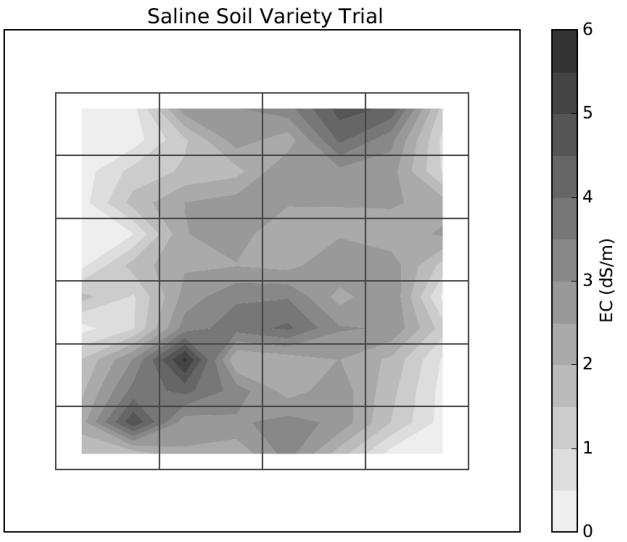


Figure 1. Soil EC values in the variety trial plots

Figure 2. Variety trial plots in late July.

Alfalfa biomass was sampled in early September; perennial grass biomass was not sampled as these species establish more slowly than alfalfa. Average alfalfa biomass production was similar across varieties, and was roughly 1500 lbs/ acre. To better understand how each variety responds to salinity, alfalfa biomass was regressed on soil EC measurements (Figure 3). Across varieties, a negative correlation was observed between alfalfa biomass and soil EC ($p < 0.1$); however, no significant negative correlations were observed between alfalfa biomass and soil EC when each variety was considered individually. These preliminary results suggest that there are no strong differences in biomass production as it relates to salinity during the establishment year for the alfalfa varieties under investigation. We will be interested in continuing to collect biomass in future years and evaluate stand performance and persistence under saline conditions.

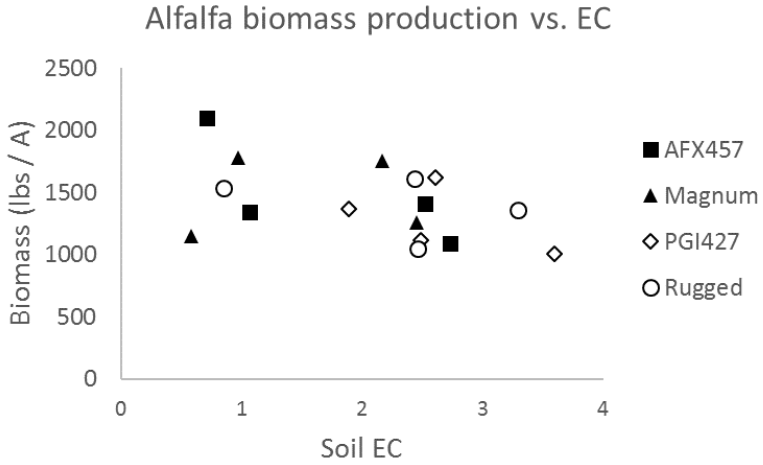


Figure 3. Alfalfa biomass production graphed against soil EC, a proxy measure of salinity.

Extension Education and Future Work

On August 10th, the WREC hosted a field day for members of the oil and natural gas industries. The goal of the event was to highlight research being conducted at the WREC relevant to these groups and provide an opportunity for these stakeholders to interact with researchers. Approximately 40 people attended, including members of various state-level industry groups. Clair Keene discussed perennial forages and their potential to facilitate oil and gas-impacted areas remediation. She also highlighted the variety trial and its relevance to appropriate variety selection on salt-affected soils in the Oil Patch of Northwestern North Dakota.

The perennial forage stand will be kept for at least two more years. During this time, we will continue to monitor the depth to groundwater and evaluate perennial forage productivity and performance. The MSCA recommends maintaining the perennial stand for at least three years and encourages maintenance beyond this, suggesting five or six years if the stand continues to produce acceptable yields. The WREC seeks to lower the depth of water table to below 8 ft year-round in the saline seep and wet slough areas and reduce EC at the soil surface in the saline seep. These two goals will be used to determine when it will be appropriate to rotate back into annual crops.

Dr. Clair Keene speaking about saline seeps at a field day for members of the oil and gas industries at the WREC, August 2016.

Photo Credit: Rene Jean, Williston Herald

Site comparison aerial photos. 1995 black and white photo and color 2009 photo. Note the change in productive crop acreage in the saline-affected area and the consistent acreage not cropped in the wetland/pothole due to elevated water table and periodic ponded water. The wetland area will become more productive in a perennial forage than cropped in just drier periods.

Acknowledgements

The WREC thanks the MSCA for their partnership in this project. We also thank Don Miller and Alforex Seeds for their generous donation of the alfalfa and salt-tolerant grass species seed used in this project. Alforex Seeds also provide a hand-held soil probe that was used to measure EC values.

Stump the Plant Doctors

Clair Keene, Audrey Kalil, Kyla Splichal, Dimitri Fonseka, and Taheni Jbir

Education and Outreach Booth at Annual Field Day was a Success

The Stump the Plant Doctors booth was a successful new addition to the WREC July field day. The booth was set up at the entrance to the Ernie French Center to allow attendees to have their plant questions answered by agriculture and horticulture professionals. Dr. Clair Keene had a display of common weed species in pots for identification and answered weed control questions. Dr. Audrey Kalil and Dimitri Fonseka identified plant diseases brought in for identification. Kyla Splichal fielded questions about gardening and ornamental plant selection and care.

The booth attracted over 50 visitors with many bringing samples for plant or disease identification. Visitors took home numerous NDSU Extension publications on topics such as tree planting, tree pruning, and ornamental plant selection that were available at the booth. Visitors commented that the booth was a great opportunity to have their plant-related questions answered and appreciated the opportunity to discuss their issues with professionals. The WREC looks forward to offering the Stump the Plant Doctors booth at future field days.

(from left): Taheni Jbir, Dr. Audrey Kalil, and Dimitri Fonseka at the Stump the Plant Doctors booth during the WREC July field day.

Dr. Clair Keene explaining weed identification at the Stump the Plant Doctors booth.

Photo credit: Rene Jene, Williston Herald

"Agriculture not only gives riches to a nation, but the only riches she can call her own."

Samuel Johnson

WREC FOUNDATION SEED INCREASE UPDATE

Kyle Dragseth, David Weltikol, Cameron Wahlstrom, Kelly Stehr, NDSU Williston Research Extension Center

Hello to you all! We hope you all had a great 2016 growing season and are getting geared up for another great year in 2017. Our foundation seed increase program is keeping plenty busy during the winter months cleaning grain and preparing for what we hope is another successful year!

We are very excited that through a cooperative effort with the North Dakota Game and Fish Department, we have acquired a lease on 1,120 acres located on the River bottoms of the Lewis and Clark Wildlife Management Area. This parcel of land is located only 2 miles south of our existing Research Extension Center and will serve as a useful addition to our Foundation Seed Increase Program, allowing us to grow more crop varieties and volume of new and existing crop varieties.

Listed below are the varieties available for sale. Please contact the WREC at 701-774-4315 or Kyle at 701-770-1652, by writing to the Williston Research Extension Center at 14120 Hwy 2, Williston, ND 58801, or by email to NDSU.Williston.REC@ndsu.edu with any questions on the varieties and for pricing and availability. If you are looking to grow a variety not listed please contact us and we will see if that variety is available at one of our other Research Extension Centers or other sources.

Williston Research Extension Center Foundation Seed Increase

Varieties include the following:

Barley	HRSW	HRWW	Durum	Peas	Lentils	Flax
ND Genesis	Barlow	Decade	Joppa	Midas	Avondales	CDC Glas
	Mott		Carpio	Mystique	Richlea	
	Elgin		Tioga			
	Bolles					

Eastern Agricultural Research Center Foundation Seed Increase

Varieties include the following:

HRSW	Durum
Duclair	Silver

Seed availability and prices can be obtained by calling 406-433-2208, by writing to the Eastern Agricultural Research Center, 1501 N Central Avenue, Sidney, MT 59270, or by email at cchen@montana.edu.

WREC Welcomes New Staff

Dr. Clair Keene, Area Extension Specialist in Cropping Systems

Clair Keene joined the Williston REC in February of 2016, moving to North Dakota from State College, Pennsylvania where she earned her Ph.D. in Agronomy from Penn State University. Clair conducted research on integrated weed management in no-till corn and soybean and agronomic crop performance in a multi-state project focused on reducing tillage in organic corn-soybean-winter wheat rotations by using cover crops. Clair emphasized weed science in her graduate program and is interested in how crop rotations can be used as a weed management tool and reduce herbicide inputs. Prior to starting her Ph.D. at Penn State, Clair worked for a year as a Border Servant Corps volunteer in Las Cruces, New Mexico as an adult educator at a domestic violence shelter. Clair is excited about working with farmers to improve their cropping systems and finding ways to reach out to the non-farming public and engage them with agriculture and food production.

Clair grew up in Bellevue, Nebraska and attended Iowa State University as an undergraduate. At Iowa State, Clair earned degrees in biology and Spanish and credits a soil science course late in her degree program with pulling her into the world of agronomy. In 2016, Clair conducted research on herbicide options for safflower production and helped start a long-term project remediating a saline seep with alfalfa. Clair looks forward to cultivating relationships with MonDak farmers and finding ways to improve cropping profitability and sustainability. Additionally, she will work with new county ag agents in Northwestern North Dakota to increase their agronomic knowledge and enable them to better serve their stakeholders.

Clair moved to Williston with her husband Drew Robinson. They enjoy hiking, fishing, and exploring the wildlife refuges, grasslands, and unique places of western North Dakota and eastern Montana.

Emma Link, Agronomy Research Specialist II

Emma Link joined the Williston REC in February 2016. Emma grew up in Moorhead, MN. She has always had a passion for sustainable agriculture. After successful completion of a B.A. at Concordia College she went on to NDSU where she attained a Master of Natural Resources Management with a focus in Range Science. Her research focused on retrospective rangeland management practices on grassland bird decline. Emma works in all areas of dryland agronomic research and variety trials.

Dimitri Fonseka, Plant Pathology Research Specialist II

Dimitri Fonseka joined the Williston REC in February 2016. Dimitri, a native of Sri Lanka obtained his B.S. Degree in Biotechnology with a focus in Microbiology and Chemistry from NDSU. His passion towards agriculture started with the experience he had in sunflower breeding in his junior and senior years. Dimitri continued at NDSU to earn a M.S. in Plant Pathology. His research was focused on evaluating efficacy of multiple fungicides that are used for disease management of potato early blight and brown spot.

Upon successful completion of his M.S. Degree, Dimitri joined Williston Research Extension Center as a Plant Pathology Research Specialist. He assists in all phases of the Plant Pathology research program.

Williston Research Extension Center Staff

Administration

Jerald Bergman
Director

Kelly Stehr
Administrative Assistant

Agronomy-Dryland

Gautam Pradhan
Research Agronomist

Austin Link
Ag Research Specialist

Emma Link
Ag Research Specialist

Vacant
Ag Research Specialist

Horticulture/Agronomy

Kyla Splichal
Research Specialist

Vacant
Research Specialist

Agronomy-Irrigation

Tyler Tjelde
Irrigation Agronomist

Justin Jacobs
Ag Research Specialist

Under Recruitment
Irrigation Ag Technician

David Schmidt
Irrigation Ag Technician

Foundation Seed Increase and Farm Management

Kyle Dragseth
Foundation Seedstocks/Farm Manager

David Weltikol
Ag Technician Mechanic

Cameron Wahlstrom
Ag Research Specialist

Extension

Clair Keene
Extension Specialist/ Cropping Systems

Soil Science

Jim Staricka
Soil Scientist

Plant Pathology

Audrey Kalil
Plant Pathologist

Dimitri Fonseka
Plant Pathology Research Specialist

Seasonal Employees

Lynn Staricka

Sandy Spurlock

Consultants

Don Tanaka
Ag Cropping Specialist

Charles Flynn
Chemist

2016 Summer Staff

Haley Becker
Kyra Candee
Adam Carlson
Nicolas Curren
Grace Dragseth
Taheni Gargouri Jbir
Sara Jacobs
Ron Hunt
Rojee Pradhan
Brad Raab
Samantha Schmoker
Trinitie Stehr

Williston Research Extension Center

FRONT ROW: Kyle Dragseth, Jim Staricka, Nicolas Curran, Jerry Bergman, Gautam Pradhan, Dave Schmidt, Kyla Splichal, Clair Keene, Dimitri Fonseka, Grace Dragseth SECOND ROW: Kelly Stehr, Lynn Staricka, Emma Link, Kyra Candee, Samantha Schmoker, Taheni Gargouri-Jbir, Audrey Kalil, Sara Jacobs, Rojee Pradhan, Trinitie Stehr THIRD ROW: David Weltikol, Cameron Wahlstrom, Austin Link, Ron Hunt, Tyler Tjelde, Haley Becker, Adam Carlson, Brad Raab.

Eastern Agricultural Research Center

FRONT ROW: Miriam Backhaus, Abbey Ries. 2nd ROW: Jonathan Wood, Garrett Norby, Kyler Garsjo, Christopher Olson, Avery Gurney, AJ Fox. 3rd ROW: Rebecca Garza, Frankie Crutcher, Sherry Turner, Calla Kowatch-Carlson, Maninder Walia, Chengci Chen, Cherie' Gatzke. BACK ROW: Benton Carr, Ron Brown, Thomas Gross, Yesuf Mohammed, Grant Brunsvold, Reza Keshavarz.
NOT IN PHOTO: Charles Flynn, Doug Hettich, Chuck Lowman, Red Lovec

EASTERN AGRICULTURAL RESEARCH CENTER

Administration

Chengci Chen
Agronomy
Superintendent

Cherie' Gatzke
Administrative Assistant

Plant Pathology Research

Frankie Crutcher
Plant Pathologist

Amber Ferda
Research Associate

Farm Operations

Ron Brown
Farm/Foundation Seedstock Manager

Ben Carr
Farm Mechanic

Agronomy Research

Yesuf Mohammed
Research Scientist

Reza Keshavarz
Post Doc Research

Maninder Kaur Walia
Post Doc Research

Rebecca Garza
Research Assistant II

Calla Kowatch-Carlson
Research Assistant III

Thomas Gross
Research Assistant II

2016 Summer/Seasonal Staff

Miriam Backhaus	Aric Carlson	Charles Flynn
AJ Fox	Kyler Garsjo	Avery Gurney
Doug Hettich	Samantha Hoesel	Richard "Red" Lovec
Chuck Lowman	Garrett Norby	Christopher Olson
Abbey Ries	Jonathan Wood	

A WEED TO WATCH FOR

NARROW-LEAVED HAWK'S BEARD

(*Crepis tectorum* L.)

Narrow-leaved hawk's beard is an annual weed that can grow as a winter annual (fall germination) or summer annual (spring germination). It is also called "false dandelion" because it is similar in appearance to dandelion. NLHB can be distinguished from dandelion by its branching flowering stems whereas dandelion only has one flower per stem. NLHB has been present in the prairie provinces of Canada for decades, but has only recently been appearing in the MonDak. Farmers and landowners have reported NLHB along pipeline installations and roads in 2016. Fall herbicide application is critical for controlling NLHB because it is less susceptible to herbicides in the spring.

NDSU | WILLISTON RESEARCH EXTENSION CENTER

Narrow-leaved hawk's beard reported in Divide & Williams Co.

Fall herbicide options:

glyphosate + tribenuron (RoundUp + Express)
glyphosate + tribenuron + thifensulfuron (RoundUp + Panoflex)
glyphosate + 2,4-D

Spring herbicide options:

glyphosate (RoundUp)
glyphosate + saflufenacil (RoundUp + Sharpen)

Reference to trade names does not imply endorsement of a product or brand by NDSU Extension

CLAIR KEENE, PH.D.
Area Extension Specialist in Cropping Systems

Williston REC
14120 Highway 2
Williston, ND 58801

clair.keene@ndsu.edu

Upcoming Events for 2017

January 4	Diversity Direction & Dollars - Ramada Grand Dakota Lodge – Dickinson, ND
January 10-11	Manitoba-North Dakota Zero Till Conference – Grand Hotel – Minot, ND
January 11	New Trends in Agriculture - Cottonwood Inn – Glasgow, MT
January 23-24	Northern Pulse Growers Assn. Conf. - Riverside Holiday Inn – Minot, ND
January 25-27	Ag Expo-North Dakota State Fair Center—Minot, ND
February 3-4	2015 NDFMGA & Local Foods Conference – Baymont Inn and Suites – Mandan, ND
February 7-9	National Hard Spring Wheat Show - Grand Williston Hotel – Williston, ND
February 10-11	GATE – Eastern Plains Event Center – Glendive, MT
February 14-15	Agri International Trade Show-Bismarck Event Center - Bismarck, ND
February 15	MonDak Pulse Day – Grand Williston and Conference Center -- Williston, ND
March 2-3	MonDak Ag Days - Richland County Event Center – Sidney, MT
March 7-9	Western Crop/Pest Management School – Grand International Inn – Minot, ND
March 14-15	KUMV-TV Farm and Ranch Showcase - Raymond Center – Williston, ND
March 17-18	KATQ Northeast Montana Farm Expo – Plentywood, MT
June 20	Sidney ARS and EARC Dryland Farm Field Day -- Sidney, MT
June 21-25	UMVF – Williston, ND
June 22	Froid Research Farm Field Day -- Froid, MT
June 29	Northern Agricultural Research Center Field Day – Havre, MT
July 7	Bozeman Farm Days – Bozeman, MT
July 10	Central Grasslands Research Extension Center Field Day-Streeter, ND
July 11	Hettinger Research Extension Center Field Day- Hettinger, ND
July 12	Dickinson Research Extension Center Field Day- Dickinson, ND
July 12	Central Agricultural Research Center Field Day – Huntley, MT
July 13	Williston Research Ext. Center Field Day – Williston, ND
July 13	Northwestern Agricultural Research Center Field Day – Kalispell, MT
July 13-14	MonDak Ag Showcase – Williston, ND
July 14	Nesson Valley Irrigation Field Day - Nesson Valley
July 17	Agronomy Seed Farm Field Day- Casselton, ND
July 18	Carrington Research Extension Center Field Day- Carrington, ND
July 19	North Central Research Extension Center Field Day- Minot, ND
July 19	Eastern Agricultural Research Center Field Day – Sidney, MT
July 20	Langdon Research Extension Center- Langdon, ND
July 21-29	North Dakota State Fair – Minot, ND
July 27	Northern Great Plain Research Lab/ARS Field Day-Mandan ND
July 27	Western Agricultural Research Center Field Day – Corvallis, MT
	MSU MAES Summer Conference
August 2-5	Richland County Fair – Sidney, MT