2017 Agricultural Research Update

NDSU Williston Research Extension Center

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MSU Eastern Agricultural Research Center

Serving the MonDak Region




MONTANA STATE UNIVERSITY
MONTANA AGRICULTURAL EXPERIMENT STATION

Regional Report No. 23 – December 2017

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ND Agricultural Experiment Station

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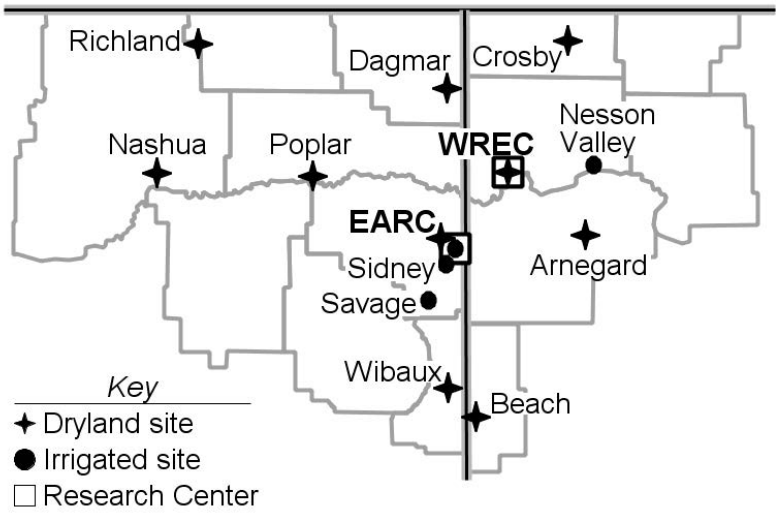
Off-Station Cooperators – Producers – CES Agents

MONTANA
SMALL GRAIN--PULSES:
Dagmar - Brian Kaae - Agent Colleen Buck
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:
East Fairview - Rodney Hurley
Savage - Triple C Farms, 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.

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Weather Information

Weather Summary Williston, ND

Month	Precipitation 2017	Precipitation Avg	Temperature 2017	Temperature Avg	*
	- inches -		- degrees F -		
Oct-Dec. 2016	1.71	1.74			
January-March	2.05	1.18			
April	0.48	1.17	45.3	46.0	0
May	0.89	2.25	58.3	57.0	0
June	1.29	2.68	66.3	65.0	5
July	1.37	2.23	76.9	72.0	18
August	2.54	1.56	68.6	71.0	5
September	2.62	1.38	59.0	60.0	1
April-July	4.03	8.33			
April-Sept	9.19	11.27			
Total-Oct 16-Sept 17	12.95	14.20			

*Number of Days over 89° F

Last Spring Frost – May 18, 2017 (32° F)

First Fall Frost – October 4, 2017 (31° F)

Weather Summary Sidney, MT

Month	Precipitation 2017	Precipitation Avg	Temperature 2017	Temperature Avg	*
	- inches -		- degrees F -		
Oct-Dec. 2016	1.27	1.85			
January-March	1.05	1.29			
April	0.31	1.16	46.4	44.6	0
May	0.47	2.15	53.7	56.0	1
June	1.27	2.74	66.7	64.5	3
July	0.60	2.07	71.1	70.1	13
August	1.47	1.47	69.3	68.8	6
September	1.86	1.28	61.9	58.0	3
April-July	2.65	8.12			
April-Sept	5.98	10.87			
Total- Oct 16-Sept 17	8.30	14.01			

*Number of Days over 89° F

Last Spring Frost – May 19, 2017 (27.3° F)

First Fall Frost – October 6, 2017 (30.7° F)

Off-Station Precipitation* North Dakota

Site	April	May	June	July	Aug	Total
Arnegard	0.19	0.85	2.36	0.87	1.68	5.95
Crosby	0.24	1.54	0.96	0.11	1.00	3.85
Nesson Valley	0.38	0.88	1.29	0.89	3.57	7.01

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

Off-Station Precipitation* Montana

Site	April	May	June	July	Aug	Total
E Fairview	0.31	.047	1.27	0.60	1.47	4.12
Nashua	0.21	0.38	0.41	0.52	0.49	2.01
Poplar	0.25	0.43	0.16	0.50	0.56	1.90
Richland	0.39	0.33	0.47	0.21	0.07	1.47
Savage	0.74	0.70	0.63	0.77	1.11	3.95
Wibaux	0.79	1.09	0.57	0.69	2.38	5.52

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

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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
AKF-Astro	AKF-Astro	2016	short	medium	NA	MR	MR	NA	S	NA	low	low
Ambush	Dynagro	2016	medium	M early	M	R	MR/MS	NA	M	NA	NA	NA
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
Boost	SD	2016	medium	medium	M	R	MR/MS	NA	M	NA	medium	high
Brennan	AgriPro	2009	short	M early	MR	R	MR	M	MS	S	medium	medium
Caliber	Dynagro	2016	short	medium	R	R	MR	NA	S	NA	NA	NA
Choteau	MT	2004	M short	M late	MS	R	MR/MS	MR	S	R	medium	medium
Duclair	MT	2011	medium	medium	R	R	NA	NA	NA	R	medium	medium
Egan[3]	MT	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
Glenn	NDSU	2005	M tall	M early	MR	R	MR/MS	M	MR	S	high	M high
HRS 3100	Croplan	2016	medium	medium	MR	R	MR/MS	NA	MS	NA	NA	NA
HRS 3419	Croplan	2014	M short	late	MR	NA	MR	MR	MR	NA	M high	medium
HRS 3504	Croplan	2015	M short	medium	MR	R	R	NA	MS	NA	NA	NA
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
Lang-MN	MN	2017	M tall	medium	MR	R	MR	NA	MS	NA	M high	medium
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 Nitro	limagrain	2015	short	medium	MR	NA	NA	NA	NA	NA	M high	medium
LCS Prime	limagrain	2015	medium	M early	MR	MR	MR/MS	NA	M	NA	M high	low
LCS Rebel	limagrain	2017	medium	M early	M	R	MS	NA	M	NA	NA	NA
LCS Trigger	limagrain	2016	medium	late	M	R	R	NA	M	NA	NA	NA
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
MS Camaro	Meridian	2016	M short	M early	M	R	R	NA	MR	NA	high	high
MS Chevelle	Meridian	2014	short	M early	M	MR	R	NA	MR	NA	high	high
ND-VitPro	ND	2016	medium	M early	R	R	MA	NA	M	NA	high	high
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
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
Shelly	MN	2016	medium	medium	MR	NA	MR/MS	NA	M	NA	NA	NA
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 Rockford	Syngenta	NA	medium	M late	M	MR	M	MR	MR	NA	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 Valda	Syngenta	2015	medium	M early	R	R	MR	MR	M	NA	medium	M high
TCG-Climax	21st C gen.	2017	M short	late	MR	R	S	NA	MS	NA	high	high
TCG-Cornerstone	21st C gen.	2015	M short	medium	MR	R	MR/MS	NA	MA	NA	NA	high
TCG-Spitfire	21st C gen.	2015	M short	medium	MR	R	NA	NA	MS	NA	NA	NA
Velva	NDSU	2011	M short	M late	R	R	MR/MS	M	MS	S	medium	medium
Vida	MT	1998	medium	medium	MR	MS	MS	MR	S	MR	medium	medium
WB9879CLP*	WB	2012	medium	medium	R	S	S	MR	MS	R	medium	high
WB9479	WB	2017	M short	M early	R	R	R	NA	MS	NA	NA	NA
WB9590	WB	2017	M short	M early	NA	R	MR	NA	MS	NA	NA	NA
WB9653	WB	2015	M short	M early	R	NA	MR	NA	MS	NA	medium	medium
WB9719	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**;** MT = Montana State University; NDSU = North Dakota State University; SD = South Dakota State University; TS = Tigren Seed; WB = WestBred.

[2]M = Intermediate; MR = Moderately resistant; MS = Moderately susceptible; NA = data not available; R = Resistant; S = susceptible; VS = Very susceptible.

[3]Resistant to orange wheat blossom midge. *Clearfield wheat with imidazolinone tolerance.

Spring Wheat Dryland Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Plant Height	Heading Date	Protein†	Test weight‡	Yield#		
					2017	2-Yr Avg	3-Yr Avg*
	(in)	DAP*	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Prevail	24.2	64	17.9	50.7	33.7	45.8	42.3
LCS Prime	23.4	63	17.4	48.2	25.2	40.5	42.3
WB9653	25.7	59	18.6	50.3	28.1	42.2	41.0
MS Chevelle	23.4	58	18.6	50.5	29.5	43.7	40.8
SY Valda	19.2	63	17.7	50.8	29.0	42.2	40.6
Velva	24.6	64	19.8	50.9	27.8	43.3	40.5
Surpass	22.3	61	19.5	48.3	29.4	42.1	40.2
Elgin-ND	24.8	62	18.9	47.3	28.7	43.0	38.9
Mott	24.3	63	19.9	50.1	27.5	40.4	38.9
Linkert	23.8	59	18.0	50.9	32.1	41.7	38.8
SY Ingmar	20.2	62	17.4	48.8	30.8	41.3	38.3
WB-Mayville	25.2	64	18.9	48.1	27.7	40.2	38.2
Boost	20.3	58	17.9	51.5	31.9	40.2	37.9
Prestige	21.9	60	18.3	48.4	29.4	40.4	37.7
SY Rowyn	22.2	65	17.4	50.3	30.9	40.9	37.4
Rollag	24.3	58	18.0	52.7	29.3	41.5	37.4
Prosper	22.8	58	16.6	51.7	28.6	39.9	37.2
Redstone	22.8	68	20.7	46.0	24.4	40.7	37.0
SY Soren	24.3	65	18.2	47.1	25.1	39.7	36.6
LCS Nitro	22.6	66	20.4	48.9	24.9	38.7	36.5
Glenn	20.9	58	17.8	51.6	28.4	40.5	36.5
Faller	20.2	58	17.4	52.2	30.3	41.9	36.1
Barlow	24.3	59	18.9	51.4	27.6	40.2	35.6
LCS Breakaway	21.0	61	18.4	50.5	27.5	38.6	34.7
Bolles	22.0	65	19.7	49.8	21.9	33.8	33.7
HRS 3504	21.7	58	16.8	51.5	32.0	45.9	-
TCG-Cornerstone	23.0	58	17.4	49.1	32.1	43.5	-
HRS 3100	22.7	57	18.3	49.4	29.7	43.3	-
LCS Anchor	22.2	65	18.0	49.7	27.8	41.5	-
Shelly	22.6	60	18.3	50.0	31.4	41.5	-
TCG-Climax	22.7	57	17.0	49.9	30.1	38.8	-
HRS 3616	22.2	64	18.1	47.7	25.0	38.6	-
Egan	20.7	63	18.4	50.4	28.4	38.4	-
ND-VitPro	22.2	67	21.4	49.0	22.2	37.8	-
AKF-Astro	21.3	59	17.1	48.6	34.3	-	-
MS Camaro	24.0	63	18.2	48.7	33.2	-	-
WB9479	22.4	59	18.5	49.4	31.3	-	-
LCS Rebel	22.2	65	18.7	49.6	30.8	-	-
Lang-MN	22.0	65	18.2	48.7	30.7	-	-
WB9590	19.3	58	17.6	49.6	30.1	-	-
Dyna-Gro Caliber-1667	20.3	59	18.6	49.9	29.3	-	-
Dyna-Gro Ambush-1660	19.3	58	18.0	49.9	29.1	-	-
TCG-Spitfire	21.9	58	18.2	50.3	28.8	-	-
HRS 3419	22.3	59	18.2	51.2	28.1	-	-
SY Rockford	22.8	60	18.8	49.2	28.0	-	-
HRS 3530	21.4	61	18.6	50.0	26.8	-	-
WB9719	21.0	65	20.7	52.5	25.5	-	-
LCS Trigger	17.7	57	17.4	49.5	24.9	-	-
Mean	22.3	61.1	18.4	49.8	28.7	-	-
CV (%)	5.0	1.3	2.6	1.7	7.1	-	-
LSD (5%)	1.8	1.3	0.8	1.4	3.3	-	-
LSD (10%)	1.5	1.1	0.6	1.1	2.8	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft — Previous crop: Peas
Planted: 5-3-2017 — Harvested: 8-15-2017
Soil test (0-6"): P=17 ppm; K=380 ppm; pH=5.8; OM=2.5%; — Soil type: Williams-Bowbells loam
(0-24"): NO_3-N=27 lb/a

Applied fertilizers in lb/a: N=55; 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: Goldsky @ 1.0 pt/a (6-7-17)

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Spring Wheat Divide Variety Trial - NDSU

Variety	Protein†	Test weight‡	Yield#	
			2017	2-Yr Avg
	(%)	(lb/bu)	(bu/a)	(bu/a)
Glenn	12.7	63.3	29.0	55.2
Barlow	13.3	62.7	28.4	54.3
Velva	11.6	60.4	31.3	53.1
Mott	13.6	60.6	20.2	51.3
Faller	12.9	59.5	25.0	49.9
SY Soren	13.2	61.0	26.3	49.1
Elgin-ND	13.1	60.7	30.1	45.6
Reeder	12.3	60.4	28.4	44.1
SY Ingmar	14.6	62.4	23.0	39.8
Bolles	15.1	59.9	23.6	-
Mean	13.2	61.1	26.5	-
CV (%)	8.5	0.9	8.1	-
LSD (5%)	1.9	0.8	NS	-
LSD (10%)	1.6	1.0	3.1	-

Location: Crosby, ND; Latitude 48° 48' N; Longitude 103° 18' W; Elevation 2044 ft
Previous crop: Durum
Harvested: 8/17/2017
Planted: 5/5/2017
Soil type: Farnuf-Alkabo
Soil test (0-6"): N/A
(0-24"): NO_3-N=24 lb/a

Applied fertilizer in lb/a: 75 N : 18 P : 0 K : 4.5 S Broadcasted
†Protein adjusted to 12% moisture
‡Test weight reported on a 13.5% moisture basis
#Yield reported on a 13.5% moisture basis

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Spring Wheat McKenzie Variety Trial - NDSU

Variety	Protein†	Test weight‡	Yield#	
			2016	2017
	(%)	(lb/bu)	(bu/a)	(bu/a)
Elgin-ND	13.1	58.6	59.8	40.1
Faller	12.9	56.1	61.8	34.0
SY Ingmar	13.2	58.5	56.6	36.0
Mott	13.7	60.7	53.0	38.2
Glenn	13.3	58.9	58.4	31.8
SY Soren	13.6	59.5	49.3	39.9
Barlow	13.9	57.6	50.8	38.3
Reeder	15.0	57.3	56.1	33.0
Velva	14.0	57.1	44.8	37.6
Bolles	13.9	58.9	-	36.6
Mean	13.6	58.3	54.5	36.6
CV (%)	9.8	2.4	8.6	26.2
LSD (5%)	NS	2.4	7.7	NS
LSD (10%)	NS	2.0	6.4	12.1

Location: Arnegard, ND; Latitude 47° 48' N; Longitude 103° 25' W
Previous crop: Durum
Harvested: 8/23/2017
Planted: 5/12/2017
Soil type: Dooley-Zahl complex
Soil test (0-6"): P=7 ppm; K=216 ppm; OM=2.6%, pH=7.7
(0-24"): NO_3-N=20 lb/a

Applied fertilizer in lb/a: 79.43 N : 21.2 P : 0 K : 5.3 S Broadcasted
†Protein adjusted to 12% moisture
‡Test weight reported on a 13.5% moisture basis
#Yield reported on a 13.5% moisture basis

Hard Red Spring Wheat Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Origin	Plant height	Days to head	Protein†	Test weight	Yield		
						2017	2-Yr Avg	3-Yr Avg
		(in)	(DAP+)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
LCS Iguacu	Limagrain	35	57	13.6	60.4	115.6	98.7	97.8
Croplan HRSW 3530	Croplan	36	57	15.3	59.3	103.9	96.7	97.5
Croplan HRS 3419	Croplan	33	60	14.3	58.4	105.5	103.8	94.9
Prosper	NDSU	36	52	14.5	60.1	113.8	98.6	94.2
Velva	NDSU	36	55	15.3	59.5	101.6	91.9	94.0
Reeder	NDSU	37	57	15.5	60.9	108.6	94.6	93.4
Elgin-ND	NDSU	37	53	15.3	60.1	103.5	96.7	93.2
SY Soren	Syngenta	30	53	15.1	61.2	111.3	94.3	92.0
Faller	NDSU	34	55	14.6	59.5	116.9	98.0	91.8
Bolles	U of MN	34	56	17.0	60.0	107.6	93.5	89.0
Mott	NDSU	34	57	16.2	59.8	102.7	91.2	88.7
Rollag	U of MN	33	55	15.3	61.6	108.8	91.6	88.2
WB-Mayville	Westbred	30	52	15.1	60.4	113.5	91.0	88.1
Barlow	NDSU	36	51	15.8	61.9	101.8	89.2	88.1
Prevail	SDSU	35	52	14.3	59.8	106.1	90.1	87.9
Linkert	U of MN	31	55	15.5	60.6	111.3	91.5	87.1
Steele-ND	NDSU	36	54	15.4	61.1	107.0	91.5	86.5
Glenn	NDSU	37	51	16.4	63.0	98.3	84.0	83.1
Prestige	Pulse-USA	34	61	14.4	59.1	105.2	104.8	-
SY Ingmar	Syngenta	32	54	15.1	60.4	111.4	98.0	-
MS Chevelle	Meridian	32	53	14.4	58.8	109.2	97.8	-
LCS Prime	Limagrain	34	51	14.4	61.3	116.3	96.9	-
LCS Nitro	Limagrain	32	59	13.6	59.2	104.8	96.1	-
WB Digger	Westbred	35	59	15.0	59.1	106.2	92.0	-
SY Valda	Syngenta	30	53	14.7	60.0	112.4	91.3	-
ND-VitPro	NDSU	36	53	15.7	61.5	102.7	90.1	-
Redstone	Pulse-USA	34	50	15.4	59.3	109.9	89.7	-
Focus	SDSU	38	50	15.9	61.7	110.9	88.9	-
Egan	MSU	34	54	17.0	58.8	96.5	88.6	-
LCS Anchor	Limagrain	31	53	15.7	60.8	108.4	86.6	-
WB9312	Westbred	32	53	12.9	59.7	116.6	-	-
TCG-Spitfire	21st Century Genetics	32	57	13.7	59.6	115.9	-	-
SY Rockford	Syngenta	36	58	14.8	58.9	115.4	-	-
Surpass	SDSU	33	50	14.6	59.4	110.3	-	-
LCS Trigger	Limagrain	38	61	13.7	58.5	108.7	-	-
MS Camaro	Meridian	31	52	15.8	60.7	107.4	-	-
TCG-Wildfire	21st Century Genetics	38	57	14.8	60.4	103.6	-	-
Croplan HRS 3504	Croplan	29	56	14.4	58.6	103.2	-	-
TCG-Climax	21st Century Genetics	35	59	17.2	62.1	100.8	-	-
LCS Rebel	Limagrain	37	52	16.0	61.3	98.8	-	-
TCG-Cornerstone	21st Century Genetics	30	56	15.2	60.2	97.1	-	-
Boost	SDSU	35	57	15.7	59.4	96.1	-	-
Mean		34.0	54.5	15.11	60.2	107.3	93.6	90.9
C.V. (%)		-	-	2.76	1.09	8.32	-	-
LSD (5%)		-	-	0.58	0.91	12.44	-	-
LSD (10%)		-	-	0.49	0.77	10.42	-	-

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

Planted: 5-1-2017 — Harvested: 8-16-2017

Residue at planting: Conventional till — Soil type: Lihen Loamy Fine Sand

Plot size: 87.5 ft^2

Soil test to (0-6"): P=20 ppm; K=206 ppm; pH=7.8; OM=2.5%

(0-24"): NO3-N=54 lb/a

Applied fertilizer in lb/a broadcast: 319 lbs of Urea (46-0-0)

Yield goal: 90 bu/a

Planting population: 1.5 million seeds/a

Herbicides applied: Wolverine Advance 1.7 pt/a (5/30/2017)

Fungicides applied: Prosaro 421 SC 8 oz/A (6/29/2017)

Rainfall: 5.75 in (5/1/2017 - 8/16/2017)

Irrigation: 12.65 in (5/1/2017 - 8/16/2017)

+Days after planting

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

†Protein content adjusted to a 12% moisture

Dryland Spring Wheat Advanced Yield - MSU EARC, Sidney, MT

Variety	Plant height	Days to heading	Protein	Grain Yield †
	(in)	(julian*)	(%)	(bu/a)
AGRIPR10	20.2	164	14.9	19.4
AGRIPR12	21.7	167	13.5	21.9
AGRIPR14	20.9	165	14.1	27.7
AGRIPR141	22.0	165	14.1	20.3
AGRIPR151	21.9	165	14.3	26.0
AGRIPR161	21.1	167	13.7	29.4
BZ 92413R	21.5	165	13.8	24.3
BZ 996434	22.8	163	14.1	15.1
CI10003	27.4	168	14.5	21.9
CI13596	24.5	166	14.6	28.9
HRS3504	20.2	168	13.0	23.2
HRS3616	21.8	164	14.0	19.5
HRS3661	21.9	163	14.4	23.4
LIMAGR143	25.7	165	14.2	23.8
LIMAGR161	22.7	163	12.5	22.7
LIMAGR171	23.1	164	14.4	28.8
PI574642	23.5	169	13.9	28.8
PI633974	21.9	167	14.3	18.7
PI642366	21.9	166	13.0	22.2
PI660981	23.0	164	14.2	25.3
PI671855	23.0	167	15.4	22.4
PI676978	20.6	163	14.4	24.5
PI679964	23.9	168	12.9	27.2
WB171	19.7	163	14.3	22.9
WB172	22.8	169	14.7	22.4
WB173	22.2	167	13.7	26.4
WB9879CLP	22.8	167	14.1	26.7
WF161	21.9	165	14.3	23.8
WF162	19.9	166	14.0	21.5
WF163	24.1	168	14.4	27.5
WSCIA	21.5	166	14.0	26.8
Mean	22.3	165.7	14.1	24.0
CV (%)	5.5	0.8	3.1	24.2
LSD	4.9	2.0	0.7	9.2

Location: EARC Dryland Farm — Previous crop: Fallow
Planted: 4/19/2017 — Harvested: 7/31/2017
Soil Test N Avail (lb/a): 57.5 — Soil Type: Williams Clay Loam
Soil Test P2O5 (lb/a): 34 — Precip 2017: 3.92"
N added (lb/a): 55 — Irrigation (sprinkler): n/a
Plot Width (ft): 5'

(julian*) is a continuous count of days since January 1
†Grain Yield adjusted to 12.0% moisture basis
^0: no lodging - 9: plants lying flat on ground

Irrigated Spring Wheat Advanced Yield - MSU **EARC, Sidney, MT**

Variety	Plant height (in)	Days to heading (julian*)	Protein (%)	Grain Yield † (bu/a)
AGRIPR10	30.4	165	12.8	87.8
AGRIPR12	30.8	167	10.7	101.0
AGRIPR14	30.3	166	13.2	97.7
AGRIPR141	32.9	168	12.4	86.4
AGRIPR151	32.3	168	10.9	92.9
AGRIPR161	34.6	169	12.0	100.6
BZ92413R	29.5	167	11.6	77.2
BZ996434	34.1	164	13.3	96.1
CI10003	44.4	171	12.4	78.0
CI13596	43.6	168	13.1	80.7
HRS3419	33.6	171	12.2	107.5
HRS3504	32.7	169	11.7	101.7
HRS3616	34.4	166	13.0	97.4
LIMAGR143	36.7	166	11.9	78.6
LIMAGR161	34.8	165	10.2	91.2
LIMAGR171	38.2	166	13.0	91.9
PI574642	35.4	169	12.4	93.2
PI633974	34.3	168	11.7	89.0
PI642366	34.0	168	11.3	99.4
PI660981	36.4	165	11.8	94.2
PI671855	33.2	168	13.4	85.4
PI676978	34.0	165	12.4	94.3
PI679964	38.1	169	11.7	103.4
WB171	29.7	165	12.5	94.9
WB172	35.3	170	12.3	94.2
WB173	32.7	168	12.5	95.7
WB9879CLP	34.9	168	12.1	92.1
WF161	35.0	167	12.3	92.7
WF162	32.4	169	11.3	100.7
WF163	37.7	168	11.9	89.0
WSCIA	33.3	168	12.0	91.0
Mean	34.5	167.3	12.1	92.8
CV (%)	3.8	0.6	5.8	7.4
LSD	5.4	1.7	1.1	10.9

Location: EARC, Sidney, MT — Previous crop: Sugarbeet
Planted: 4/20/2017 — Harvested: 8/17/2017
Soil Test N Avail (lb/a): 21.8 — Soil Type: Savage Silty Clay
N added (lb/a): 149 — Precip 2017: 4.12"
P2O5 added (lb/a): 52 — Irrigation (sprinkler): 4.67"
Plot Width (ft): 5'
(julian*) is a continuous count of days since January 1.
†Grain Yield adjusted to 12.0% moisture basis

Dryland Spring Wheat - MSU **EARC, Sidney, MT**

Variety	Plant height (in)	Days to heading (julian*)	Protein (%)	Grain Yield † (bu/a)
Brennan	20.2	164	15.5	35.8
Choteau	22.0	166	15.0	32.6
Duclair	23.6	166	14.2	36.3
Egan	24.5	168	15.5	33.0
Foruna	28.6	165	14.2	31.8
Lanning	24.1	166	14.1	39.1
MT1543	23.5	165	14.3	33.6
MT1570	22.6	165	15.4	29.2
Reeder	26.1	168	14.4	35.7
SY Soren	23.8	166	14.7	33.7
Vida	24.3	166	13.7	40.9
WB 9879 CLP	22.8	168	15.4	34.3
Mean	23.9	166.1	14.7	34.6
CV (%)	6.4	0.8	3.9	11.9
LSD	6.6	2.3	1.0	7.0

Location: EARC Dryland Farm, MT Previous crop: Peas

Planted: 4/21/2017 Harvested: 8/11/2017

Soil Test N Avail (lb/a): 31 Soil Type: Williams Clay Loam

Soil test P2O5 (lb/a): 23.2 Precip 2017: 3.92"

N added (lb/a): 200 lbs 46-0-0 + 50 lbs 11-52-0

Plot Width (ft): 5' Irrigation (sprinkler): n/a

(julian*) is a continuous count of days since January 1.

†Grain Yield adjusted to 12.0% moisture basis

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

Variety	Plant height (in)	Protein (%)	Grain Yield † (bu/a)
Choteau	23.0	14.9	27.2
Duclair	24.4	14.7	24.8
Egan	24.3	15.6	24.8
Foruna	27.4	13.4	24.9
Lanning	24.4	15.2	33.9
Reeder	25.2	15.3	29.7
SY Soren	22.4	15.5	25.5
Vida	25.5	14.7	30.8
WB 9879 CLP	23.5	15.5	22.3
Mean	24.5	15.0	27.1
CV (%)	8.8	3.4	13.3
LSD	9.1	0.9	6.0

Previous crop: Fallow
Planted: 4/25/2017
Harvested: 8/4/2017
Fertilizer: Supplied by cooperator 65-70 lbs MESZ (Microessential sulfur & zinc)
Cooperator also applied 300 lbs wheat blend in the fall.
†Grain Yield adjusted to 12.0% moisture basis

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

Variety	Plant height (in)	Protein (%)	Grain Yield † (bu/a)
Brennan	20.2	16.3	21.8
Choteau	20.7	15.0	24.3
Duclair	20.9	14.5	23.1
Egan	22.3	16.1	20.6
Foruna	24.3	13.9	23.5
Lanning	21.1	15.6	25.0
Reeder	21.4	14.8	21.6
SY Soren	21.4	15.2	24.4
Vida	21.3	13.0	28.4
WB 9879 CLP	20.9	15.4	25.3
Mean	21.4	15.0	23.8
CV (%)	8.8	3.9	16.5
LSD	8.2	1.0	6.7

Previous Crop: Peas
Planted: 4/27/2017
Harvested: 8/16/2017
Fertilizer: 200 lbs Urea, 50 lbs 11-52-0
†Grain Yield adjusted to 12.0% moisture basis

Wheat Variety Comparisons – Williston, ND 2017

Gautam Pradhan, Jerald Bergman, Kyle Dragseth

The gross return per acre was calculated by multiplying 3 year average yield from dryland varietal trials and the market price obtained on 12/03/2017 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 the case of durum, the choice rate was used.

Spring Wheat

Variety	3 Yr Avg. (2015–2017) Yield bu/a	Protein %	Gross Return $/a	+ or - Barlow $/a
Mott	38.9	16.6	269.32	39.03
Velva	40.5	15.8	262.95	32.66
Prevail	42.3	15.0	254.22	23.93
Elgin-ND	38.9	15.8	253.38	23.09
Linkert	38.8	15.9	253.36	23.07
WB-Mayville	38.2	16.0	251.55	21.26
WB9653	41.0	15.0	247.46	17.17
SY Valda	40.6	15.1	246.41	16.12
Bolles	33.7	17.0	241.48	11.19
Redstone	37.0	15.8	240.05	9.76
SY Ingmar	38.3	15.4	238.98	8.69
SY Soren	36.6	15.7	236.57	6.28
MS Chevelle	40.8	14.6	235.83	5.54
LCS Nitro	36.5	15.7	234.37	4.08
Rollag	37.4	15.3	231.41	1.12
Barlow	35.6	15.8	230.29	0.00
Prestige	37.7	15.1	229.84	-0.45
Glenn	36.5	15.3	227.28	-3.01
LCS Breakaway	34.7	15.8	225.66	-4.63
SY Rowyn	37.4	14.9	224.13	-6.16
Prosper	37.2	14.8	219.02	-11.27
Faller	36.1	14.7	211.54	-18.75

Durum

Variety	3 Yr Avg. (2015–2017) Yield bu/a	Protein %	Gross Return $/a	+ or - Ben $/a
Tioga	32.7	17.2	204.49	26.67
AC Navigator	30.8	17.3	192.70	14.88
Carpio	30.7	18.1	191.69	13.87
Joppa	30.6	17.8	191.17	13.35
Alkabo	30.4	17.5	189.93	12.11
VT Peak	30.2	18.4	188.61	10.79
Alzada	30.1	17.5	187.98	10.16
Divide	29.7	17.9	185.34	7.52
Grenora	29.6	17.8	184.97	7.15
AC Commander	29.6	18.3	184.72	6.90
Normanno	29.1	17.6	181.66	3.84
Mountrail	28.8	18.0	180.27	2.45
Ben	28.5	18.4	177.82	0.00
Pierce	28.1	17.7	175.39	-2.43
Lebsock	27.4	17.9	170.94	-6.88
Strongfield	27.1	18.5	169.32	-8.50
Rugby	26.7	18.3	166.99	-10.83
CDC Verona	26.4	19.6	165.30	-12.52
Maier	26.1	18.9	163.13	-14.70
Silver	24.3	18.3	151.56	-26.26

DURUM VARIETY DESCRIPTIONS

					Resistance To[2]					Quality Factors			
VARIETY	ORIGIN[1]	YEAR RELEASED	HEIGHT	MATURITY	LODGING	LEAF RUST	FOLIAR DISEASE	ROOT ROT	SCAB	TEST WEIGHT	KERNEL SIZE[3]	GRAIN PROTEIN	OVERALL QUALITY
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
DIVIDE	NDSU	2005	M TALL	M LATE	M	R	M	M	MR	MEDIUM	MEDIUM	M HIGH	EXCELLENT
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
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
MOUNTRAIL	NDSU	1998	M TALL	M LATE	M	R	M	M	S*	MEDIUM	MEDIUM	MEDIUM	AVERAGE
ND GRANO	NDSU	2017	MEDIUM	M LATE	MS	R	NA	NA	M	HIGH	MEDIUM	M HIGH	GOOD
ND RIVELAND	NDSU	2017	TALL	MEDIUM	M	R	NA	NA	M	HIGH	MEDIUM	MHIGH	GOOD
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	MT	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
VT PEAK	VITERRA	2010	M TALL	MEDIUM	MS	NA	NA	NA	NA	MEDIUM	M SMALL	M HIGH	GOOD

[1]Refers to developer: CANADA represents developer from that country; DGP = Dakota Growers Pasta; MT = Montana State University; NDSU = North Dakota State University; WB = WestBred.

[2]MR = Moderately resistant; M = Intermediate; MS = Moderately susceptible; NA = data not available; R = Resistant; S = Susceptible; VS = Very susceptible. 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.

Durum Dryland Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Plant Height	Heading Date	Protein†	Test weight‡	Yield#		
					2017	2-Yr Avg	3-Yr Avg
	(in)	DAP*	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Tioga	24.4	57	18.8	50.9	28.5	28.5	32.7
AC Navigator	20.7	59	17.7	53.5	27.8	27.6	30.8
Carpio	22.6	59	18.5	50.1	26.7	28.3	30.7
Joppa	23.8	56	18.4	50.3	27.6	27.2	30.6
Alkabo	21.8	57	17.8	51.1	27.7	27.9	30.4
VT Peak	21.4	56	17.7	52.5	26.8	28.3	30.2
Alzada	17.2	56	18.0	51.0	27.6	27.1	30.1
Divide	21.7	58	18.7	50.6	27.0	27.1	29.7
Grenora	19.5	56	18.1	49.8	25.6	28.9	29.6
AC Commander	20.2	59	18.8	50.5	26.7	25.7	29.6
Normanno	16.1	55	19.1	50.4	26.3	27.3	29.1
Mountrail	21.7	58	18.3	50.3	23.8	26.0	28.8
Ben	22.4	56	18.3	51.9	26.7	25.2	28.5
Pierce	21.7	55	17.9	51.0	26.4	26.2	28.1
Lebsock	20.7	57	17.3	51.5	27.0	25.5	27.4
Strongfield	23.4	58	19.3	50.6	24.8	25.1	27.1
Rugby	25.2	57	18.8	51.4	25.1	23.6	26.7
CDC Verona	23.5	58	20.4	49.5	22.9	25.8	26.4
Silver	15.9	55	19.9	50.4	19.2	21.0	24.3
ND Grano	22.3	58	19.2	50.4	26.0	33.1	-
ND Riveland	24.1	56	18.4	51.4	27.6	32.6	-
Maier	21.8	59	19.8	50.6	26.1	-	-
TCG Bright	22.3	58	18.0	50.8	25.6	-	-
Mean	21.5	57.0	18.6	50.9	26.1	-	-
CV (%)	5.6	1.4	3.3	1.1	7.6	-	-
LSD (5%)	2.0	1.3	1.0	0.9	3.2	-	-
LSD (10%)	1.7	1.1	0.8	0.8	2.7	-	-

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

Planted: 4-22-2017 Harvested: 8-15-2017

Soil test (0-6"): P=17 ppm; K=380 ppm; pH=5.8; OM=2.5%; Soil type: Williams-Bowbells loam

(0-24"): NO_3-N=27 lb/a

Applied fertilizers in lb/a: N=33; 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: Goldsky @ 1.0 pt/a (6-7-17)

Durum Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Origin	Plant height	Days to head	Protein†	Test weight	Yield		
						2017	2-Yr Avg	3-Yr Avg
		(in)	(DAP+)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
ND Riveland	NDSU	38	60	16.4	60.3	112.4	99.3	94.4
Tioga	NDSU	40	58	16.7	60.4	97.4	87.7	88.3
Mountrail	NDSU	37	59	16.5	60.5	99.3	88.7	88.0
Carpio	NDSU	39	60	16.8	60.9	106.1	89.3	87.7
Joppa	NDSU	38	60	15.9	61.0	102.8	85.2	87.5
Grenora	NDSU	35	58	16.0	58.9	99.0	87.0	86.0
VT Peak	Viterra	36	57	16.3	61.7	102.0	90.5	86.0
CDC Verona	Canada	37	59	17.1	59.6	99.7	83.0	85.1
Divide	NDSU	38	60	16.9	60.9	97.9	82.7	84.4
Pierce	NDSU	41	60	16.3	61.4	94.1	84.2	84.1
Alkabo	NDSU	34	57	15.4	60.5	101.5	81.7	82.3
Strongfield	Canada	38	60	17.7	59.6	90.1	80.5	81.4
DG Max	DGP	36	58	17.2	60.3	88.6	78.8	81.0
Maier	NDSU	38	60	17.8	60.9	100.1	80.6	80.8
Lebsock	NDSU	33	57	16.4	60.1	88.6	78.5	78.9
AC Navigator	Canada	33	60	16.3	61.2	90.3	76.1	78.8
AC Commander	Canada	29	59	15.8	59.6	86.7	75.3	77.0
Ben	NDSU	38	58	16.4	60.6	84.9	75.2	76.0
Alzada	WB	29	56	16.1	59.0	90.5	72.9	74.5
Rugby	NDSU	42	59	16.8	59.9	89.5	72.6	74.2
Silver	MSU	28	53	16.1	58.0	90.9	75.3	73.8
Normanno	AllStar Seed Company	29	57	16.8	57.4	94.4	77.2	73.8
ND Grano	NDSU	36	60	16.4	61.3	105.4	93.3	-
Mean		35.7	58.3	16.52	60.18	96.19	82.43	82.00
C.V. (%)		-	-	2.18	0.81	6.98	-	-
LSD (5%)		-	-	0.51	0.69	9.47	-	-
LSD (10%)		-	-	0.42	0.57	7.91	-	-

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

Planted: 4-28-2017 — Harvested: 8-17-2017

Residue at planting: Conventional till — Soil type: Lihen Loamy Fine Sand

Plot size: 87.5 ft^2

Soil test to (0-6"): P=20 ppm; K=206 ppm; pH=7.8; OM=2.5%

(0-24"): NO3-N=54 lb/a

Applied fertilizer in lb/a broadcast: 319 lbs of Urea (46-0-0)

Yield goal: 90 bu/a

Planting population: 1.5 million seeds/a

Herbicides applied: Wolverine Advance 1.7 pt/a (5/30/2017)

Fungicides applied: Prosaro 421 SC 8 oz/A (6/30/2017)

Rainfall: 5.75 in (4/28/2017 - 8/17/2017)

Irrigation: 12.65 in (4/28/2017 - 8/17/2017)

⁺Days after planting

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

†Protein content adjusted to a 12% moisture

Durum Divide Variety Trial - NDSU

Variety	Protein[†]	Test weight[‡]	Yield[#]	
			2017	2-Yr Avg
	(%)	(lb/bu)	(bu/a)	(bu/a)
Lebsock	13.9	59.1	27.4	27.4
Mountrail	13.8	58.1	28.1	28.1
Joppa	14.5	59.6	26.8	26.8
Divide	13.5	59.7	27.2	27.2
Alkabo	13.0	60.3	28.6	28.6
Carpio	13.4	58.5	27.6	27.6
Tioga	13.7	60.1	25.6	25.6
ND Grano	13.0	59.7	28.1	-
ND Riveland	13.2	59.8	31.7	-
Plaza	15.1	59.6	23.4	-
Mean	13.7	59.5	27.4	-
CV (%)	11.3	1.9	13.3	-
LSD (5%)	2.7	1.9	6.2	-
LSD (10%)	2.2	1.6	5.2	-

Location: Crosby, ND; Latitude 48° 48' N; Previous crop: Durum
Longitude 103° 18' W: Elevation 2044 ft Harvested: 7/20/17
Planted: 5/5/2017 Soil type: Farnuf-Alkabo
Soil test (0-6"): N/A
(0-24"): NO_3-N=24 lb/a
Applied fertilizer in lb/a: 75 N : 18 P : 0 K : 4.5 S Broadcasted
[†]Protein adjusted to 12% moisture
[‡]Test weight reported on a 13.5% moisture basis
[#]Yield reported on a 13.5% moisture basis

Durum McKenzie Variety Trial - NDSU

Variety	Protein[†]	Test weight[‡]	Yield[#]	
			2016	2017
	(%)	(lb/bu)	(bu/a)	(bu/a)
Tioga	14.3	59.4	59.3	36.6
Joppa	15.4	59.0	61.5	33.8
Mountrail	16.3	57.2	57.3	27.3
Carpio	14.4	58.2	55.3	29.2
Alkabo	15.0	59.2	49.1	33.4
Lebsock	15.6	58.6	47.1	31.2
Divide	14.7	59.0	48.1	27.8
ND Grano	16.2	58.2	-	31.8
ND Riveland	14.5	59.9	-	41.5
Plaza	14.5	59.6	-	33.2
Mean	15.1	58.8	54.0	32.6
CV (%)	9.8	2.4	8.8	26.2
LSD (5%)	NS	2.4	8.5	NS
LSD (10%)	NS	2.0	7.0	NS

Location: Arnegard, ND; Latitude 47° 48' N; Previous crop: Durum
Longitude 103° 25' W Harvested: 8/23/17
Planted: 5/12/2017 Soil type: Dooley-Zahl complex
Soil test (0-6"): P=7 ppm; K=216 ppm; OM=2.6%, pH=7.7
(0-24"): NO_3-N=20 lb/a
Applied fertilizer in lb/a: 79 N : 21.2 P : 0 K : 5.3 S Broadcasted
[†]Protein adjusted to 12% moisture
[‡]Test weight reported on a 13.5% moisture basis
[#]Yield reported on a 13.5% moisture basis

Dryland Statewide Durum - MSU **EARC, Sidney, MT**

Variety	Plant height (in)	Days to heading (julian*)	Protein (%)	Grain Yield † (bu/a)
Alkabo	22.8	168	13.1	35.8
Alzada	21.7	165	13.3	37.4
Carpio	23.2	170	14.6	34.2
Divide	24.4	171	15.1	35.9
Dynamic	24.4	172	12.7	35.7
Fortitude	23.6	170	13.3	39.4
Grenora	22.4	169	14.3	37.2
Joppa	25.3	170	14.1	40.4
Mountrail	22.6	169	13.5	36.0
Precision	23.2	170	13.2	33.9
Tioga	25.7	170	14.2	32.8
Vivid	25.5	171	15.7	30.9
Mean	23.7	169.7	13.9	35.8
CV (%)	5.4	0.5	4.3	6.0
LSD	5.4	1.3	1.0	3.5

Location: EARC Dryland Farm, MT Previous crop: Fallow
Planted: 4/19/2017 Harvested: 8/7/2017
Soil Test N Avail (lb/a): 57.5 Soil Type: Williams Clay Loam
Soil Test P2O5 (lb/a): 34 Precip 2017: 3.92"
N added (lb/a): 55 Plot Width (ft): 5'
(julian*) is a continuous count of days since January 1.
†Grain Yield adjusted to 12.0% moisture basis Irrigation (sprinkler): n/a
^0: no lodging - 9: plants lying flat on ground

Irrigated Statewide Durum - MSU **EARC, Sidney, MT**

Variety	Plant height (in)	Days to heading (julian*)	Protein (%)	Grain Yield † (bu/a)
Alkabo	37.0	168	12.4	81.9
Alzada	30.2	165	11.6	71.2
Carpio	39.9	170	11.4	82.1
Divide	40.3	170	11.8	84.8
Dynamic	38.2	169	12.5	75.2
Fortitude	36.1	169	12.3	77.3
Grenora	37.1	169	12.1	82.0
Joppa	40.8	169	11.2	79.4
Mountrail	39.0	169	11.6	81.3
Precision	39.9	169	11.8	76.8
Tioga	169.7	169	11.5	78.6
Vivid	37.8	169	12.4	76.0
Mean	48.8	168.7	11.9	78.9
CV (%)	103.7	0.5	9.0	8.6
LSD	190.7	1.5	1.7	11.7

Location: EARC Sidney, MT Previous crop: Sugarbeet
Planted: 4/20/2017 Harvested: 8/17/2017
Soil Test N Avail (lb/a): 21.8 Soil Type: Savage Silty Clay
N added (lb/a): 100 lbs/ac 11-52+ 300 lbs/ac Urea Precip 2017: 4.12"
Plot Width (ft): 5' Irrigation (sprinkler): 4.67"
(julian*) is a continuous count of days since January 1.
†Grain Yield adjusted to 12.0% moisture basis
^0: no lodging - 9: plants lying flat on ground

Dryland Uniform Regional Durum - MSU **EARC, Sidney, MT**

Variety	Plant height (in)	Days to heading (julian*)	Protein (%)	Grain Yield † (bu/a)
Alkabo	25.6	169	14.1	37.5
Carpio	26.0	171	14.8	34.7
Divide	25.9	170	13.0	32.1
Joppa	24.7	170	13.7	34.5
Mountrail	110.0	170	13.9	37.4
Tioga	27.7	170	14.6	34.4
Mean	40.0	169.9	14.0	35.1
CV (%)	88.8	0.6	3.9	8.2
LSD	107.7	1.7	0.9	4.4

Location: EARC Dryland Farm, MT — Previous crop: Fallow

Planted: 4/19/2017 — Harvested: 8/1/2017

Soil Test N Avail (lb/a): 57.5 — Soil Type: Williams Clay Loam

Soil Test P2O5 (lb/a): 34 — Precip 2017: 3.92"

N added (lb/a): 55 — Plot Width (ft): 5'

(julian*) is a continuous count of days since January 1.

†Grain Yield adjusted to 12.0% moisture basis

^0: no lodging - 9: plants lying flat on ground — Irrigation (sprinkler): n/a

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

Variety	Plant height (in)	Protein (%)	Grain Yield † (bu/a)
Alkabo	26.4	13.1	28.6
Alzada	24.3	13.3	26.5
Carpio	27.6	13.8	25.4
CDCDynamic	25.6	15.4	22.6
CDCForititude	26.9	15.2	20.6
CDCPrecision	25.9	14.5	27.3
CDCVivid	26.8	15.4	25.6
Divide	26.6	14.3	22.9
Grenora	25.7	14.4	26.8
Joppa	28.1	14.4	23.3
Mountail	26.1	13.9	29.7
Tioga	28.5	13.8	23.9
Mean	26.5	14.3	25.3
CV (%)	6.8	3.9	11.0
LSD	7.8	1.0	4.7

Previous crop: Fallow

Planted: 4/25/2017

Harvested: 8/4/2017

Fertilizer: Supplied by cooperator 65-70 lbs MESZ (Microessential sulfur & zinc)

Cooperator also applied 300 lbs wheat blend in the fall.

†Grain Yield adjusted to 12.0% moisture basis

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

Variety	Plant height (in)	Protein (%)	Grain Yield † (bu/a)
Alkabo	24.9	12.3	32.3
Alzada	22.0	13.1	34.9
Carpio	24.9	12.9	26.4
Divide	25.5	12.4	30.5
Grenora	24.5	13.1	31.7
Joppa	24.8	12.9	24.8
Mountail	24.9	12.9	31.0
Tioga	25.3	12.3	26.1
Mean	24.6	12.7	29.7
CV (%)	9.3	4.2	14.7
LSD	10.1	0.9	7.6

Previous Crop: Peas

Planted: 4/27/2017

Harvested: 8/16/2017

Fertilizer: 200 lbs Urea, 50 lbs 11-52-0

†Grain Yield adjusted to 12.0% moisture basis

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
AAC GATEWAY	CANADA	2012	M SHORT	MEDIUM	GOOD	R	R	R	NA	MEDIUM	MEDIUM
AC BROADVIEW	CANADA	2009	MEDIUM	MEDIUM	GOOD	R	R	R	NA	MEDIUM	MEDIUM
AC FLOURISH	CANADA	2010	SHORT	EARLY	GOOD	R	MR	MR	NA	MEDIUM	M LOW
ACCIPITER	CANADA	2008	SHORT	MEDIUM	GOOD	R	R	MS	S	MEDIUM	MEDIUM
BEARPAW*	MT	2011	M SHORT	MEDIUM	FAIR	R	R	S	NA	MEDIUM	LOW
BRAWL CL PLUS	CO	2011	SHORT	EARLY	FAIR	NA	NA	NA	NA	M HIGH	M HIGH
CDC CHASE	CANADA	2013	MEDIUM	MEDIUM	GOOD	M	TR-R	MR	R	M HIGH	MEDIUM
DECADE	MT/NDSU	2010	MEDIUM	M EARLY	GOOD	R	R	S	M	MEDIUM	MEDIUM
DENALI	CO/KSU	2011	MEDIUM	M LATE	NA	NA	MR	S	NA	MEDIUM	M HIGH
EMERSON	CANADA	2011	SHORT	MEDIUM	GOOD	NA	R	MS	NA	M HIGH	MEDIUM
FLOURISH	CANADA	2010	SHORT	EARLY	GOOD	R	MR	R	NA	MEDIUM	M LOW
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
JUDEE*	MT	2011	MEDIUM	MEDIUM	FAIR	R	S	S	NA	MEDIUM	M HIGH
LOMA	MT	2016	MEDIUM	M LATE	GOOD	NA	R	NA	NA	MEDIUM	MEDIUM
LYMAN	SDSU	2008	MEDIUM	MEDIUM	FAIR	M	R	R	MR	M HIGH	M HIGH
MOATS	CANADA	2010	MEDIUM	MEDIUM	GOOD	MS	R	MR	NA	M HIGH	MEDIUM
NORTHERN	MT	2015	M SHORT	M LATE	FAIR	NA	R	NA	NA	MEDIUM	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
REDFIELD	SD	2013	SHORT	MEDIUM	FAIR	R	S	MS	NA	M HIGH	MEDIUM
SUNRISE	CANADA	2008	MEDIUM	MEDIUM	GOOD	MS	MR	MS	R	MEDIUM	LOW
SY MONUMENT	AGRIPRO	2015	M SHORT	MEDIUM	FAIR	NA	MR	MR	NA	M LOW	MEDIUM
SY WOLF	AGRIPRO	2010	M SHORT	MEDIUM	POOR	R	R	MR	MR	HIGH	M LOW
WARHORSE	MT	2013	SHORT	M LATE	FAIR	MR	R	S	NA	MEDIUM	MEDIUM
WB 4614	WB	2013	MEDIUM	MEDIUM	GOOD	NA	NA	NA	NA	M HIGH	MEDIUM
WB4483	WB	2016	M SHORT	LATE	GOOD	NA	MS	MR	MR	MEDIUM	M LOW
WB4575	WB	2016	M SHORT	MEDIUM	NA	NA	NA	NA	NA	MEDIUM	M LOW
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
YELLOWSTONE	MT	2005	MEDIUM	MEDIUM	GOOD	M	S	MS	M	LOW	M HIGH

[1]Refers to developer: CANADA represents developers from that country; MT = Montana State University; NDSU = North Dakota State University; NE = University of Nebraska; SDSU = South Dakota State University; WB = WestBred.

[2]M = Intermediate; MR = Moderately resistant; MS = Moderately susceptible; NA = Data not available; R = Resistant, S = Susceptible.

[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	MEDIUM	M LATE	FAIR	MR	NA	NA	NA	MEDIUM	LOW
Hyalite*	MT/WB	2005	M SHORT	M EARLY	FAIR	MR	R	S	NA	MEDIUM	MEDIUM
NuDakota	AgriPro	2007	SHORT	MEDIUM	POOR	R	MR	MR	NA	MEDIUM	MEDIUM
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	MEDIUM	MEDIUM
NuWest	MSU/GM	1994	MED	MEDIUM	GOOD	R	MR	S	MR	M LOW	MEDIUM
Wendy	SDSU	2004	SHORT	EARLY	GOOD	NA	NA	NA	NA	MEDIUM	MEDIUM

[1]Refers to developer: GM = General Mills; ID = University of Idaho; MT = 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 - NDSU **WREC, Williston, ND 2017**

Variety	Winter Survival	Plant height	Days to heading	Protein†	Test weight ‡	Yield#		
						2017	2-Yr Avg	3-Yr Avg
	(%)	(in)	(julian)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
WB Matlock	97	19.0	156	14.7	59.5	54.5	48.4	49.6
AAC Gateway	93	18.6	156	15.5	59.7	41.9	40.7	41.6
Peregrine	92	18.4	158	13.3	58.3	49.9	49.3	48.1
Jerry	90	18.9	157	15.1	57.9	43.2	42.9	43.9
Accipiter	90	16.6	158	10.4	43.6	37.8	40.5	43.8
Redfield	88	17.3	155	14.7	59.3	46.5	46.3	46.4
Moats	85	19.8	158	14.7	56.0	44.7	44.2	44.8
Broadview	84	17.9	157	14.0	58.6	47.4	45.2	48.3
Ideal	82	18.7	156	13.8	59.6	45.2	42.7	39.3
CDC Chase	77	-	-	-	-	-	-	-
SY Sunrise	71	-	-	-	-	-	-	-
Emerson	70	-	-	-	-	-	-	-
Lyman	69	-	-	-	-	-	-	-
Decade	67	-	-	-	-	-	-	-
Flourish	67	-	-	-	-	-	-	-
SY Monument	67	-	-	-	-	-	-	-
Loma	53	-	-	-	-	-	-	-
Oahe	46	-	-	-	-	-	-	-
Overland	38	-	-	-	-	-	-	-
Northern	33	-	-	-	-	-	-	-
SY Wolf	28	-	-	-	-	-	-	-
Overland-FHB1	25	-	-	-	-	-	-	-
WB4614	22	-	-	-	-	-	-	-
Keldin	19	-	-	-	-	-	-	-
Mean	65	18.4	156.6	14.0	56.9	45.7	-	-
CV (%)	3.6	7.9	0.3	2.8	0.8	7.7	-	-
LSD (5%)	10.2	2.1	0.7	0.6	0.7	5.3	-	-
LSD (10%)	8.5	1.8	0.6	0.5	0.6	4.4	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft
Previous crop: Peas
Planted: 9-18-2016
Harvested: 07-20-2017
Soil test (0-6"): P=27 ppm; K=226 ppm; pH=6.6; OM=2.5%
Soil type: Williams-Bowbells loam
(0-24"): NO_3-N=24 lb/a

Statistical analysis only performed on varieties > 80% winter survival.

Applied fertilizers in lb/a: N=36; P_2O_5=26; K_2O=0

†Protein adjusted to 12% moisture

‡Test weight reported on a 13.5% moisture basis

#Yield reported on a 13.5% moisture basis

Chemical Applications: Goldsky @ 1.0 pt/a (5-12-17)

Relative winter hardiness rating: 1 = excellent, 10 = very poor

Winter Wheat Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Origin	Plant height	Days to head	Lodging	Protein†	Test weight	Yield		
							2017	2-Yr Avg	3-Yr Avg
		(in)	(julian+)	(0-9*)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Decade	MSU/NDSU	35	158	0	10.4	58.9	136.1	117.5	110.6
Jerry	NDSU	37	156	2	9.6	57.7	108.0	100.7	100.5
Peregrine	Canada	39	158	1	10.2	61.2	134.0	122.3	-
CDC Accipiter	Canada	34	159	0	10.0	60.3	136.3	119.5	-
Boomer	WB	32	159	0	10.4	56.6	128.7	119.2	-
CDC Falcon	Canada	31	156	0	10.0	59.8	125.4	119.2	-
Radiant	Canada	39	159	0	10.2	59.9	120.5	117.0	-
SY Wolf	AgriPro	33	156	0	11.3	60.2	130.6	110.4	-
Northern	MSU	31	159	1	10.6	60.0	113.2	107.9	-
Overland	U of NE	31	157	0	9.9	59.6	106.3	104.0	-
MT1488	MSU	34	157	1	12.1	60.7	143.7	-	-
Ideal	SDSU	30	155	0	9.4	59.3	134.6	-	-
Oahe	SDSU	35	155	1	11.2	61.4	134.2	-	-
AAC Gateway	Canada	33	158	0	11.6	59.7	119.7	-	-
WB4614	WB	28	157	0	10.6	59.7	115.3	-	-
AC Emerson	Canada	33	158	0	11.3	60.3	106.7	-	-
Mean		33.3	157.1	0.3	10.56	59.71	124.57	113.76	105.57
C.V. (%)		-	-	-	7.87	2.05	13.84	-	-
LSD (5%)		-	-	-	1.39	2.05	24.55	-	-
LSD (10%)		-	-	-	1.15	1.70	20.47	-	-

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

Planted: 9-14-2016 Harvested: 7-31-2017

Residue at planting: Conventional till Soil type: Lihen Loamy Fine Sand

Plot size: 87.5 ft^2

Soil test to (0-6"): P=20 ppm; K=206 ppm; pH=7.8; OM=2.5%

(0-24"): NO3-N=54 lb/a

Applied fertilizer in lb/a broadcast: 319 lbs of Urea (46-0-0)

Yield goal: 100 bu/a

Planting population: 1.25 million seeds/a

Herbicides applied: Bison 1 1/2 pt/A + Axial XL 1 pt/A (5/11/2017)

Fungicides applied: None

Rainfall: 3.44in (1/1/2017 - 7/31/2017)

Irrigation: 12.65 in (5/11/2017 - 7/31/2017)

+Dates beginning January 1, 2017

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

†Protein content adjusted to a 12% moisture

Intrastate Winter Wheat Evaluation - MSU **EARC, Sidney, MT**

Entry	Variety	Plant height (in)	Days to heading (julian*)	Protein (%)	Grain Yield † (bu/a)
1	Yellowstone	19.7	152	8.5	38.8
2	Judee	17.7	155	12.0	16.9
3	Warhorse	18.8	155	10.6	23.5
4	Brawl CLP	21.9	150	10.4	24.0
5	Decade	21.9	151	8.6	46.7
6	Bearpaw	21.0	152	9.6	34.5
7	SY Clearstone 2CL	22.2	153	8.3	40.0
8	WB-Quake	20.6	154	9.2	38.2
9	Northern	17.3	155	9.2	36.7
10	SY Wolf	18.9	151	9.4	30.8
11	SY Monument	20.6	152	7.6	41.9
12	SY Sunrise	18.9	150	9.4	45.8
13	07CL039-7	19.4	150	10.0	25.1
14	MTCL1131	22.8	155	9.0	41.5
15	Keldin	22.7	154	9.2	29.6
16	WB4614	19.9	153	9.0	33.8
17	WB4623CLP	20.6	156	12.2	12.9
18	WB4483	16.9	155	9.4	30.4
19	WB4575	22.6	153	9.7	41.5
20	BZ9WM09-1620	21.5	155	11.4	21.0
21	BZ9W09-2216	20.3	153	8.9	39.9
22	LCS Chrome	21.1	152	10.1	38.0
23	PSB13NEDH-7-140	24.5	151	10.0	40.2
24	PSB13NEDH-7-45	18.8	151	8.9	42.8
25	LCS Jet	18.5	156	9.5	26.4
26	Long Branch	20.5	150	9.3	26.1
27	Loma	17.5	157	11.4	23.2
28	MT1265	24.1	154	8.3	45.2
29	Denali	24.8	152	8.2	39.1
30	Langin	19.2	149	8.3	31.9
31	CO13003C	20.1	151	7.6	32.4
Mean		20.5	152.7	9.4	33.5
CV (%)		98.6	7.6	12.4	29.4
LSD		99.0	18.8	1.9	16.6

Location: EARC Dryland Farm — Previous crop: Fallow

Planted: 9/13/2016 — Harvested: 7/20/2017

Soil Test N Avail (lb/ac): 57.5 — Soil Type: Williams Clay Loam

N added (lb/ac): 69 — Precip 2016-2017: 4.76"

Plot Width (ft): 5' — Irrigation (sprinkler): n/a

(julian*) is a continuous count of days since January 1.

†Grain Yield adjusted to 12.0% moisture basis

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

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												
AAC Synergy	S	M/F	2015	M short	M late	MR	MR	NA	MR	MR	NA	NA
Abi Balster	BARI	M/F	2015	M short	medium	M	NA	NA	NA	NA	NA	NA
Abi Growler	BARI	M/F	2015	M short	medium	MR	NA	NA	NA	NA	NA	NA
AC Metcalfe*	Canada	M	1997	medium	late	M	S	MR	MS	MS	medium	medium
CDC Copeland*	Canada	M	1999	tall	M late	MS	MR	S	MS	VS	low	medium
CDC Meredith	Canada	M	2008	medium	late	M	MR	NA	MS	S	NA	NA
Celebration	BARI	M/F	2008	M short	medium	MR	S		MS/S	MR/R	NA	NA
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*	MT	F/M		tall	medium	MR	NA	S	S	NA	M high	M high
Eslick	MT	F	2003	medium	M late	MS	S	NA	NA	MS	medium	M low
Harrington*	Canada	F/M	1981	M short	late	S	S	S	MS	S	medium	M low
Haxby	MT	F	2003	medium	medium	MS	S	S	S	MS	V high	medium
Hockett*	MT	F/M	2008	medium	medium	MS	S	S	NA	NA	medium	M high
LCS Genie	Lime	M	NA	short	medium	MR	NA	NA	NA	NA	NA	NA
LCS Odyssey	Lime	M/F	NA	short	medium	M	NA	NA	NA	NA	NA	NA
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
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
Quest*	MN	M	2010	M short	medium	MS	S	S	MR	MR/R	M low	medium
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												
Haybet	MT	H	1989	tall	medium	S	NA	S	NA	NA	low	medium
Hays	MT	H	2003	M tall	medium	MS	NA	NA	NA	NA	low	medium

[1]Refers to developer: BARI = Busch Ag Resources; Inc.; CANADA represents developers from that country; Lime = Limagrain; MN = University of Minnesota; MT = Montana State University; NDSU = North Dakota State University; S = Syngenta; WB = WestBred.
[2]F = Feed; M = Malt.

[3]MR = Moderately resistant; M = Intermediate; MS = Moderately susceptible; NA = Data not available; R = Resistant; S = Susceptible; VS = Very susceptible.

*Recommended as malting in Western U.S.

Barley Dryland Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Plant Height	Heading Date	Protein†	Test weight‡	Plump %	Yield#		
						2017	2-Yr Avg	3-Yr Avg*
	(in)	DAP*	(%)	(lb/bu)	>6/64	(bu/a)	(bu/a)	(bu/a)
Two Row								
Pinnacle	19.4	66	16.0	46.5	68.3	52.4	67.8	65.6
Hockett	18.9	73	16.4	46.5	68.5	62.7	69.8	63.5
ND Genesis	20.7	65	14.7	45.8	70.6	59.1	68.1	59.5
CDC Meredith	21.1	58	17.3	40.9	26.6	50.4	66.2	59.3
Conlon	20.9	61	16.0	48.9	89.5	44.2	57.8	50.5
LCS Genie	18.9	66	16.0	45.7	51.1	61.6	71.7	-
AAC Synergy	19.6	68	16.8	43.0	58.6	57.3	69.5	-
LCS Odyssey	18.0	70	17.0	46.3	53.3	59.1	67.5	-
Sirish	19.7	63	17.4	45.9	52.4	55.8	67.0	-
ABI Balster	19.0	63	17.0	42.7	43.4	57.2	66.8	-
ABI Growler	18.8	63	17.8	41.2	37.4	53.2	64.2	-
Explorer	19.7	74	16.1	46.2	68.8	57.3	-	-
Six Row								
Celebration	20.2	65	16.9	44.4	53.4	60.0	73.6	62.2
Tradition	18.8	59	15.7	46.8	68.5	56.3	67.1	60.9
Lacey	19.2	66	17.1	44.2	57.3	56.9	67.2	59.0
Stellar-ND	18.9	67	16.7	44.4	67.6	59.2	62.9	58.2
Quest	18.8	58	16.5	46.2	62.7	48.4	62.5	57.9
Innovation	18.4	63	17.2	45.3	67.9	53.8	63.8	57.9
Mean	19.4	64.9	16.6	45.1	59.2	55.8	-	-
CV (%)	8.0	11.7	1.3	3.0	16.8	10.2	-	-
LSD (5%)	2.5	12.3	1.0	0.8	17.4	9.6	-	-
LSD (10%)	2.1	10.3	0.8	0.7	14.5	8.0	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft — Previous crop: Peas
Planted: 4-21-2017 — Harvested: 8-2-2017
Soil test (0-6"): P=17 ppm; K=380 ppm; pH=5.8; OM=2.5% — Soil type: Williams-Bowbells loam
(0-24"): NO_3-N=27 lb/a

Applied fertilizers in lb/a: N=29; P_2O_5=18; K_2O=0; S=5

DAP* = Days after planting (Drought stress contributed to high variability in DAP.)

†Protein adjusted to 0% moisture

‡Test weight reported on a 13.5% moisture basis

#Yield reported on a 13.5% moisture basis

Chemical Applications: Valor/LV6 @ 1 qt/ac and 3 oz/ac (10-17-2016); Axial Star/Supremacy @ 16oz/ac and 6 oz/ac
DAP* = Days after planting

Barley Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Origin	Plant height	Days to head	Lodging	Protein†	Test weight	Plump %	Yield		
								2017	2-Yr Avg	3-Yr Avg
		(in)	(DAP+)	(0-9*)	(%)	(lb/bu)	>6/64	(bu/a)	(bu/a)	(bu/a)
Six Row										
Quest	U of MN	35	55	0	14.8	51.6	88	156.2	122.5	121.3
Tradition	BAR	37	53	0	14.6	50.6	92	160.0	121.3	120.3
Lacey	U of MN	37	55	0	14.5	51.0	89	152.0	119.7	118.0
Stellar-ND	NDSU	33	54	0	14.2	49.8	95	142.1	111.4	113.0
Celebration	BAR	37	55	0	14.8	50.9	88	143.8	113.8	111.7
Two Row										
CDC Copeland	Canada	38	63	1	13.8	52.0	90	153.5	123.2	127.8
ND Genesis	NDSU	32	53	0	13.2	51.9	96	131.0	116.0	120.7
Pinnacle	NDSU	33	51	0	13.0	52.1	94	128.7	111.0	119.9
Hockett	MSU	30	58	4	14.6	51.4	86	134.2	113.0	117.9
AC metcalfe	Canada	31	57	1	15.0	51.3	85	142.8	115.5	115.5
Conlon	NDSU	32	49	0	15.1	51.9	93	136.4	110.7	102.6
CDC Meredith	Canada	35	63	8	14.3	49.2	83	131.4	120.7	-
ABI Balster	BAR	31	57	0	14.1	50.8	91	158.6	-	-
AAC Synergy	Syngenta	30	59	0	13.8	51.2	93	145.5	-	-
Explorer	SECOBRA	26	59	1	14.5	51.5	91	144.4	-	-
Sirish	Syngenta	29	62	0	14.1	51.0	89	143.4	-	-
LCS Genie	Limagrain	28	64	0	13.2	50.5	87	143.4	-	-
LCS Odyssey	Limagrain	29	63	0	12.9	51.2	93	139.9	-	-
ABI Growler	BAR	32	59	0	14.2	49.0	88	136.8	-	-
Mean		32.4	57.2	0.7	14.14	50.99	90.1	143.38	116.58	117.16
C.V. (%)		-	-	-	6.36	1.67	5.84	10.57	-	-
LSD (5%)		-	-	-	0.32	0.30	1.85	5.36	-	-
LSD (10%)		-	-	-	0.42	3.03	1.15	6.42	-	-

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

Planted: 4-28-2017 — Harvested: 8-8-2017

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

Plot size: 87.5 ft^2

Soil test to (0-6"): P=20 ppm; K=206 ppm; pH=7.8; OM=2.5%

(0-24"): NO3-N=54 lb/a

Applied fertilizer in lb/a broadcast: 217 lbs of Urea (46-0-0)

Yield goal: 120 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: Prosaro 421 SC 8 oz/A (6/29/2017)

Rainfall: 4.57 in. (4/28/2017 - 8/8/2017)

Irrigation: 11.85 in (4/28/2017 - 8/8/2017)

+Days after planting

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

†Protein content adjusted to a 0% moisture

Barley Divide Variety Trial - NDSU

Variety	Protein†	Test weight‡	Plump %	Yield#	
				2017	2-Yr Avg
	(%)	(lb/bu)	>6/64	(bu/a)	(bu/a)
Two Row					
ND Genesis	12.5	49.7	79.1	38.8	38.8
Pinnacle	11.5	50.3	81.7	45.7	45.7
Hockett	15.2	51.7	83.9	28.7	28.7
Conlon	13.2	50.4	89.1	31.5	31.5
AAC Synergy	13.5	48.7	82.5	35.1	-
ABI Growler	14.5	47.6	78.1	35.2	-
Six Row					
Lacey	11.6	49.1	55.7	41.6	41.6
Innovation	12.6	48.1	53.5	37.9	37.9
Celebration	13.6	46.8	48.8	40.7	40.7
Tradition	12.9	47.5	41.5	38.5	38.5
Mean	13.1	49.0	69.4	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: Crosby, ND; Latitude 48° 48' N; Longitude 103° 18' W; Elevation 2044 ft
Previous Crop: Durum
Planted: 5/5/2017
Harvested: 8/17/2017
Soil type: Farnuf-Alkabo
Soil test (0-6"): N/A
(0-24"): NO_3-N=24 lb/a
Applied fertilizer in lb/a: 47 N : 18 P : 0 K : 4.5 S Broadcasted
†Protein adjusted to 0% moisture
‡Test weight reported on a 13.5% moisture basis
#Yield reported on a 13.5% moisture basis

Barley McKenzie Variety Trial - NDSU

Variety	Protein†	Test weight‡	Plump %	Yield#	
				2016	2017
	(%)	(lb/bu)	>6/64	(bu/a)	(bu/a)
Two Row					
ND Genesis	14.9	45.3	29.4	97.1	43.4
Pinnacle	14.9	45.2	36.3	96.4	34.4
Hockett	14.9	50.7	76.0	87.5	40.2
Conlon	14.3	47.1	64.1	88.0	31.9
AAC Synergy	16.4	45.8	42.7	-	43.1
ABI Growler	16.1	44.4	43.4	-	36.9
Six Row					
Innovation	14.2	46.7	30.1	87.1	48.5
Lacey	13.6	47.8	26.0	88.8	44.7
Celebration	15.3	45.2	31.4	89.9	37.0
Tradition	13.4	47.8	44.8	82.9	43.9
Mean	14.8	46.6	42.4	89.7	40.4
CV (%)	16.7	4.1	39.6	4.7	24.8
LSD (5%)	NS	3.3	28.8	7.3	NS
LSD (10%)	NS	2.7	23.8	6.0	14.2

Location: Arnegard, ND; Latitude 47° 48' N; Longitude 103° 25' W
Previous crop: Durum
Planted: 5/12/2017
Harvested: 8/23/2017
Soil type: Dooley-Zahl complex
Soil test (0-6"): P=7 ppm; K=216 ppm; OM=2.6%, pH = 7.7
(0-24"): NO_3-N=20 lb/a
Applied fertilizer in lb/a: 51 N : 21.2 P : 0 K : 5.3 S Broadcasted
†Protein adjusted to 0% moisture
‡Test weight reported on a 13.5% moisture basis
#Yield reported on a 13.5% moisture basis

Dryland Hulless Barley - MSU **EARC, Sidney, MT**

Variety	Plant height (in)	Days to heading (julian*)	Protein (%)	Grain Yield † (bu/a)
09WA-265.12	26.1	172	15.0	32.8
2Ab09-X06F058HL-31	21.7	172	17.1	21.8
Falcon	21.9	175	18.5	12.0
Havener	22.8	173	14.9	28.8
Transit	24.4	171	18.7	22.0
Washonupana	23.6	57	5.1	28.7
X05013-T1	22.6	171	15.6	38.6
X0626-T229	20.9	112	9.9	44.9
X07G30-T131	24.5	171	16.2	34.6
Mean	23.2	152.6	14.6	29.4
CV (%)	7.9	24.3	23.1	28.7
LSD	2.1	56.8	5.0	13.8

Location: EARC Dryland Farm, MT
Previous crop: Fallow
Planted: 4/18/2017
Harvested: 8/8/2017
Soil test N avail (lb/a): 57.5
Soil Type: Williams Clay Loam
Soil Test P2O5 (lb/a): 34
Precip 2017: 3.92"
N added (lb/a): 55
Plot width (ft): 5'
(julian*) is a continuous count of days since January 1.
†Grain Yield adjusted to 12.0% moisture basis
^0: no lodging - 9: plants lying flat on ground

Irrigated Hulless Barley - MSU **EARC, Sidney, MT**

Variety	Plant height (in)	Days to heading (julian*)	Lodging (0 to 9^)	Protein (%)	Grain Yield † (bu/a)
09WA-265.12	32.7	170	0	11.7	102.6
2Ab09-X06F058HL-31	30.6	171	0	13.9	96.0
Falcon	26.1	173	0	16.0	53.2
Franubet	-	-	-	-	-
Havener	30.1	169	0	11.7	111.4
Transit	34.3	171	0	16.8	82.8
Wanupana	-	-	-	-	-
Washonupana	-	-	-	-	-
X05013-T1	31.5	172	0	13.8	106.5
X0626-T229	30.6	170	0	13.3	118.0
X07G30-T131	33.1	171	0	13.2	88.0
Mean	31.1	170.8	0.0	13.8	94.8
CV (%)	5.8	0.7	.	8.8	10.1
LSD	7.9	2.2	0.0	2.0	15.8

Location: EARC Sidney, MT
Previous crop: Sugarbeet
Planted: 4/19/2017
Harvested: 8/17/2017
Soil test N avail (lb/a): 21.8
Soil Type: Savage Silty Clay
N added (lb/a): 149
Precip 2017: 4.12"
P2O5 added (lb/ac\): 52
Irrigation (sprinkler): 4.67"
Plot width (ft): 5'
(julian*) is a continuous count of days since January 1.
†Grain Yield adjusted to 12.0% moisture basis
^0: no lodging - 9: plants lying flat on ground

Dryland Intrastate Barley - MSU **EARC, Sidney, MT**

Variety	Plant height	Days to heading	Plump >6/64	Thin	Protein	Grain Yield †
	(in)	(julian*)	(%)	(%)	(%)	(bu/a)
10ARS191-3	23.2	173	38.9	2.0	13.8	41.3
10WA-106.18	23.8	168	49.1	2.0	13.5	48.9
11WA-107.58	25.5	167	88.5	0.4	13.8	54.6
2Ab08-X05M010-65	21.3	171	59.4	2.5	13.8	48.5
Balster	23.8	170	80.2	1.4	14.3	37.1
Copeland	24.1	171	81.5	1.0	14.2	48.9
Craft	26.2	170	91.9	0.2	14.6	39.7
Genesis	24.8	165	93.5	0.2	13.3	39.1
Genie	20.1	170	49.7	3.3	13.4	49.4
Growler	24.0	171	79.9	1.2	14.4	38.3
Harrington	22.7	170	80.0	1.3	14.2	41.8
Hockett	24.3	170	87.6	0.7	13.2	46.4
Metcalfe	25.1	168	82.3	0.3	14.2	40.2
Odyssey	22.6	172	83.4	0.8	13.4	45.0
Synergy	22.0	171	86.2	0.3	13.2	48.5
Mean	23.6	169.9	75.5	1.2	13.8	44.5
CV (%)	7.1	0.8	5.0	34.6	2.9	15.5
LSD	6.8	2.2	6.7	0.7	0.6	11.4

Location: EARC Dryland Farm, MT — Previous crop: Fallow
Planted: 4/18/2017 — Harvested: 8/11/2017
Soil Test N Avail (lb/ac): 57.5 — Soil Type: Williams Clay Loam
Soil Test P2O5 (lb/ac): 34 — Precip 2017: 3.92"
N added (lb/ac): 55 — Plot Width (ft): 5'
(julian*) is a continuous count of days since January 1.
†Grain Yield adjusted to 12.0% moisture basis
^0: no lodging - 9: plants lying flat on ground

Irrigated Intrastate Barley - MSU **EARC, Sidney, MT**

Variety	Plant height	Days to heading	Plump >6/64	Thin	Protein	Grain Yield †
	(in)	(julian*)	(%)	(%)	(%)	(bu/a)
10ARS191-3	29.8	170	77.0	3.1	12.3	103.1
10WA-106.18	31.1	168	91.5	1.1	10.6	117.8
11WA-107.58	30.6	168	96.1	0.4	11.4	118.7
2Ab08-X05M010-65	26.1	171	89.8	1.9	10.5	117.9
Balster	30.4	170	96.2	0.4	11.0	135.5
Copeland	32.2	171	93.1	0.9	11.1	120.1
Craft	32.7	168	95.3	0.7	12.3	110.7
Genesis	32.5	165	97.4	0.5	11.8	110.2
Genie	27.2	171	92.0	0.9	10.5	128.6
Growler	29.0	171	93.3	1.0	11.0	115.1
Harrington	32.8	170	92.9	0.8	11.6	125.4
Hockett	31.1	168	95.8	0.6	11.8	114.3
Metcalfe	30.6	168	94.5	0.7	11.5	110.8
Odyssey	26.0	172	96.3	0.7	10.5	127.1
Synergy	31.6	170	96.2	0.6	11.7	127.2
Mean	30.2	169.4	93.2	1.0	11.3	118.8
CV (%)	6.5	0.7	2.9	65.0	6.7	10.6
LSD	7.9	1.9	4.3	1.0	1.2	19.9

Location: EARC Sidney, MT — Previous crop: Sugarbeet
Planted: 4/19/2017 — Harvested: 8/16/2017
Soil test N avail (lb/ac): 21.8 — Soil Type: Savage Silty Clay
N added (lb/ac): 149 — Precip 2017: 4.12"
P2O5 added (lb/ac): 52 — Irrigation (sprinkler): 4.67"
(julian*) is a continuous count of days since January 1. — Plot width (ft): 5'
†Grain Yield adjusted to 12.0% moisture basis
^0: no lodging - 9: plants lying flat on ground

Dryland Barley - MSU **EARC, Sidney, MT**

Variety	Plant height	Days to heading	Plump >6/64	Protein	Grain Yield †
	(in)	(julian*)	(%)	(%)	(bu/a)
09WA-265.12	22.0	172	31.0	12.7	44.1
Balster	20.9	172	52.0	14.1	60.5
Bill Coors 100	18.6	172	71.5	14.3	47.7
Champion	20.9	172	41.0	13.5	50.9
Claymore	20.5	175	50.3	13.7	46.5
Conrad	18.4	179	57.0	14.9	47.6
Copeland	19.9	173	58.3	14.5	47.0
Eslick	15.9	179	27.7	13.5	53.5
Genie	18.0	178	69.3	12.3	58.1
Growler	19.2	177	51.3	15.3	40.7
Haxby	19.9	173	61.3	13.3	44.3
Haybet	23.0	173	12.7	14.8	46.7
Hays	19.2	174	22.3	15.0	47.2
Hockett	21.4	176	74.0	13.0	58.4
Lavina	21.4	174	21.0	14.6	48.1
Merit 57	20.2	176	40.7	13.9	47.7
Metcalfe	21.0	174	68.0	13.2	55.8
Moravian165	21.8	171	64.0	12.9	48.5
Odyssey	18.8	179	63.0	13.3	47.5
Oreana	18.4	175	70.3	12.7	52.8
Synergy	20.3	176	75.0	13.2	50.1
Mean	20.0	174.6	51.5	13.7	49.7
CV (%)	8	1.4	17.6	6.6	21.1
LSD	6.7	3.9	14.8	1.5	16.3

Location: EARC Sidney, MT Previous crop: Peas

Planted: 4/21/2017 Harvested: 8/10/2017

Soil test N avail (lb/ac): 31 Soil Type: Williams Clay Loam

Soil Test P2O5 (lb/ac): 23.2 Precip 2017: 3.92"

N added (lb/ac): 200lbs 46-0-0 + 50lbs 11-52-0 Plot width (ft): 5'

(julian*) is a continuous count of days since January 1.

†Grain Yield adjusted to 12.0% moisture basis

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

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
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
CS CAMDEN	CANTERRA	WHITE	MEDIUM	MED	R	S	MS	NA	NA	NA
DEON	MN	YELLOW	TALL	LATE	R	S	R	T	V HIGH	NA
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
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
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: CANADA represents developers from that country; MN = Minnesota; NDSU = North Dakota State University; SDSU = South Dakota State University.

[2]M = Intermediate; MR = Moderately resistant; MS = Moderately susceptible; MT = Moderately tolerant; NA = Data not available; R = Resistant; S = Susceptible; T = Tolerant; VS = Very susceptible.

Oat Dryland Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Heading Date DAP*	Height (in)	Test weight‡ (lb/bu)	Yield# 2017 (bu/a)	Yield# 2-Yr Avg (bu/a)	Yield# 3-Yr Avg (bu/a)
Killdeer	48	20.4	36.1	67.5	89.7	81.6
AC Pinnacle	51	23.3	36.3	72.9	88.1	79.8
CDC Dancer	49	24.7	37.2	66.3	83.7	79.8
Minstrel CDC	50	23.7	36.1	64.3	85.1	76.6
Leggett	49	23.8	38.4	63.1	83.7	76.0
Souris	49	22.3	37.0	65.1	79.1	73.7
Deon (MN)	50	26.4	39.2	70.9	76.6	73.4
Rockford	50	22.7	38.3	62.8	81.6	72.7
Otana	51	26.9	34.7	68.7	77.4	72.3
HiFi	51	24.4	37.6	61.6	77.0	71.2
Newburg	49	25.6	38.4	64.9	74.7	70.4
Jury	49	25.9	39.5	66.0	73.8	70.2
Beach	48	23.5	38.8	56.4	71.2	65.0
Hytest	47	26.1	39.4	49.8	63.4	60.0
Stallion	52	20.4	35.3	50.4	71.2	59.9
Paul	52	26.3	49.0	42.8	52.7	55.3
Hayden	48	26.3	38.5	71.8	-	-
CS Camden	48	24.3	36.1	68.0	-	-
Mean	49.6	24.3	38.1	63.0	-	-
CV (%)	1.6	5.0	2.4	7.9	-	-
LSD (5%)	1.3	2.0	1.5	7.8	-	-
LSD (10%)	1.1	1.7	1.2	6.5	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft Previous crop: Peas
Planted: 5-4-2017 Harvested: 8-11-2017
Soil test (0-6"): P=19 ppm; K=230 ppm; pH=5.5; OM=2.5%; Soil type: Williams-Bowbells loam
(0-24"): NO_3-N=74 lb/a

Applied fertilizers in lb/a: N=5; P_2O_5=18; K_2O=0; S=5

DAP* = Days after planting

‡Test weight reported on a 13.5% moisture basis

#Yield reported on a 13.5% moisture basis

Chemical Applications: Bromac Advanced @ 2 pints/a (6/9/17)

Oats Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Origin	Plant height	Days to head	Lodging	Test weight	Yield		
						2017†	2-Yr Avg	3-Yr Avg
		(in)	(DAP+)	(0-9*)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
AC Pinnacle	Canada	43	59	6	42.7	110.1	159.3	172.5
Souris	NDSU	41	56	3	44.3	115.1	154.9	166.1
Jury	NDSU	45	56	8	45.1	107.8	152.5	162.5
Leggett	Canada	44	59	3	44.7	109.5	151.4	161.1
Goliath	SDSU	50	60	7	44.6	95.3	138.5	159.0
Rockford	NDSU	44	61	3	45.3	111.9	149.6	153.5
HiFi	NDSU	46	60	6	44.2	106.5	142.2	153.3
Deon	MN	41	57	5	43.6	112.6	160.1	-
Hayden	SDSU	44	56	4	45.6	122.2	155.5	-
Otana	MSU	43	59	6	42.1	101.9	150.1	-
Beach	NDSU	44	57	2	44.2	111.3	143.3	-
GM423	General Mills	46	63	9	40.2	100.9	142.5	-
Furlong	Canada	44	63	2	43.8	124.3	-	-
Killdeer	NDSU	42	54	6	42.8	110.6	-	-
Hytest	SDSU	39	52	2	45.0	91.5	-	-
Mean		43.7	57.9	4.4	43.89	108.78	150.00	161.13
C.V. (%)		-	-	-	1.39	8.88	-	-
LSD (5%)		-	-	-	0.87	13.34	-	-
LSD (10%)		-	-	-	0.73	11.12	-	-

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

Planted: 4-27-2017 Harvested: 8-14-2017

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

Plot size: 87.5 ft^2

Soil test to (0-6"): P=20 ppm; K=206 ppm; pH=7.8; OM=2.5%

(0-24"): NO3-N=54 lb/a

Applied fertilizer in lb/a broadcast: 319 lbs of Urea (46-0-0)

Yield goal: 200 bu/a

Planting population: 1.25 million seeds/a

Herbicides applied: Starane NXT 10 oz/a + Bison 1.5 pt/a (5/30/2017)

Fungicides applied: none

Rainfall: 5.66 in (4/27/2016 - 8/14/2016)

Irrigation: 11.85 in (4/27/2017 - 8/14/2017)

⁺Days after planting

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

†Yields affected by shatter loss due to late season rain

Flax Variety Descriptions

Variety[1]	ORIGIN[2]	YEAR RELEASED	RELATIVE MATURITY[3]	SEED COLOR	PLANT HEIGHT[3]	RESISTANCE TO WILT[4]
Bison	NDSU	1926	MIDIUM	BROWN	MEDIUM	MR
Carter	NDSU	2004	MIDIUM	YELLOW	MEDIUM	MR
CDC Bethume	Canada	1999	M LATE	BROWN	M TALL	MR
CDC Glas	Canada	2012	M LATE	BROWN	M TALL	MR
CDC Melyn	Canada	2016	M LATE	YELLOW	MEDIUM	MR
CDC Neela	Canada	2013	M LATE	BROWN	MEDIUM	MR
CDC Plava	Canada	2015	MIDIUM	BROWN	MEDIUM	MR
CDC Sanctuary	Canada	2012	MIDIUM	BROWN	M TALL	MR
CDC Sorrel	Canada	2007	M LATE	BROWN	M TALL	MR
Gold ND	NDSU	2014	MIDIUM	YELLOW	M TALL	MR/R
Nekoma	NDSU	2002	LATE	BROWN	MEDIUM	MR
Omega	NDSU	1989	MIDIUM	YELLOW	MEDIUM	MS
Pembina	NDSU	1998	MIDIUM	BROWN	MEDIUM	MR
Prairie Blue	Canada	2003	M LATE	BROWN	MEDIUM	NA
Prairie Grande	Canada	2008	M EARLY	BROWN	MEDIUM	MR
Prairie Sapphire	Canada	2012	MIDIUM	BROWN	MEDIUM	MR
Prairie Thunder	Canada	2006	MEDIUM	BROWN	SHORT	NA
Rahab 94	SDSU	1994	MIDIUM	BROWN	MEDIUM	MR
Shape	Canada	2010	MIDIUM	BROWN	MEDIUM	R
Webster	SDSU	1998	LATE	BROWN	TALL	MR
York	NDSU	2002	LATE	BROWN	MEDIUM	R

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

[2]Refers to developer: NDSU = North Dakota State University; SD = South Dakota State University; CANADA represents developers from that country.

[3]M = Medium. [4]MR = Moderately resistant; NA = Data not available; R = Resistant; S = Susceptible.

Dryland Flax Variety Trial - NDSU — **WREC, Williston, ND 2017**

Variety	Origin	Seed Color	Days to Flower	Days to Mature	Plant Height	Oil[2]		Test Weight	Yield				
						2017	3-Yr Avg		2015	2016	2017	2-Yr Avg	3-Yr Avg
			DAP[1]	DAP[1]	inch	----%----		lb/bu	(bu/a)	(bu/a)	(bu/a)	(bu/a)	(bu/a)
Brown Seeded													
CDC Sanctuary	Can.	Brown	56	88	20	43.2	39.7	52.6	28.1	26.9	11.8	19.4	22.3
CDC Glas	Can.	Brown	56	87	21	43.3	40.0	52.4	30.4	22.4	12.6	17.5	21.8
CDC Sorrel	Can.	Brown	54	87	21	43.3	39.7	52.2	29.5	25.0	10.3	17.6	21.6
Prairie Blue	Can.	Brown	54	88	21	43.2	39.9	52.9	28.6	22.7	11.8	17.3	21.0
Prairie Thunder	Can.	Brown	55	89	21	42.6	38.5	53.4	27.4	22.8	11.6	17.2	20.6
Prairie Sapphire	Can.	Brown	55	87	21	43.9	40.5	52.5	26.9	23.3	11.3	17.3	20.5
Shape	Can.	Brown	53	89	21	42.6	39.8	53.1	26.2	23.5	11.6	17.6	20.4
Webster	SD	Brown	53	89	21	42.4	39.5	52.9	27.5	23.7	9.8	16.8	20.3
Nekoma	ND	Brown	54	88	20	43.4	39.6	52.9	27.2	22.6	10.6	16.6	20.2
Rahab 94	SD	Brown	56	88	19	42.3	39.2	52.0	27.6	23.4	9.4	16.4	20.1
CDC Bethune	Can.	Brown	54	89	20	42.6	38.9	53.1	27.8	22.1	10.5	16.3	20.1
Pembina	ND	Brown	55	89	21	43.3	39.8	52.8	27.7	22.6	9.6	16.1	20.0
Bison	ND	Brown	53	89	21	42.7	39.2	53.2	26.2	20.4	12.3	16.4	19.6
Prairie Grande	Can.	Brown	53	90	21	43.3	39.4	53.0	27.1	22.4	8.6	15.5	19.4
York	ND	Brown	52	88	20	41.9	38.5	52.9	26.6	20.9	9.7	15.3	19.1
CDC Neela	Can.	Brown	53	86	19	43.7	-	52.3	-	24.5	11.8	-	-
CDC Plava	Can.	Brown	54	88	21	42.9	-	52.6	-	25.0	7.4	-	-
Yellow Seeded													
Carter	ND	Yellow	54	88	19	43.3	39.4	53.2	30.1	22.2	10.0	16.1	20.8
CDC Melyn	Can.	Yellow	58	89	22	44.2	-	53.8	-	-	8.7	-	-
Gold ND	ND	Yellow	56	90	22	45.5	40.5	53.5	29.8	23.6	10.5	17.0	21.3
Omega	ND	Yellow	55	88	20	43.5	39.4	54.0	27.4	18.6	9.8	14.2	18.6
Mean			54.4	88.3	20.7	43.19	-	52.93	-	-	10.47	-	-
CV (%)			2.0	1.6	6.3	2.3	-	0.4	-	-	14.1	-	-
LSD (5%)			1.8	NS	2.1	1.62	-	0.32	-	-	2.41	-	-
LSD (10%)			1.5	NS	1.7	1.35	-	0.27	-	-	2.02	-	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft — Previous crop: Durum
Planting Date: 4/26/2017 — Harvest Date: 8/9/2017
Soil test (0-6"): P=24 ppm; K=266 ppm; pH=5.8; OM=2.3% — Soil type: Williams-Bowbells loam
(0-24"): NO_3-N=26 lb/a
Applied fertilizer in lb/a: 64 N : 40.4 P2O5 : 0 K2O
Chemical Applications: 3 oz./a Valor, 8.5 oz./a Sonalan (preplant fall applied)
DAP[1] = Days after planting
Oil[2] = Oils are reported on a oven dried basis, 120°F for 4 hours

Flax Irrigated Variety Trial -NDSU — **WREC, Nesson Valley, ND 2017**

Variety	Origin	Seed type	Days to flower	Days to mature	Plant height	Oil[†]	Test weight	Yield		
								2017	2-Yr Avg	3-Yr Avg
			(DAP*)	(DAP*)	(in)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
CDC Glas	Canada	Brown	61	93	26	40.6	53.3	37.6	47.2	47.7
Prarie Blue	Canada	Brown	60	92	26	40.1	53.4	36.7	43.5	42.2
Carter	NDSU	Yellow	57	95	25	39.5	53.2	32.2	39.1	36.9
Bison	NDSU	Brown	58	94	26	40.5	54.3	38.9	45.2	-
Gold ND	NDSU	Yellow	61	96	28	40.6	54.0	38.4	42.4	-
York	NDSU	Brown	56	92	26	40.1	53.1	36.6	41.6	-
CDC Sorrel	Canada	Brown	62	90	27	40.0	53.5	33.7	41.4	-
CDC Sanctuary	Canada	Brown	58	90	27	40.0	53.3	37.7	37.5	-
CDC Melyn	Canada	Yellow	62	89	25	40.1	53.6	31.8	-	-
Mean			59.6	92.4	26.1	40.16	53.53	35.95	42.21	42.28
C.V.(%)			-	-	-	1.02	0.95	12.33	-	-
LSD (5%)			-	-	-	0.71	0.88	7.67	-	-
LSD (10%)			-	-	-	0.58	0.73	6.32	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: Durum
Planted: 5-2-2017 — Harvested: 9-7-2017
Plot size: 48.75 ft^2 — Soil type: Lihen Loamy Fine Sand
Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%
(0-24"): NO3-N=52 lb/a
Applied fertilizer in lb/a broadcast: 190 lbs of urea (46-0-0)
Yield goal = 50 bu/a
Planting population = 30 lbs/a
Herbicides applied: Spartan Charge 7.5oz/a (5/4/2017), Section 2EC 8oz/a + Trophy Gold 2qt/100gal H2O (6/26/2017)
Fungicides applied: Priaxor 8oz/a (6/28/2017)
Rainfall: 6.64 in. (5/2/2017 - 9/7/2017)
Irrigation: 15.4 in. (5/2/2017 - 9/7/2017)
*Days after planting
*0: no lodging - 9: plants lying flat on ground
†Oil content adjusted to a 9% moisture

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	BB
Baldy	MT	YES	N	HIGH LINO	GOOD	GOOD	V HIGH	LOW	MED	NA	NA
Cardinal	MT/NDSU	YES	N	HIGH LINO	V GOOD	V GOOD	HIGH	FAIR	MED	T	MT
Finch	MT/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	NA
Hybrid 300	STI	YES	N	HIGH OLEIC	V GOOD	V GOOD	V HIGH	FAIR	MED	MT	NA
Hybrid 446	STI	YES	N	HIGH OLEIC	V GOOD	V GOOD	V HIGH	FAIR	MED	MT	NA
Hybrid 528	STI	YES	STP	HIGH OLEIC	GOOD	GOOD	M HIGH	GOOD	MED	MT	NA
Hybrid 621	STI	YES	STP	HIGH OLEIC	GOOD	GOOD	M HIGH	GOOD	MED	MT	NA
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	MT/NDSU	YES	N	HIGH OLEIC	GOOD	V GOOD	HIGH	FAIR	M EARLY	T	MT
Montola 2000	MT/NDSU	YES	N	HIGH OLEIC	M GOOD	GOOD	MED	GOOD	EARLY	MS	MS
Montola 2001	MT/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	MT/NDSU	YES	N	HIGH OLEIC	GOOD	GOOD	M HIGH	GOOD	M EARLY	MS	MT
Morlin	MT/NDSU	YES	STP	HIGH LINO	V GOOD	GOOD	MED	GOOD	M LATE	T	T
Nutrasaff	MT/NDSU	YES	RED	HIGH LINO	GOOD	GOOD	MED	HIGH	MED	T	MT
Rubis Red	MT	YES	N	HIGH LINO	GOOD	GOOD	V HIGH	LOW	MED	NA	NA
STI 1201	STI	YES	STP	HIGH OLEIC	GOOD	GOOD	M HIGH	GOOD	MED	MT	NA
STI 1401	STI	YES	STP	HIGH OLEIC	GOOD	GOOD	M HIGH	HIGH	MED	MT	NA

[1]Refers to developer: MT = 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]N = Normal; RED = Reduced; STP = Striped.

[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; MS = Moderately susceptible; MT = Moderately tolerant; S = Susceptible; T = Tolerant. NA = Not Available

Dryland McKenzie Safflower Variety Trial - NDSU **WREC, McKenzie County, ND 2017**

Variety	Oil[1]			Test Weight			
	2017	2-Yr Avg	3-Yr Avg	2014	2017	2-Yr Avg	3-Yr Avg
		----%----		lb/bu	(lb/a)	(lb/a)	(lb/a)
Hybrid 1601	35.1	35.8	35.7	42.1	2330	2095	2007
Cardinal	33.9	34.8	35.7	44.1	1954	1776	1653
Hybrid 446	29.9	30.5	31.2	45.4	2066	1889	1645
Montola 2003	36.6	36.3	36.5	43.3	1787	1612	1536
MonDak	34.7	35.3	35.1	44.1	1652	1590	1469
Finch	33.9	35.2	36.0	43.6	1617	1540	1428
Hybrid 200	31.5	32.1	31.9	43.5	1675	1433	1387
NutraSaff	47.7	46.8	47.6	37.6	1466	1456	1296
Hybrid 300	31.9	32.5	-	45.0	1870	1844	-
STI 1401	45.9	46.5	-	36.0	1278	1444	-
Mean	36.10	-	-	42.48	1769.37	-	-
CV (%)	2.5	-	-	1.1	9.4	-	-
LSD (5%)	1.52	-	-	0.80	284.70	-	-
LSD (10%)	1.3	-	-	0.66	234.99	-	-

Location: Arnegard, ND; Latitude 47° 48'; Longitude 103° 25'W — Previous Crop: Durum
Planting Date: 5/12/2017 — Harvest Date: 10/10/2017
Soil test (0-6"): P=7 ppm; K=216 ppm; pH=7.7; OM=2.6% — Soil type: Dooley-Zahl Complex
(0-24"): NO3-N= 20 lb/a
Applied fertilizer in lb/a: 54 N : 22 P2O5 : 0 K2O : 5.5 S
Chemical Applications: 3 oz./a Spartan Charge with 12 oz./a RT3 (Glyphosate) (applied 5/11/2017)
Seed Oil Content[1]= Oils are reported on a oven dried basis, 120 °F for 4 hours

Irrigated Safflower Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Plant Height	Days to Flower	Oil[†]	Test Weight	Yield		
					2017	2-Yr Avg	3-Yr Avg
	(in)	(DAP[+])	(%)	(lb/bu)	(lb/a)	(lb/a)	(lb/a)
MonDak	27	72	32.8	43.2	2689	2238	2018
Hybrid 1601	30	71	32.1	39.3	2672	2449	2364
Montola 2003	25	72	34.2	42.4	2628	2038	1785
Rubis Red	27	69	28.3	47.0	2622	1918	-
Hybrid 446	27	70	27.5	44.5	2552	2132	1953
Hybrid 200	27	72	27.1	40.6	2379	1791	1729
Cardinal	29	73	32.0	44.7	2368	1865	1654
Baldy	26	69	25.2	45.9	2223	1608	-
Montola 2001	26	73	29.7	36.2	2195	1773	-
Hybrid 300	25	71	27.5	43.6	2156	-	-
STI 1201	24	72	39.1	37.4	2128	1649	1583
Finch	30	74	32.4	41.5	2041	1742	1669
Montola 2004	23	71	32.4	40.9	1985	1451	-
Hybrid 9049	26	70	27.3	42.1	1974	1735	1670
Morlin	26	73	32.9	38.0	1974	1594	-
Montola 2000	23	71	31.0	38.4	1971	1759	-
NutraSaff	28	72	44.8	36.3	1561	1379	1242
STI 1401	27	73	42.8	33.0	1508	1388	-
Mean	26.4	71.6	32.29	41.05	2222.8	1794.8	1766.6
C.V. (%)	7.8	3.0	3.47	4.54	13.4	-	-
LSD (5%)	3.4	3.6	1.85	3.09	493.9	-	-
LSD (10%)	2.8	3.0	1.54	2.57	411.2	-	-

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

Planted: 5-8-2017 Harvested: 9-8-2017

Plot size: 50 ft^2 Soil type: Lihen Loamy Fine Sand

Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%

(0-24"): NO3-N=52 lb/a

Applied fertilizer in lb/a broadcast: 100 lbs of Urea (46-0-0)

Yield goal: 2,000 lb/a

Planting population: Conventional 20 lb/a PLS, Hybrid 18 lb/a PLS

Herbicides applied: Prowl H2O 3.5pt/a (5/15/2017), Section 2EC 8oz/a + Trophy Gold 2qt/100gal H2O (6/26/2017), Gramoxone 2pt/a + Class Act 2pt/100gal H2O (8/30/2017)

Fungicides applied: Priaxor 8oz/a (7/20/2017), Endura 11oz/a (8/7/2017)

Rainfall: 6.57 in. (5/8/2017 - 9/8/2017)

Irrigation: 9.8 in. (5/8/2017 - 9/8/2017)

Irrigation dates and amounts (inches): 1.0 (5/17), 0.8 (5/24), 0.6 (6/7), 1.0 (6/15), 1.0 (6/21), 0.8 (6/26), 0.8 (6/30), 0.8 (7/5), 1.2 (7/25), 1.2 (7/31), and 0.8 (8/3)

[+]Days after planting

[†]Oil adjusted to an oven dry basis

Dryland Sunflower Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Company	Hybrid Type	Oil Type	Days to Flower	Days to Mature	Plant Height	Oil[2] 2017	Oil[2] 2-Yr Avg	Oil[2] 3-Yr Avg*	Test Weight	Yield 2017	Yield 2-Yr Avg	Yield 3-Yr Avg
				DAP[1]	DAP[1]	inch		----%----		(lb/bu)	(lb/a)	(lb/a)	(lb/a)
Cobalt II	Nuseed	Clearfield	High Oleic	70	126	44	38.7	38.1	36.5	30.7	3027	2634	2219
Camaro II	Nuseed	Clearfield	NuSun	72	119	50	36.6	36.8	36.2	31.1	2767	2385	2174
N4HM354	Nuseed	Clearfield	NuSun	72	114	44	39.1	38.7	37.2	30.3	2733	2425	2110
Talon	Nuseed	Express	NuSun	72	119	42	33.6	34.0		26.2	2645	2167	1911
Falcon	Nuseed	Express	NuSun	76	126	46	35.5	36.8	-	30.7	3549	2714	-
63C4 CL	NuTech	Clearfield	High Oleic	72	116	44	38.9	36.8	-	30.4	2683	2027	-
3845 HO	Croplan	Conventional	NuSun	73	125	49	40.0	-	-	31.2	4408	-	-
545 CL	Croplan	Clearfield	NuSun	74	126	41	37.0	-	-	30.1	3440	-	-
Badger DMR	Nuseed	Clearfield	NuSun	70	122	51	30.3	-	-	29.1	3318	-	-
455 E HO	Croplan	Express	High Oleic	73	127	49	38.6	-	-	30.2	3147	-	-
7919 CL HO	Croplan	Clearfield	High Oleic	74	133	49	39.6	-	-	28.9	3075	-	-
3732	Croplan	Conventional	NuSun	73	123	47	38.7	-	-	30.8	3025	-	-
458 E HO	Croplan	Express	High Oleic	73	124	49	37.2	-	-	27.9	3025	-	-
7717 CL HO	Croplan	Clearfield	High Oleic	73	126	48	37.8	-	-	29.4	3004	-	-
549 CL	Croplan	Clearfield	NuSun	70	117	51	36.6	-	-	31.4	2993	-	-
N5LM307	Nuseed	Clearfield	NuSun	71	122	49	31.9	-	-	27.8	2622	-	-
432 E	Croplan	Express	NuSun	70	115	46	34.7	-	-	30.8	2475	-	-
Mean				72.2	122.3	47.0	36.74	-	-	29.84	3055.03	-	-
CV (%)				2.0	1.9	4.9	2.9	-	-	2.2	12.5	-	-
LSD (5%)				2.4	3.9	3.9	1.77	-	-	1.10	637.62	-	-
LSD (10%)				2.0	3.2	3.2	1.48	-	-	0.91	530.24	-	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft — Previous crop: Durum
Planting Date: 6/6/2017 — Harvest Date: 11/17/17

Soil test (0-6"): P=24 ppm; K=245 ppm; pH=6.5; OM=1.7% — Soil type: Williams-Bowbells loam
(0-24"): NO3-N=24 lb/a

Applied fertilizer in lb/a: 79 N, 19 S

Chemical Applications: 9 lbs./a Sonalan (fall applied, preplant), 32 oz./a RT3 (Glyphosate) (Burndown, applied 6/7/2017)

DAP[1] = Days after planting

Seed Oil Content[2]= Oils are reported on a oven dried basis, 120 °F for 4 hours

Trial was thinned to a population of 22,000 plants per acre on week of 7/17/17-7/20/17

Carinata Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Company/ Brand	Days to flower	Flower duration	Days to mature	Plant height	Lodging	Oil†	Test weight	Yield 2017	Yield 2-Yr Avg
		(DAP+)	(Days)	(DAP+)	(in)	(0-9*)	(%)	(lb/bu)	(lb/a)	(lb/a)
A120	Agrisoma	56	13	101	45	1	33.1	52.0	2681.6	3292.8
L140P**	Bayer	52	15	97	46	1	36.8	49.6	2740.2	3236.1
DH-40.008	Agrisoma	57	16	105	49	0	34.0	52.4	2712.1	-
DH-146.842	Agrisoma	59	11	109	27	0	36.1	51.5	2342.5	-
DH-69.485	Agrisoma	60	11	105	43	0	33.9	52.1	2174.8	-
DH-56.149	Agrisoma	60	11	105	47	0	30.9	52.7	2142.9	-
Mean		57.3	12.9	103.7	42.7	0.4	34.14	51.71	2465.68	3264.45
C.V. (%)		-	-	-	-	-	2.47	0.49	15.43	-
LSD (5%)		-	-	-	-	-	1.56	0.46	702.01	-
LSD (10%)		-	-	-	-	-	1.26	0.38	568.87	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: Durum
Planted: 5-2-2017 — Harvested: 9-7-2017
Plot size: 48.75 ft^2 — Soil type: Lihen Loamy Fine Sand

Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%
(0-24"): NO3-N=52 lb/a

Applied fertilizer in lb/a broadcast: 319 lbs of Urea (46-0-0)

Yield goal: 2,500 lbs/a

Planting population: 720,000 seeds/a

Herbicides applied: Sonolan 2pt/a (5/4/2017), Section 2EC 8oz/a + Trophy Gold 2qt/100gal H2O (6/26/2017)

Fungicides applied: Priaxor 8oz/a (6/28/2017)

Rainfall: 6.74 in. (5/2/2017 - 9/7/2017)

Irrigation: 12.8 in. (5/2/2017 - 9/7/2017)

**Canola variety used as check

+Days After Planting

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

†Oil content adjusted to a 8.5% moisture

Dryland Canola Roundup Ready Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Brand/Company	Days to Flower	Days to Mature	Plant Height	Seed Oil Content[2]			Yield		
					2017	2-Yr Avg	3-Yr Avg	2017	2-Yr Avg	3-Yr Avg
		DAP[1]	DAP[1]	inches	(%)	(%)	(%)	(lb/a)	(lb/a)	(lb/a)
Star 402	Star Specialty Seed	52	93	31	42.1	44.3	44.4	944	1590	1552
HyCLASS 955	Croplan	52	92	33	41.0	42.3	42.8	1035	1604	1518
HyCLASS 930	Croplan	51	92	31	41.1	43.8	43.6	995	1577	1480
7150RR	Integra	51	90	32	39.4	42.5	43.4	800	1428	1422
6074 RR	BrettYoung	55	101	31	36.8	41.0	-	693	1465	-
6080 RR	BrettYoung	53	96	32	38.4	41.7	-	748	1488	-
CS2100	Canterra Seeds	54	95	32	37.9	41.3	-	891	1498	-
CS2000	Canterra Seeds	54	97	33	37.8	40.5	-	832	1555	-
PS 5000	Proseed	53	95	36	38.9	-	-	905	-	-
300 Mag	Proseed	53	97	32	40.3	-	-	862	-	-
DG 533G	Dyna-Gro	54	97	31	38.8	-	-	820	-	-
HyCLASS 970	Croplan	53	98	32	39.6	-	-	804	-	-
CS2300	Canterra Seeds	56	100	34	37.2	-	-	621	-	-
Mean		53.1	95.3	32.3	39.18	-	-	842.4	-	-
CV (%)		0.9	1.8	5.6	2.3	-	-	14.0	-	-
LSD (5%)		0.7	2.4	2.5	1.28	-	-	162.1	-	-
LSD (10%)		0.6	2.0	2.1	1.06	-	-	135.3	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft — Previous crop: Oats/HRSW
Planted: 5/4/2017 — Harvested: 8/14/2017
Soil test (0-6"): P=25 ppm; K=322 ppm; pH=6.5; OM=2.4% — Soil type: Williams-Bowbells loam
(0-24"): NO_3-N=13 lb/a
Applied fertilizers in lb/a: N=83.98; P=20; K=0; S = 24.62
Chemical Applications: 1 qt./a RT3, 2 pt./a LV6 (preplant fall applied)
DAP[1]= Days after planting
Seed Oil Content[2]= Oils are reported on a oven dried basis, 120 °F for 4 hours

Dryland Canola Conventional Vareity Trial - NDSU **WREC, Williston, ND 2017**

Variety (Trait)	Brand/Company	Days to Flower	Days to Mature	Plant Height	Seed Oil Content[2]		Yield	
					2017	2-Yr Avg	2017	2-Yr Avg
		DAP[1]	DAP[1]	inches	(%)	(%)	(lb/a)	(lb/a)
C5507	Cibus	55	99	34	39.5	43.2	748	1318
C5513	Cibus	56	99	33	40.2	43.1	637	1240
C5522	Cibus	54	98	34	39.2	42.9	825	1241
DG 200CL (Clearfield)	Dyna-Gro	56	98	32	36.8	-	936	-
Mean		55.1	98.1	33.4	38.92	-	786.6	-
CV (%)		0.8	0.9	4.8	1.47	-	10.1	-
LSD (5%)		0.6	1.3	2.2	0.82	-	108.6	-
LSD (10%)		0.5	1.1	1.8	0.68	-	90.0	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft — Previous crop: Oat/HRSW
Planted: 5/4/2017 — Harvested: 8/16/2017
Soil test (0-6"): P=25 ppm; K=322 ppm; pH=6.5; OM=2.4% — Soil type: Williams-Bowbells loam
(0-24"): NO_3-N=13 lb/a
Applied fertilizer in lb/a: N=83.98; P=20; K=0; S = 24.62
Chemical Applications: 1 qt./a RT3, 2 pt./a LV6 (preplant fall applied), 8 oz./a Stinger applied 6/12/2017,
DAP[1]= Days after planting
Seed Oil Content[2]= Oils are reported on a oven dried basis, 120 ° F for 4 hours

Roundup Ready Canola Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Company/Brand	Days to flower	Flower duration	Days to mature	Plant height	Lodging	Oil[†]	Test weight	Yield	
									2017	2-Yr Avg[‡]
		(DAP[+])	(Days)	(DAP[+])	(in)	(0-9[*])	(%)	(lb/bu)	(lb/a)	(lb/a)
Star 402	Star Specialty Seed	51	21	100	48	1	42.8	48.9	3738	4326
6074 RR	BrettYoung	54	19	103	51	0	40.8	47.8	3843	4256
HyCLASS 955	Croplan	49	23	97	46	1	41.1	49.4	3967	-
HyCLASS 930	Croplan	50	21	98	44	0	41.2	49.4	3924	-
300 Mag	Proseed	52	21	102	47	1	40.8	48.4	3805	-
6080 RR	BrettYoung	51	19	95	49	1	39.3	47.9	3664	-
7150RR	Integra	51	21	97	45	1	40.4	48.8	3582	-
HyCLASS 970	Croplan	51	22	100	47	0	40.6	48.5	3325	-
DG 533G	Dyna-Gro	52	19	99	46	0	39.9	48.3	3284	-
PS 5000	Proseed	52	20	98	48	1	40.0	48.5	3177	-
Mean		51.3	20.5	98.8	47.1	0.5	40.69	48.60	3630.9	4291.1
C.V. (%)		-	-	-	-	-	1.89	1.49	16.7	-
LSD (5%)		-	-	-	-	-	1.12	1.05	880.5	-
LSD (10%)		-	-	-	-	-	0.93	0.87	730.9	-

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

Planted: 5-2-2017 Harvested: 8-23-2017

Plot size: 48.75 ft^2 Soil type: Lihen Loamy Fine Sand

Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%

(0-24"): NO3-N=52 lb/a

Applied fertilizer in lb/a broadcast: 319 lbs of Urea (46-0-0)

Yield goal: 2,500 lbs/a

Planting population: 720,000 seeds/a

Herbicides applied: Sonolan 2pt/a (5/4/2017), Cornerstone 5 Plus 24oz/a + Class Act 2Qt/100gal H2O (6/26/2017)

Fungicides applied: Priaxor 8oz/a (6/28/2017)

Rainfall: 5.75 in. (5/2/2017 - 8/23/2017)

Irrigation: 12.8 in. (5/2/2017 - 8/23/2017)

[+]Days After Planting

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

[†]Oil content adjusted to a 8.5% moisture

[‡]2 year average based on 2015 and 2017 yields

Conventional Canola Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Company/Brand	Days to flower	Flower duration	Days to mature	Plant height	Lodging	Oil[†]	Test weight	Yield
		(DAP[+])	(Days)	(DAP[+])	(in)	(0-9[*])	(%)	(lb/bu)	(lb/a)
C5507	Cibus	47	20	95	45	1	38.4	47	2669
DG 200CL	Dyna-Gro	52	16	98	45	0	36.6	49	2447
C5522	Cibus	50	19	95	46	0	37.7	47	2279
C5513	Cibus	54	14	99	47	1	37.7	46	1877
Mean		50.5	17.0	96.4	46.0	0.3	37.61	47.4	2317.9
C.V. (%)		-	-	-	-	-	1.47	1.7	13.0
LSD (5%)		-	-	-	-	-	0.88	1.3	482.7
LSD (10%)		-	-	-	-	-	0.71	1.1	391.2

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

Planted: 5-2-2017 Harvested: 8-23-2017

Plot size: 48.75 ft^2 Soil type: Lihen Loamy Fine Sand

Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%

(0-24"): NO3-N=52 lb/a

Applied fertilizer in lb/a broadcast: 319 lbs of Urea (46-0-0)

Yield goal: 2,500 lbs/a

Planting population: 720,000 seeds/a

Herbicides applied: Sonolan 2pt/a (5/4/2017), Section 2EC 8oz/a + Trophy Gold 2qt/100gal H2O (6/26/2017),

Fungicides applied: Priaxor 8oz/a (6/28/2017)

Rainfall: 5.75 in. (5/2/2017 - 8/23/2017)

Irrigation: 12.8 in. (5/2/2017 - 8/23/2017)

[+]Days After Planting

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

[†]Oil content adjusted to a 8.5% moisture

EARC-CARC Irrigated Canola Variety Trial **EARC, Sidney, MT**

Variety	Adj. Yield (lb/ac)	Test wt (lb/bu)	Oil %	Days to Flower DAP[1]	Height (in)
HyCLASS 955	1832	53.5	50.9	49	38.2
6074 RR	2240	51.6	49.8	53	46.9
InVigor L140P	1840	53.0	47.5	54	42.5
HyCLASS 930	1871	53.6	49.7	49	39.8
6080 RR	1591	53.2	48.4	53	44.9
DKL 35-23	1661	54.0	49.3	49	39.4
HyCLASS 970	1893	53.5	49.7	54	44.1
InVigor L252	2220	53.1	48.9	56	43.7
InVigor L230	1924	54.3	49.7	49	40.2
C5513	1372	52.5	48.1	61	46.5
5545 CL	1844	53.1	49.6	55	43.3
C5507	1910	50.6	48.7	53	50.0
DKL 70-10	1890	53.9	48.3	54	41.7
InVigor L233P	1859	52.6	48.1	50	43.7
C5522	2002	51.6	49.4	55	42.9
Mean	1863	52.9	49.1	53	43.2
P-values	<0.0001	0.0079	0.1490	<0.0001	0.0309
LSD (0.05)	201	1.79	NS	1	15
C.V. (%)	8	2.37	2.90	1	10

Planted: April 18, 2017
Harvested: July 27, 2017
Soil type: Savage Silty Clay
Previous crop: Sugarbeet
Residual Soil N to 3 ft: 21.8 lb/ac
Applied fertilizer: None

Precipitation April to August: 4.12”
Irrigation (sprinkler): 5.81”Plot width: 6’
Herbicide: Roundup and Sonalan before planting
Insecticide: Sevin XLR Plus
The grain yield was adjusted to 8% seed moisture content before statistical analysis.
DAP[1] = Days after planting

EARC-IDAHO Irrigated Canola Variety Trial **EARC, Sidney, MT**

Entry	Adj. Yield (lb/ac)	Oil (%)	Test wt (lb/bu)	Days to Flower DAP[1]	Height (in)
05.SC.12A10.19.12	1111	44.0	51.9	50	42.1
07.IR.5.5.5.8	959	43.9	52.1	59	43.7
07.IR.7.8.8.2	1198	42.8	51.3	62	42.1
07.IR.7.8.8.7	1224	43.4	50.2	56	43.3
07.SC.17.20.B4	1256	43.8	50.7	52	42.9
07.SC.27.19.B3	865	43.0	51.7	51	38.2
07.SI.8.A10	1319	45.0	51.9	49	42.5
Arriba	770	42.2	51.9	49	34.3
Cara	908	44.2	52.0	52	39.8
DG.200.CL	1349	43.0	51.6	62	55.1
Empire	1149	44.5	53.7	52	38.2
Gem	970	46.6	50.0	53	38.6
Goldrush	612	39.0	38.6	46	36.2
HyCLASS.930.RR	1749	44.8	51.2	54	44.9
HyCLASS.955.RR	1651	46.6	52.9	53	48.8
HyCLASS.970.RR	1535	47.1	51.7	53	47.6
InVigor.L140P.LL	1329	43.5	52.7	56	49.2
Profit	975	43.0	51.5	55	42.9
Star 402 RR	1355	45.9	53.0	53	43.7
Westar	1113	43.3	52.5	55	40.9
Mean	1170	44.0	51.1	53	42.8
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD (0.05)	325	2.52	1.9	1.7	16
C.V. (%)	19.63	4.06	2.58	2.22	10.32

Planted: April 18, 2017
Harvested: July 27, 2017
Soil type: Savage Silty Clay
Previous crop: Sugarbeet
Residual Soil N to 3 ft: 21.8 lb/ac
Applied fertilizer: None
Precipitation April to August: 4.12”

Irrigation (sprinkler): 5.81”
Plot width: 6’
Herbicide: Roundup and Sonalan before planting
Insecticide: Sevin XLR Plus
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
DAP[1] = Days after planting

Dryland Soybean Roundup Ready Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety (Trait)	Company/Brand	Maturity Group[1]	Maturity Date	Plant Height	Oil[2]		Protein[3]		Test Weight	Yield	
					2017	2-Yr Avg	2017	2-Yr Avg		2017	2-Yr Avg
			(date)	inch	----%----		----%----		lb/bu	(bu/a)	(bu/a)
20097 (RR2Y)	Integra	00.9	9/14	19	17.7	16.0	35.8	25.8	55.7	29.3	25.1
6008R2 (RR2Y)	NuTech	00.8	9/7	16	18.2	16.4	33.1	24.8	55.3	26.0	22.0
RX0516 (RR2X)	REA Hybrids	0.5	9/21	19	16.4	-	37.1	-	56.1	31.1	-
RX0327 (RR2X)	REA Hybrids	0.3	9/15	18	17.1	-	36.7	-	56.3	30.9	-
RX0628 (RR2X)	REA Hybrids	0.6	9/18	20	16.9	-	36.2	-	56.2	30.5	-
ND17009GT (GT)	NDSU	00.9	9/13	20	17.0	-	37.1	-	58.0	30.3	-
20126 (RR2Y)	Integra	0.1	9/14	19	17.4	-	35.9	-	55.7	30.1	-
6048 (GT)	NuTech	0.4	9/14	17	16.8	-	37.3	-	56.5	28.1	-
6502 (GT)	NuTech	00.5	9/10	15	17.2	-	35.7	-	55.4	26.8	-
50319N (RR2X)	Integra	0.3	9/21	20	16.9	-	36.1	-	56.6	24.6	-
Mean			9/14	18.3	17.15	-	36.09	-	56.16	28.77	-
CV (%)			1.1	5.7	1.0	-	1.2	-	0.6	11.4	-
LSD (5%)			1.9	1.5	0.25	-	0.6	-	0.49	4.67	-
LSD (10%)			1.6	1.3	0.21	-	0.5	-	0.41	3.88	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft — Previous crop: Durum
Planting Date: 5/18/2017 — Harvested: 10/5/2017
Soil test (0-6"): P=21 ppm; K=250 ppm; pH=6.9; OM=1.8% — Soil type: Williams-Bowbells loam
(0-24"): NO_3-N=34 lb/a
Applied fertilizer in lb/a: none, seed inoculated with a peat based inoculum at planting
Chemical Applications: 3oz./a Valor, 8.5 oz/a Sonalan (preplant fall applied), 2pt./a Basagran (6/4/17
Maturity Group[1] = provided by the company
Oil[2] = Oils are reported on a oven dried basis, 120°F for 4 hours
Protein[3] = Protein content adjusted to 13% mositure

Dryland Soybean Conventional Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Company/Brand	Maturity Group	Maturity Date	Plant Height	Oil[1]		Protein[3]		Test Weight	Yield	
					2017	2-Yr Avg	2017	2-Yr Avg		2017	2-Yr Avg
			(date)	inch	----%----		----%----		lb/bu	(bu/a)	(bu/a)
AG 00932	Asgrow (RR Check)	00.9	9/10	15	17.0	15.4	35.1	35.0	54.9	25.7	21.8
AG 00632	Asgrow (RR Check)	00.6	9/8	14	17.0	15.5	36.0	35.5	54.8	19.0	22.3
ND Henson	NDSU	0.0	9/11	16	17.4		35.2	35.8	56.9	26.9	24.7
ND Bison	NDSU	0.7	9/21	19	17.1	-	35.2	-	55.3	23.8	-
Mean			9/12	16.2	17.13	-	35.37	-	55.49	23.86	-
CV (%)			1.2	7.4	1.7	-	1.7	-	1.3	13.7	-
LSD (5%)			2.0	1.8	0.41	-	0.8	-	1.07	4.83	-
LSD (10%)			1.7	1.5	0.34	-	0.7	-	0.89	4.03	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft — Previous crop: Durum
Planting Date: 5/18/2017 — Harvested: 10/5/2017
Soil test (0-6"): P=21 ppm; K=250 ppm; pH=6.9; OM=1.8% — Soil type: Williams-Bowbells loam
(0-24"): NO_3-N=34 lb/a
Applied fertilizer in lb/a: none, seed inoculated with a peat based inoculum at planting
Chemical Applications: 3oz./a Valor, 8.5 oz/a Sonalan (preplant fall applied), 2pt./a Basagran (6/4/17
Oil[1] = Oils are reported on a oven dried basis, 120°F for 4 hours
Protein[2] = Protein content adjusted to 13% mositure

Dryland McKenzie Soybean Roundup Ready VT - NDSU **WREC, Mckenzie County, ND 2017**

Variety (Trait)	Company/Brand	Maturity Group[1]	Oil[2]		Protein[3]		Test Weight	Yield	
			2017	2-Yr Avg	2017	2-Yr Avg		2017	2-Yr Avg
			----%----		----%----		lb/bu	(bu/a)	(bu/a)
6008R2 (RR2Y)	NuTech	00.8	18.3	17.4	29.7	29.2	54.9	25.4	24.4
20097 (RR2Y)	Integra	00.9	17.9	17.2	32.4	30.8	54.9	25.4	26.0
RX0516 (RR2X)	REA Hybrids	0.5	17.0	-	32.8	-	55.7	28.4	-
6048 (GT)	NuTech	0.4	17.0	-	33.8	-	55.8	28.0	-
20126 (RR2Y)	Integra	0.1	17.8	-	32.5	-	53.1	26.3	-
ND17009GT (GT)	NDSU	00.9	17.8	-	31.5	-	58.3	26.2	-
RX0628 (RR2X)	REA Hybrids	0.6	17.6	-	31.3	-	54.8	23.6	-
RX0327 (RR2X)	REA Hybrids	0.3	17.3	-	33.0	-	54.3	23.5	-
6502 (GT)	NuTech	00.5	17.4	-	31.1	-	54.8	22.4	-
Mean			17.57	-	32.02	-	55.19	25.46	-
CV (%)			3.9	-	6.3	-	1.0	17.2	-
LSD (5%)			NS	-	NS	-	0.95	NS	-
LSD (10%)			NS	-	NS	-	0.79	NS	-

Location: Arnegard, ND, Latitude 47° 48'; Longitude 103° 25'W — Previous crop: Durum
Planting Date: 5/12/2017 — Harvested: 10/10/2017
Soil test (0-6"): P=7 ppm; K=216 ppm; pH=7.7; OM=2.6% — Soil type: Dooley-Zahl Complex
(0-24"): NO3-N=20 lb/a
Applied fertilizer in lb/a: 4.95 N : 18 P : 0 K; seed inoculated with a peat based inoculum at planting
Chemical Applications: Preplant: 3 oz./a Spartan Charge with 12 oz./a RT3 (Glyphosate) (5/11/2017
Maturity Group[1] = provided by the company
Oil[2] = Oils are reported on a oven dried basis, 120°F for 4 hours
Protein[3] = Protein content adjusted to 13% mositure

Roundup Ready Soybean Irrigated Variety Trial - NDSU — **WREC, Nesson Valley, ND 2017**

Variety	Company/Brand	Relative maturity group	Plant height	Days to mature	Lodging	Protein†	Oil‡	Test weight	Harvest Moisture¥	Yield		
										2017	2-Yr Avg	3-Yr Avg
			(in)	(DAP+)	(0-9*)	(%)	(%)	(lb/bu)	(%)	(bu/a)	(bu/a)	(bu/a)
ND17009GT	NDSU	00.9	35	115	3	37.8	14.9	57.9	13.0	67.7	62.7	58.9
6008R2	NuTech	00.8	33	119	2	33.0	15.5	56.6	12.6	49.6	55.0	51.0
R00727	REA Hybrid	00.7	36	115	1	35.3	14.7	56.0	12.8	80.4	75.4	-
20300 R2Y	Integra	0.3	35	124	1	36.2	14.6	56.6	13.7	80.4	-	-
RX0628	REA Hybrid	0.6	36	126	1	35.7	15.1	56.2	13.2	79.7	-	-
RX0327	REA Hybrid	0.3	32	122	2	36.7	14.8	56.7	12.7	78.3	-	-
RX0228	REA Hybrid	0.2	38	118	2	36.0	14.8	57.2	12.5	77.5	-	-
RX00738	REA Hybrid	00.7	33	118	2	35.4	14.6	57.2	12.1	73.4	-	-
20617N R2Y	Integra	0.6	33	126	2	37.6	14.4	56.9	13.3	71.3	-	-
RX0516	REA Hybrid	0.5	35	127	3	35.8	14.1	56.6	12.9	70.5	-	-
50319N	Integra	0.3	36	126	2	35.1	14.7	57.3	15.6	67.9	-	-
6048	NuTech	0.4	34	124	2	37.4	14.6	56.9	13.4	61.0	-	-
6502	NuTech	00.5	23	116	1	35.1	15.3	56.4	12.1	50.9	-	-
Mean		-	33.9	121.2	1.8	35.93	14.76	56.80	13.06	69.88	64.36	54.94
CV (%)		-	-	-	-	0.93	1.28	0.68	5.06	9.22	-	-
LSD (5%)		-	-	-	-	0.48	0.27	0.55	0.94	9.22	-	-
LSD (10%)		-	-	-	-	0.40	0.23	0.46	0.79	7.67	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: Durum
Planted: 5-17-2017 — Harvested: 10-6-2017
Plot size: 61.25 ft^2 — Soil Type: Lihen Loamy Fine Sand
Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%
(0-24"): NO3-N=52 lb/a
Applied fertilizer in lb/a broadcast: none / seed inoculated
Yield goal = 50 bu
Planting population = 200,000 seeds/a
Herbicides applied: Spartan Charge 4oz/a (5/31/2017), Cornerstone 5 Plus 24oz/a + Class Act 2qt/100gal H2O (6/26/2017),
Cornerstone 5 Plus 24oz/a + Class Act 2qt/100gal H2O (9/6/2017)
Fungicides applied: Priaxor 8oz/a (7/20/2017)
Rainfall: 7.84 in. (5/17/2017 - 10/6/2017)
Irrigation: 15.4 in. (5/17/2017 - 10/6/2017)
+Days After Planting
*0: no lodging - 9: plants lying flat on ground
†Protein adjusted to 13% moisture
‡Oil content adjusted to 13% moisture
¥Moisture taken at harvest

Conventional Soybean Irrigated Variety Trial - NDSU — **WREC, Nesson Valley, ND 2017**

Variety	Company/Brand	Relative maturity group	Plant height	Days to mature	Lodging	Protein†	Oil‡	Test weight	Harvest Moisture¥	Yield		
										2017	2-Yr Avg	3-Yr Avg
			(in)	(DAP+)	(0-9*)	(%)	(%)	(lb/bu)	(%)	(bu/a)	(bu/a)	(bu/a)
Sheyenne	NDSU	0.7	30	127	2	35.8	14.9	57.0	13.9	45.0	58.1	58.8
ND Henson	NDSU	0.0	29	129	1	35.9	14.5	55.1	16.1	44.7	63.5	58.8
Ashtabula	NDSU	0.4	31	123	1	35.1	14.9	57.3	14.0	45.9	62.1	58.7
ND Bison	NDSU	0.7	31	130	1	35.2	14.6	55.1	17.0	42.0	61.4	58.3
ND Benson	NDSU	0.4	30	121	1	36.1	14.9	57.3	12.9	46.6	54.9	55.8
Mean			30.3	125.9	1.3	35.62	14.75	56.37	14.77	44.86	60.01	58.08
C.V. (%)			-	-	-	2.52	2.14	3.00	21.88	17.60	-	-
LSD (5%)			-	-	-	1.39	0.49	2.61	4.98	12.16	-	-
LSD (10%)			-	-	-	1.13	0.40	2.13	4.07	9.95	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: Durum
Planted: 5-17-2017 — Harvested: 10-6-2017
Plot size: 61.25 ft^2 — Soil type: Lihen Loamy Fine Sand
Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%
(0-24"): NO3-N=52 lb/a
Applied fertilizer in lb/a broadcast: none / seed inoculated
Yield goal = 50 bu
Planting population = 200,000 seeds/a
Herbicides applied: Spartan Charge 4oz/a (5/31/2017), Section 2EC 8oz/a + Trophy Gold 2qt/100gal H2O (6/26/2017)
Raptor 4oz/a + Basagran 8oz/a + Trophy Gold 2qt/100gal H2O + 2qt/a UAN (6/26/2017)
Fungicides applied: Priaxor 8oz/a (7/20/2017)
Rainfall: 7.84 in. (5/17/2017 - 10/6/2017)
Irrigation: 15.4 in. (5/17/2017 - 10/6/2017)
+Days After Planting
*0: no lodging - 9: plants lying flat on ground
†Protein adjusted to 13% moisture
‡Oil content adjusted to 13% moisture
¥Moisture taken at harvest

Dryland Corn Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Company/Brand	Maturity[1]	Days to Silk	Ear Height	Test Weight	Yield[¥]		
						2017	2-Yr Avg	3-Yr Avg
			DAP[2]	inch	lb/bu	(bu/a)	(bu/a)	(bu/a)
3537	Integra	85	76	29	49.6	66.4	59.7	60.6
3142	Integra	81	70	29	52.8	73.1	59.9	58.1
6880 VT2P	Thunder Seed	80	72	29	52.4	76.6	-	-
4578 VT2P	Thunder Seed	78	71	31	52.3	73.8	-	-
6874 VT2P	Thunder Seed	74	69	27	57.0	68.9	-	-
Mean			71.5	29.3	52.82	71.76	-	-
CV (%)			0.5	3.1	1.0	4.5	-	-
LSD (5%)			0.5	1.4	0.79	4.97	-	-
LSD (10%)			0.4	1.1	0.64	4.07	-	-

Location of the WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft
Previous crop: Durum
Harvest Date: hand harvested
Planting Date: 6/5/2017
(10/11/2017), threshed (11/16/2017)
Soil test (0-6"): P=24 ppm; K=245 ppm; pH=6.5; OM=1.7%
Soil type: Williams-Bowbells loam
(0-24"): NO3-N=20 lb/a
Applied fertilizer in lb/a: N=93; P=0; K=0; S = 23
Chemical Applications: 3 oz./a Valor, 8.5 oz./a Sonalan (fall applied), 32 oz./a RT3 (applied 6/7/2017)
Maturity[1] = provided by company
DAP[2] = Days after planting
Yield[3]= yield reported on an oven dried basis, 90° F for 10 days, harvest moisture not available

Corn Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Company/Brand	Relative maturity	Days to Silk[+]	Ear Height[†]	Harvest Moisture[‡]	Test Weight	Yield[¥]		
							2017	2-Yr Avg	3-Yr Avg
			(DAP*)	(in)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
3537	Integra	85	69	43	16.7	54.5	218.7	221.6	200.8
2B840-RIB	REA Hybrids	84	67	43	16.0	55.7	229.3	222.4	182.5
1B790-RIB	REA Hybrids	79	67	43	15.0	56.8	199.3	198.4	180.3
2803	Integra	78	67	40	15.8	54.7	181.5	188.2	169.2
2B861	REA Hybrids	86	68	42	16.8	54.9	231.6	-	-
1B811	REA Hybrids	79	67	41	15.5	55.6	227.5	-	-
3718	Integra	87	69	41	17.0	55.2	211.5	-	-
IC 2862-3110	RobSeeCo	78	65	40	17.0	55.1	197.0	-	-
IC 2925-3110	RobSeeCo	79	68	40	16.6	55.7	190.1	-	-
IC 2701-3110	RobSeeCo	77	67	40	16.0	56.0	182.6	-	-
Mean			67.4	41.3	16.24	55.43	206.90	207.64	183.17
C.V. (%)			-	-	6.07	0.91	11.76	-	-
LSD (5%)			-	-	1.43	0.73	35.31	-	-
LSD (10%)			-	-	1.19	0.61	29.31	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft
Previous crop: Durum
Planted: 5-16-2017
Harvested: 10-31-2017
Plot size: 120ft^2
Soil type: Lihen Loamy Fine Sand
Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%
(0-24"): NO3-N=52 lb/a
Applied fertilizer in lb/a broadcast: 320 lbs of Urea (46-0-0)
Yield goal: 190 bu/a
Planting population: 38,000 seeds/a
Row spacing: 30 inch
Herbicide applied: Cornerstone 5 Plus 27oz/a + Class Act 1gal/ 100gal H2O (7/6/2017)
Rainfall: 7.84 in. (5/16/2017 - 10/31/2017)
Irrigation: 15.4 in. (5/16/2017 - 10/31/2017)
[+]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 - NDSU **WREC, Nesson Valley, ND 2017**

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 Seed Wt. (g)	Seeds/ Pound	Yield 2017 (lb/a)	Yield 2 Yr Avg (lb/a)
Laura	53	22	102	31	11	1	22.9	63.8	480.7	95	5078	5473
Boxer	52	25	104	32	10	1	22.4	63.6	506.1	90	4975	5327
Fabelle	51	25	107	30	9	0	21.8	64.2	482.5	94	3890	4712
Fanfare	54	23	104	32	10	1	22.0	64.4	507.7	90	4566	4680
Tobassco	53	22	101	29	9	1	21.8	64.1	386.8	118	4295	4478
Vertigo	51	26	105	30	10	1	22.3	64.4	522.6	87	5507	-
Mean	52.0	23.8	103.7	30.9	9.8	0.6	22.20	64.09	481.08	95.6	4718.5	4934.0
C.V. (%)	-	-	-	-	-	-	2.26	1.32	4.15	4.6	11.1	-
LSD (5%)	-	-	-	-	-	-	0.76	1.27	30.12	6.7	770.3	-
LSD (10%)	-	-	-	-	-	-	0.62	1.05	24.78	5.5	633.6	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: Durum
Planted: 5-2-2017 — Harvested: 8-22-2017
Plot size: 48.75 ft^2 — Soil type: Lihen Loamy Fine Sand
Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%
(0-24"): NO3-N=52 lb/a
Applied fertilizer in lb/a broadcast: none / seed inoculated
Yield goal = 2500 lbs/a
Planting population = 195,000 seeds/a
Herbicides applied: Spartan Charge 7.5oz/a (5/4/2017), Section 2EC 8oz/a + Trophy Gold 2qt/100gal H2O (6/26/2017)
Gramoxone 3.0SL 1.5pt/a + Class Act 1qt/100gal H2O (8/15/2017)
Fungicides applied: Priaxor 8oz/a (6/28/2017)
Rainfall: 5.75 in. (5/2/2017 - 8/22/2017)
Irrigation: 12.8 in. (5/2/2017 - 8/22/2017)
+Days After Planting
*Height of first pod off the ground
†0: no lodging - 9: plants lying flat on ground
‡Protein adjusted to 16% moisture

Pinto Bean Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Origin	Plant Height (in)	Days to Mature (DAP+)	Lodging (0-9*)	250 Seed Wt (g)	Seeds/ Pound	Test Weight (lb/bu)	Harvest Moisture† (%)	Yield¥ 2017 (lb/a)	Yield¥ 2-Yr Avg (lb/a)	Yield¥ 3-Yr Avg (lb/a)
LaPaz	Provita	15	109	1	93.4	486	60.8	25.6	4202	4284	4008
Lariat	NDSU	14	113	2	100.3	452	59.6	26.4	3814	3880	3887
Stampede	NDSU	14	109	1	117.4	401	58.0	22.7	3536	3317	3351
Maverick	NDSU	11	109	2	101.9	446	58.9	24.0	3934	3966	3771
ND-307	NDSU	13	109	2	106.3	428	57.1	21.9	3224	3447	3147
Windbreaker	Seminis	13	108	2	104.8	433	58.1	22.9	3075	3387	3146
Palomino	NDSU	14	110	1	98.0	463	59.3	25.8	2473	3580	3363
Monterrey	Provita	14	109	1	96.0	473	61.1	23.9	4890	4768	-
Mean		13.6	109.4	1.4	102.27	447.8	59.12	24.14	3643.7	3828.5	3524.9
C.V. (%)		-	-	-	10.24	7.0	0.59	8.47	16.3	-	-
LSD (5%)		-	-	-	15.41	46.1	0.52	3.01	871.1	-	-
LSD (10%)		-	-	-	12.75	38.2	0.43	2.49	720.8	-	-

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W; Elevation 1902 ft — Previous crop: Durum
Planted: 5-24-2017 — Harvested: 10-5-2017
Plot size: 48.75 ft^2 — Soil type: Lihen Loamy Fine Sand
Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%
(0-24"): NO3-N=52 lb/a
Applied fertilizer in lb/a broadcast: 200 lbs of Urea (46-0-0)
Yield goal = 2,500 lbs/a
Planting population = 125,000 seeds/a
Herbicides applied: Spartan Charge 4oz/a (5/31/2017), Section 2EC 8oz/a + Trophy Gold 2qt/100 gal H2O (6/26/2017)
Raptor 4oz/a + Basagran 8oz/a + Trophy Gold 2qt/100gal H2O + 2qt/a UAN (6/26/2017)
Fungicides applied: Priaxor 8oz/a (7/20/2017)
Rainfall: 7.84 in. (5/24/2017 - 10/5/2017)
Irrigation: 15.4 in. (5/24/2017 - 10/5/2017)
+Days After Planting
*0: no lodging - 9: plants lying flat on ground
†Moisture taken at harvest
¥Dry beans direct harvested

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

Variety	Grain Yield (lb/ac)		Days to Flower DAP[1]	Height (in)	TKW gm
	2016	2017			
Boxer	842	878	55	27.2	419
Fabelle	2362	1480	54	28.7	396
Fan Fare	1485	1243	54	27.2	394
Laura	1114	1139	58	26.4	412
Tabasco	959	743	58	25.2	320
Mean	1299	1096	55	26.9	388
P-value	0.0007	0.0005	<0.0001	0.2934	<0.0001
LSD (5%)	452	222	0.8	NS	17
CV (%)	24.63	10.78	1.11	6.75	2.41

Planted: April 18, 2017
Harvested: Aug. 16, 2017
Soil type: Savage Silty Clay
Previous crop: Sugar beet
Residual Soil N to 3 ft: 21.8 lb/ac
Applied fertilizer: None
Precipitation April to August: 4.12”
Irrigation (sprinkler): 5.81”
Plot width: 6’
Herbicide: Tank mix of Prowl H2O, Roundup and Outlook before planting
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
DAP[1] = Days after planting

LENTIL VARITY DESCRIPTIONS

VARIETY	ORIGIN[1]	SEED COLOR	RELATIVE MATURITY	RELATIVE HEIGHT	SEED SIZE	RESISTANCE TO[2]	
						ASCOCHYTA	ANTHRACNOSE
AVONDALE	USDA	GREEN	MEDIUM	TALL	MEDIUM	NA	NA
CDC DAZIL*	CANADA	RED	M EARLY	NA	SMALL	R	R
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 PERIDOT*	CANADA	GREEN	EARLY	NA	SMALL	R	NA
CDC PROCLAIM*	CANADA	RED	M EARLY	NA	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: NDSU = North Dakota State University; USDA = United States Department of Agriculture; CANADA and SPAIN represent developers from respective countries.

[2]MR = Moderately resistant; NA= Data not available; R = Resistant; S = Susceptible.

*Clearfield lentil with imidazolinone tolerance.

Dryland Lentil Statewide Conventional VT **WREC, Williston, ND 2017**

Variety	Seed Type	Stand	Days to Flower	Days to Mature	Vine Length	Canopy Height	1000 Seed Weight	Test Weight	Yield		
									2017	2-Yr Avg	3-Yr Avg
		(%)	DAP[1]	DAP[1]	inch	inch	(g)	lb/bu	(lb/a)	(lb/a)	(lb/a)
French Green											
CDC Lemay	French Green	66	53	76	10	9	30	61.8	527	1170	1301
Large Green											
Pennell	Large Green	98	51	78	10	9	57	56.9	656	1419	1478
Riveland	Large Green	95	48	75	11	10	64	56.4	831	1494	1452
CDC Greenland	Large Green	98	52	75	11	11	58	57.5	754	1436	1393
Medium Green											
Avondale	Medium Green	96	49	74	11	10	44	59.7	1044	1642	1671
CDC Richlea	Medium Green	95	51	76	10	9	42	60.5	814	1512	1607
Small Green											
ND Eagle	Small Green	95	48	72	10	9	32	61.6	899	1475	1475
CDC Viceroy	Small Green	91	49	75	10	10	30	62.2	726	1333	1400
Eston	Small Green	89	47	72	10	9	30	61.8	758	1193	1377
Small Red											
CDC Rouleau	Small Red	93	53	77	11	10	36	60.3	844	1710	1661
CDC Red Rider	Small Red	94	52	76	10	9	40	61.5	846	1616	1621
CDC Redberry	Small Red	92	51	77	10	9	40	60.3	731	1302	1369
CDC Rosetown	Small Red	94	52	77	10	9	28	62.2	672	1202	1294
Spanish Brown											
Pardina	Spanish Brown	96	44	71	10	8	35	62.7	797	1343	1482
Mean		92.1	49.9	75.0	10.3	9.5	40.3	60.38	778.5	-	-
CV (%)		7.4	1.7	1.8	8.3	9.5	2.6	0.5	13.7	-	-
LSD (5%)		9.4	1.1	1.9	1.2	1.2	1.5	0.43	145.70	-	-
LSD (10%)		7.9	0.9	1.6	1.0	1.0	1.2	0.36	121.83	-	-

Location, WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft Previous crop: Oats
Planting Date: 5/10/2017 Harvest Date: 8/9/2017
Soil test (0-6"): P=25 ppm; K=252 ppm; pH=6.3; OM=2.5% Soil type: Williams-Bowbells loam
(0-24"): NO3-N=13 lb/a
Applied fertilizer in lb/a: none; seed inoculated with peat-based inoculant at planting
Chemical Applications: 1 qt./a Round Up, 2 pt./a LV6 (Fall 2016), 42 oz./a Prowl H $_2$O, 1 oz./a Pursuit (applied 5/11/2017)

DAP[1]= Days after planting

Dryland Lentil Clearfield Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Seed Type	Days to Flower	Days to Mature	Vine Length	1000 Seed Weight	Test Weight	Yield		
							2017	2-Yr Avg	3-Yr Avg
		DAP[1]	DAP[1]	inch	(g)	lb/bu	(lb/a)	(lb/a)	(lb/a)
Conventional									
Avondale	Medium Green	49	74	11	44	59.4	868	-	-
Extra Small Red									
CDC Impala	Extra Small Red	54	77	10	28	62.0	645	1080	1169
French Green									
CDC Peridot	French Green	48	73	11	32	61.8	812	1277	-
Medium Green									
CDC Impress	Medium Green	52	79	13	48	58.9	708	1207	-
Small Green									
CDC Imvincible	Small Green	52	76	11	29	62.3	761	1501	1425
Small Red									
CDC Dazil	Small Red	49	75	11	30	60.7	617	1337	-
CDC Proclaim	Small Red	49	76	12	35	60.9	697	1335	-
CDC Maxim	Small Red	51	76	11	34	60.6	711	1225	1355
Mean		50.4	75.5	11.2	34.9	60.83	727.3	-	-
CV (%)		1.4	1.9	10.3	6.3	0.4	12.8	-	-
LSD (5%)		1.0	2.0	1.7	3.3	0.37	136.91	-	-
LSD (10%)		0.9	1.7	1.4	2.7	0.31	95.21	-	-

Location, WREC: Latitude 48° 8'; Longitude 103° 44'W; Elevation 2105 ft Previous crop: Oats
Planting Date: 5/10/2017 Harvest Date: 8/9/2017
Soil test (0-6"): P=25 ppm; K=252 ppm; pH=6.3; OM=2.5% Soil type: Williams-Bowbells loam
(0-24"): NO3-N=13 lb/a
Applied fertilizer in lb/a: none; seed inoculated with peat-based inoculant at planting
Chemical Applications: 1 qt./a Round Up, 2 pt./a LV6 (Fall 2016), 42 oz./a Prowl H $_2$O, 1 oz./a Pursuit (applied 5/11/17)

DAP[1]= Days after planting
DAP[1]= Days after planting

Lentil Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2017**

Variety	Origin	Seed Type	Days to Flower (DAP+)	Days to Maturity (DAP+)	Canopy Height (in)	Lodging (0-9*)	1000 Seed Weight (g)	Test Weight (lb/bu)	Yield 2017 (lb/a)	Yield 2-Yr Avg† (lb/a)
CDC Redberry	Canada	Small Red	63	93	16	3	41.9	60.5	3078	2941
CDC Viceroy	Canada	Small Green	64	92	11	4	33.7	61.1	2597	2607
CDC Richlea	Canada	Medium Green	61	92	12	4	49.0	58.9	2859	2403
CDC Red Rider	Canada	Small Red	66	96	16	4	42.5	60.1	2571	2292
CDC Greenland	Canada	Large Green	64	96	11	7	60.7	56.4	2396	1963
Pennell	USDA	Large Green	62	100	12	4	62.8	57.0	2208	1738
ND Eagle	NDSU	Small Green	60	91	12	4	37.4	60.2	2899	-
CDC Rouleau	Canada	Small Red	63	93	14	4	35.8	60.1	2729	-
Riveland	USDA	Large Green	52	91	9	7	71.0	55.1	2563	-
CDC Rosetown	Canada	Small Red	66	96	13	3	31.7	62.4	2451	-
CDC Lemay	Canada	Small Green	63	92	11	6	33.8	61.1	2323	-
Mean			62.0	93.7	12.3	4.4	45.49	59.35	2606.8	2324.1
C.V. (%)			-	-	-	-	5.40	0.79	14.5	-
LSD (5%)			-	-	-	-	3.55	0.67	544.5	-
LSD (10%)			-	-	-	-	2.95	0.56	452.5	-

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

Planted: 5-3-2017 — Harvested: 8-23-2017

Plot size: 61.25 ft^2 — Soil type: Lihen Loamy Fine Sand

Soil test to (0-6"): P=16 ppm; K=195 ppm; pH=7.6; OM=2.2%

(0-24"): NO3-N=52 lb/a

Applied fertilizer in lb/a broadcast: none / seed inoculated

Yield goal = 2,500 lb/a bu

Planting population = 750,000 seeds/a

Herbicides applied: Prowl H2O 3.5pt/a + Sharpen 2oz/a (5/15/2017), Section 2EC 8oz/a + Trophy Gold 2 qt/100gal H2O (6/26/2017)

Gramoxone 3.0 SL 2pt/a + Class Act 1 qt/100 gal H2O (8/15/2017)

Fungicides applied: Priaxor 8oz/a (6/28/2017)

Rainfall: 5.72 in. (5/3/2017 - 8/23/2017)

Irrigation: 12.8 in. (5/3/2017 - 8/23/2017)

+Days After Planting

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

†2 year averages based on 2015 and 2017

Dryland Lentil Variety Trial **EARC, Sidney, MT**

Variety	Days to Flower DAP[1]	Plant Height (in)	Adjusted Grain Yield (lb/ac)	Test wt (lb/bu)	TKW (gm)[2]
Avondale	58	14.2	1210	61.3	68
CDC Imi-green	59	16.5	873	62.4	56
CDC Impala CL	62	13.4	895	61.5	39
CDC Impress CL	58	15.0	1253	63.8	59
CDC Imvincible CL	62	13.0	1011	61.8	45
CDC Maxim CL	58	13.4	1120	60.9	50
CDC Richlea	58	15.0	1247	62.3	**70**
CDC Viceroy	61	13.8	840	61.8	45
Mean	59	14.3	1049	62.0	55
P-value	<0.0001	<0.0001	<0.0001	0.5603	<0.0001
LSD (5%)	0.88	2.6	113	NS	4.8
CV (%)	1.04	5.08	7.58	2.71	6.02

Planted: April 15, 2017
Harvested: July 4, 2017
Soil type: William Clay Loam
Previous crop: Wheat
Residual Soil N to 3 ft: 57.5 lb/ac
Residual Soil P2O5 to 6 inch: 34 lb/ac
Applied fertilizer: None
Plot width: 6'

Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Tank mix of Prowl H2O, Roundup and Outlook before planting
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
Precipitation April to August: 3.92"
DAP[1] = Days after planting
TKW (gm)[2] = Thousand kernel weight

Irrigated Lentil Variety Trial **EARC, Sidney, MT**

Variety	Days to Flower DAP[1]	Plant Height (in)	Adjusted Grain Yield (lb/ac)	Test wt (lb/bu)	TKW (gm)[2]
Avondale	61	13.8	1856	61.2	64
CDC Imi-green	62	13.8	1056	60.3	**66**
CDC Impala CL	64	14.2	1552	63.9	37
CDC Impress CL	62	12.6	1439	61.6	59
CDC Imvincible CL	63	14.2	1514	63.5	41
CDC Maxim CL	61	15.0	1616	62.8	46
CDC Richlea	62	14.6	1535	59.8	64
CDC Viceroy	63	13.8	1339	63.8	40
Mean	62	14.0	1489	62.1	52
P-value	<0.0001	0.0557	<0.0001	<0.0001	<0.0001
LSD (5%)	0.67	NS	222	0.35	4.8
CV (%)	0.76	6.57	10.57	0.40	5.32

Planted: April 18, 2017
Harvested: July 31, 2017
Soil type: Savage Silty Clay
Previous crop: Sugarbeet
Residual Soil N to 3 ft: 21.8 lb/ac
Applied fertilizer: None
Precipitation April to August: 4.12"
DAP[1] = Days after planting

Irrigation (sprinkler): 5.81"
Plot width: 6'
Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Tank mix of Prowl H2O, Roundup and Outlook before planting
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
TKW (gm)[2] = Thousand Kernel Weight

Dryland Lentil Variety Trial **EARC, Richland, MT**

Variety	Plant Height (in)	Adjusted Grain Yield (lb/ac)	Test wt (lb/bu)	TKW (gm)[1]
Avondale	11.0	1098	61.9	64
CDC Imi-green	13.4	977	61.9	67
CDC Impala CL	9.1	917	65.2	39
CDC Impress CL	10.2	1016	63.0	59
CDC Imvincible CL	9.8	802	64.8	44
CDC Maxim CL	10.2	849	63.5	53
CDC Richlea	10.2	1046	61.4	65
CDC Viceroy	9.8	1010	65.3	42
Mean	10.5	960	63.4	54
P-value	<0.0001	0.0946	<0.0001	<0.0001
LSD (5%)	2.8	NS	0.42	4.2
CV (%)	7.46	14.42	0.48	5.57

Planted: April 26, 2017
Harvested: Aug. 8, 2017
Soil type: Farnuf Reeder Loam
Previous crop: Durum wheat
Applied fertilizer: None
No irrigation

Plot width: 6’
Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Valor, Sharpen, Roundup and Assure II
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
Precipitation April to August: 4.75”
TKW (gm)[1] = Thousand kernel weight

FIELD PEA VARIETY DESCRIPTIONS

VARIETY	ORIGIN OR SUPPLIER	VINE HABIT[1]	GROWTH HABIT[2]	VINE LENGTH	RELATIVE MATURITY	SEED SIZE	RESISTANCE[3] TO POWDERY MILDEW
YELLOW COTYLEDON							
AAC CARVER	CANADA	NA	NA	MEDIUM	EARLY	MEDIUM	R
AC AGASSIZ	CANADA	SL	SD	TALL	MEDIUM	MEDIUM	R
BRIDGER	LEGUME LOGIC	SL	SD	MEDIUM	MEDIUM	MEDIUM	MS
CDC AMARILLO	CANADA	SL	SD	MEDIUM	MEDIUM	MEDIUM	R
CDC INCA	MERIDIAN SEEDS	NA	NA	NA	MEDIUM	MEDIUM	R
CDC LEROY	CANADA	SL	SD	M SHORT	MED LATE	SMALL	R
CDC MEADOW	CANADA	SL	SD	MEDIUM	EARLY	MEDIUM	R
CDC SAFFRON	CANADA	SL	SD	MEDIUM	MEDIUM	MEDIUM	R
CDC TREASURE	CANADA	SL	SD	MEDIUM	EARLY	SMALL	R
DELTA	LIMAGRAIN	SL	SD	MEDIUM	MEDIUM	MEDIUM	MR
DS ADMIRAL	DANISCO	SL	SD	TALL	MEDIUM	LARGE	R
DURWOOD	PULSE USA	SL	SD	M SHORT	M LATE	MEDIUM	NA
EARLYSTAR	MERIDIAN SEEDS	SL	SD	TALL	EARLY	MEDIUM	R
HYLINE	LEGUME LOGIC	SL	NA	NA	MEDIUM	MEDIUM	R
JETSET	MERIDIAN	SL	SD	MEDIUM	MEDIUM	M SMALL	R
KORANDO	PULSE USA	SL	SD	MEDIUM	EARLY	MEDIUM	R
LG AMIGO	PULSE USA	SL	NA	NA	M EARLY	MEDIUM	R
MONTECH 4152	MONTECH	SL	SD	MEDIUM	EARLY	LARGE	NA
MYSTIQUE	PULSE USA	SL	SD	M SHORT	M LATE	M SMALL	MR
NAVARRO	GREAT NORTHERN AG	SL	NA	M TALL	EARLY	LARGE	MS
NETTE 2010	PULSE USA	SL	NA	SHORT	M EARLY	M SMALL	NA
SALAMANCA	GREAT NORTHERN AG	SL	NA	MEDIUM	EARLY	MEDIUM	MS
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							
AAC COMFORT	MERIDIAN SEEDS	NA	NA	MEDIUM	MEDIUM	LARGE	R
ARAGORN	PROGENE	SL	SD	M SHORT	M EARLY	M LARGE	NA
ARCADIA	PULSE USA	SL	SD	MEDIUM	EARLY	SMALL	MS
CDC GREENWATER	MERIDIAN SEEDS	NA	NA	M TALL	LATE	MEDIUM	R
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
GINNY	PROGENE	NA	NA	M SHORT	MEDIUM	SMALL	NA
GREENWOOD	PROGENE	NA	NA	MEDIUM	MEDIUM	SMALL	MR
K-2	LEGUME LOGIC	SL	SD	MEDIUM	EARLY	M SMALLL	S
LG KODA	PULSE USA	SL	NA	MEDIUM	MEDIUM	MEDIUM	R
MAJORET	SWEDEN	SL	SD	MEDIUM	M LATE	MEDIUM	S
SHAMROCK	GREAT NORTHERN AG	SL	NA	NA	LATE	NA	S
STIRLING	WA	SL	SD	SHORT	EARLY	MEDIUM	R
VIPER	PULSE USA	SL	SD	M SHORT	M EARLY	MEDIUM	MR

[1]NA = Data not available; SL = Semi-leafless; [2]SD = Semi-dwarf; [3]MR = Moderately resistant; MS = Moderately susceptible; R = Resistant, S = Susceptible.

Dryland Field Pea Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Days to Flower	Days to Mature	Canopy Height	Protein[2]		1000 Seed Weight	Test Weight	Yield		
				2017	3-Yr Avg			2017	2-Yr Avg	3-Yr Avg
	DAP[1]	DAP[1]	inch	----%----		g	lb/bu	(bu/a)	(bu/a)	(bu/a)
Green Cotyledon										
CDC Striker	50	77	14	21.9	22.9	172	63.9	19.2	29.4	32.2
Arcadia	51	78	17	22.8	23.6	173	63.3	22.5	30.9	32.0
Cruiser	51	78	17	21.5	23.4	171	62.7	18.0	27.9	28.1
Viper	49	78	20	23.8	-	212	63.2	18.3	26.2	-
AAC Comfort	57	84	19	25.2	-	218	60.7	12.5	-	-
Aragorn	49	76	16	22.3	-	175	63.2	20.8	-	-
CDC Greenwater	55	83	19	25.2	-	187	62.5	15.6	-	-
Ginny	51	78	12	20.9	-	175	63.5	19.2	-	-
Greenwood	50	77	16	18.0	-	170	64.2	20.1	-	-
LG Koda	54	79	17	21.5	-	198	63.8	21.8	-	-
Shamrock	56	83	18	25.1	-	190	62.7	11.8	-	-
Yellow Cotyledon										
Agassiz	50	77	17	22.3	23.1	190	62.4	20.8	32.8	34.1
Hyline	53	78	18	23.5	23.2	198	63.9	20.8	32.6	33.8
Durwood	51	78	21	23.9	23.8	197	62.5	20.4	31.8	32.8
DS Admiral	51	78	17	22.4	23.8	200	61.9	18.8	28.2	29.8
CDC Saffron	55	80	19	23.8	24.3	203	61.5	12.5	29.1	29.5
Korando	44	75	15	23.4	25.4	253	63.9	18.3	29.3	29.4
CDC Amarillo	55	81	20	25.4	24.3	199	62.5	13.1	28.4	29.3
Nette 2010	49	76	17	21.1	23.5	193	64.8	23.4	30.4	28.9
Bridger	49	76	14	23.1	24.5	184	63.6	14.5	26.7	28.0
AAC Carver	53	79	20	22.2	-	196	63.6	21.3	32.7	-
Salamanca	51	78	20	23.3	-	211	63.2	22.1	32.4	-
Navarro	44	76	15	23.3	-	229	63.4	23.0	30.1	-
Jetset	52	79	21	24.7	-	210	61.9	20.7	27.9	-
Spider	54	82	22	26.3	-	210	62.2	10.1	26.6	-
LG Amigo	50	78	18	24.1	-	192	61.9	24.5	-	-
EarlyStar	51	77	19	23.0	-	180	63.2	22.8	-	-
SW Midas	53	78	16	21.8	-	159	62.1	17.8	-	-
Mystique	53	79	19	27.5	-	199	61.8	17.5	-	-
CDC Inca	54	80	20	23.6	-	186	63.6	17.0	-	-
Marrowfat										
Orka	49	79	14	22.7	-	311	61.1	18.4	-	-
Mean	51.4	78.6	17.6	23.22	-	198.2	62.87	18.6	-	-
CV (%)	1.6	1.5	12.7	3.6	-	3.9	0.6	11.6	-	-
LSD (5%)	1.3	2.0	3.7	1.39	-	12.8	0.60	3.56	-	-
LSD (10%)	1.1	1.6	3.1	1.16	-	10.7	0.50	2.97	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft — Previous crop: Durum
Planted: 4/27/2017 — Harvested: 7/31/2017
Soil test (0-6"): P=24 ppm; K=266 ppm; pH=5.8; OM=2.3% — Soil type: Williams-Bowbells loam
(0-24"): NO_3-N=26 lb/a

Applied fertilizer in lb/a: none; seed inoculated with peat-based inoculant at planting
Chemical Applications: Valor 3oz./a and Sonalan 8.5oz./a (preplant fall applied)

DAP[1]= Days after planting
Protein[2] = Protein content adjusted to 0% moisture

Divide County Field Pea VT - NDSU **WREC, Divide County, ND - 2017**

Variety	Protein[1]		1000 Seed Weight	Test Weight	Yield		
	2017	2-Yr Avg*			2017	2-Yr Avg*	3-Yr Avg*
	----%----		g	lb/bu	(bu/a)	(bu/a)	(bu/a)
Green Cotyledon							
Arcadia	24.5	19.8	229	61.3	32.5	36.3	-
Hampton	26.1	21.6	255	61.6	28.9	30.0	-
Yellow Cotyledon							
Agassiz	25.4	21.6	231	60.3	31.0	41.8	45.1
DS Admiral	25.6	20.1	281	61.3	24.3	34.2	39.5
EarlyStar	24.1	-	233	60.6	30.2	-	-
Nette	24.3	-	241	63.7	28.5	-	-
Mean	25.0	-	245.0	61.45	29.25	-	-
CV (%)	2.9	-	8.3	0.9	7.8	-	-
LSD (5%)	NS	-	NS	NS	4.16	-	-
LSD (10%)	NS	-	NS	NS	3.39	-	-

Location: Crosby, ND; Latitude 48° 48'N; Longitude 103° 18'W; Elevation 2044 ft
Previous crop: Durum
Planted: 5/5/2017
Harvested: 8/17/2017
Soil test (0-6"): N/A
Soil type: Farnuf-Alkabo
(0-24"): NO3-N=24 lb/a
Applied fertilizer in lb/a: 4 N : 18 P : 4.5 K Broadcasted ; seed inoculated with peat-based inoculant at planting
Chemical Applications: Spartan Charge at 3 oz./a and RT3 at 12 oz./a with AMS and NIS (Preplant) on 5/5/2017

Protein[1] = Protein content adjusted to 0% moisture
*Average of years 2014, 2016, and 2017

McKenzie County Field Pea VT **WREC, McKenzie County, ND - 2017**

Variety	Protein[1]		1000 Seed Weight	Test Weight	Yield		
	2017	2-Yr Avg			2017	2-Yr Avg	3-Yr Avg
	----%----		g	lb/bu	(bu/a)	(bu/a)	(bu/a)
Green Cotyledon							
Hampton	28.1	27.7	222	60.7	29.3	20.4	-
Arcadia	26.0	-	179	60.3	24.5	-	-
Yellow Cotyledon							
DS Admiral	26.5	25.7	238	59.5	31.5	24.0	26.3
Agassiz	28.1	26.4	195	59.5	26.7	25.3	28.8
Nette	27.0	26.2	238	62.6	27.2	28.3	-
EarlyStar	25.1	-	208	60.4	31.8	-	-
Mean	26.8	-	213.4	60.52	28.50	-	-
CV (%)	3.9	-	4.6	0.6	22.1	-	-
LSD (5%)	NS	-	17.7	0.63	NS	-	-
LSD (10%)	1.54	-	14.4	0.51	NS	-	-

Location: Arnegard, ND; Latitude 47° 48'; Longitude 103° 25'W
Previous crop: Durum
Planted: 5/12/2017
Harvested: 8/23/2017
Soil test (0-6"): P=7 ppm; K=216 ppm, OM=2.6; Ph=7.7
Soil type: Dooley-Zahl complex
(0-24"): N = 20 lb/a
Applied fertilizer in lb/a: 6 N : 22 P : 0 K Broadcasted ; seed inoculated with peat-based inoculant at planting
Chemical Applications: Spartan Charge at 3 oz./a and RT3 at 12 oz./a with AMS and NIS (Preplant) on
Protein[1] = Protein content adjusted to 0% moisture

Dryland Green Dry Pea Variety Evaluation **EARC, Sidney, MT**

Green Dry Pea Variety	Days to Flower DAP[1]	Plant Height (in)	Adjusted Grain Yield (lb/ac)	TKW (gm)[2]
Aragorn	59	9.1	199	205
Arcadia	61	8.7	280	214
CDC Greenwater	66	10.6	218	217
CDC Patrick	64	11.4	180	189
CDC Raezer	62	13.0	377	224
Hampton	63	8.7	242	231
LG Koda (LN 1123)	62	11.0	352	224
Majoret	62	10.6	236	221
PS0877MT457	55	11.8	318	241
PSO826MT190	62	11.0	237	199
PSO877MT076	62	11.4	280	217
PSO877MT499	56	10.6	288	223
Viper	56	10.6	220	238
Mean	61	10.7	264	219
P-value	<0.0001	0.1180	0.0023	<0.0001
LSD (5%)	3.4	NS	87	10
CV (%)	3.35	15.16	19.69	2.74

Dryland Yellow Dry Pea Variety Evaluation **EARC, Sidney, MT**

Yellow Dry Pea Variety	Days to Flower DAP[1]	Plant Height (in)	Adjusted Grain Yield (lb/ac)	TKW (gm)[2]
AAC Carver	63	14.2	413	215
AAC Lacombe	64	11.8	321	252
AC Earlystar	60	12.6	307	202
CDC Amarillo	64	11.0	319	213
CDC Inca	63	13.8	307	210
CDC Meadow	62	13.8	286	207
CDC Saffron	60	10.2	214	212
CDC Treasure	60	15.0	270	217
DS Admiral	60	11.0	376	229
Delta	59	10.6	405	236
Durwood	61	13.0	395	237
Jetset	62	12.2	306	228
Korando	55	11.0	365	275
Mystique	62	11.0	247	236
Navarro	55	10.6	244	249
Nette 2010	57	11.0	235	243
PSO826MT460	59	8.7	238	243
PSO826MT492	56	9.8	298	243
PSO877MT632	60	11.0	304	214
Salamanca	58	12.6	264	229
Mean	60	11.8	306	230
P-value	<0.0001	0.0033	0.0030	<0.0001
LSD (5%)	2.7	6.9	101	14.1
CV (%)	2.72	13.98	19.96	3.72

Planted: April 15, 2017
Harvested: July 21, 2017
Soil type: William Clay Loam
Previous crop: Wheat
Residual Soil N to 3 ft: 57.5 lb/ac
Residual Soil P2O5 to 6 inch: 34 lb/ac
Applied fertilizer: None
Plot width: 6’
DAP[1] = Days after planting

Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Tank mix of Prowl H2O, Roundup and Outlook before planting.
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
Statistical analysis was done separately for green and yellow dry pea cotyledon color group.
Precipitation April to August: 3.92”
TKW (gm)[2] = Thousand kernel weight

Irrigated Green Dry Pea Variety Evaluation **EARC, Sidney, MT**

Green Dry Pea Variety	Days to Flower DAP[1]	Plant Height (in)	Adjusted Grain Yield (lb/ac)	Test wt (lb/bu)	TKW (gm)[2]	Protein (%)
Aragorn	60	21.7	3017	63.7	188	22.0
Arcadia	61	24.0	3118	64.0	214	22.9
CDC Greenwater	68	33.9	2562	64.5	232	23.5
CDC Patrick	70	20.1	2378	65.6	180	24.2
CDC Raezer	62	22.8	2427	64.1	227	23.3
Hampton	60	21.3	2982	64.1	204	24.7
LG Koda (LN1123)	65	29.1	1909	64.3	224	21.9
Majoret	61	28.0	2992	64.3	228	24.0
PS0877MT457	56	25.2	3405	63.1	228	23.8
PSO826MT190	66	31.1	2411	64.4	198	22.7
PSO877MT076	67	21.3	2424	63.9	175	24.8
PSO877MT499	57	25.6	2445	64.3	202	21.1
Viper	57	28.0	**3837**	62.9	216	22.4
Mean	62	25.5	2762	64.1	209	23.2
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD (5%)	1.6	12..7	574	0.50	11.8	1.3
CV (%)	1.53	11.63	12.33	0.46	3.36	3.34

Irrigated Yellow Dry Pea Variety Evaluation **EARC, Sidney, MT**

Yellow Dry Pea Variety	Days to Flower DAP[1]	Plant Height (in)	Adjusted Grain Yield (lb/ac)	Test wt (lb/bu)	TKW (gm)[2]	Protein (%)
AAC Carver	62	27.2	3056	64.8	240	21.3
AAC Lacombe	63	30.7	3205	65.4	287	24.1
AC Earlystar	59	26.0	3477	64.5	202	20.8
CDC Amarillo	65	29.9	3026	64.7	226	22.9
CDC Inca	69	30.7	2414	65.3	223	23.1
CDC Meadow	60	28.7	2752	65.8	204	21.8
CDC Saffron	59	24.0	3084	65.8	208	22.4
CDC Treasure	60	27.2	3199	65.3	215	21.5
DS Admiral	58	26.8	3268	64.0	216	20.6
Delta	57	24.0	3524	64.8	232	21.7
Durwood	60	30.3	3310	64.1	239	22.3
Jetset	60	28.3	3563	64.1	257	21.9
Korando	54	24.8	4011	64.9	274	21.6
Mystique	63	31.9	2838	64.4	246	24.0
Navarro	54	26.0	3436	64.7	247	21.4
Nette 2010	57	27.6	3702	64.8	224	20.3
PSO826MT460	56	17.7	2599	64.0	253	22.0
PSO826MT492	56	24.4	3527	65.1	256	22.6
PSO877MT632	59	22.8	3021	64.8	213	25.1
Salamanca	60	31.1	3396	64.8	257	23.6
Mean	60	27.0	3220	64.8	236	22.2
P-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD (5%)	1.8	12.3	526	0.55	11.9	1.6
CV (%)	1.81	10.86	9.89	0.52	3.04	4.51

Planted: April 18, 2017
Harvested: July 25, 2017
Soil type: Savage Silty Clay
Previous crop: Sugarbeet
Residual Soil N to 3 ft: 21.8 lb/ac
Applied fertilizer: None
Precipitation April to August: 4.12”
Irrigation (sprinkler): 5.81”
DAP[1] = Days after planting

Plot width: 6’
Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Tank mix of Prowl H2O, Roundup and Outlook before planting.
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
Statistical analysis was done separately for green and yellow dry pea cotyledon color group.
TKW (gm)[2] = Thousand kernel weight

Dryland Green Dry Pea Variety Evaluation **EARC, Richland, MT**

Green Dry Pea Variety	Plant Height (in)	Adjusted Grain Yield (lb/ac)	Test wt (lb/bu)	TKW (gm)[1]	Protein (%)
Aragorn	12.6	782	63.6	188	22.5
Arcadia	12.2	669	64.6	181	20.9
Bluemoon	12.6	911	64.5	225	22.7
CDC Greenwater	15.4	1024	63.8	207	23.0
CDC Patrick	14.2	668	64.7	192	22.4
CDC Raezer	14.6	688	64.6	210	22.8
Ginny	13.4	907	65.2	198	21.4
Hampton	12.2	1062	64.4	206	23.9
LL 7647	17.7	1177	64.9	197	23.9
LG Koda (LN1123)	16.1	1122	65.1	207	18.9
Majoret	15.0	744	64.5	202	23.0
PS0877MT457	15.7	1099	63.5	214	23.6
PSO826MT190	16.1	972	64.1	207	22.2
PSO877MT076	13.8	1153	63.9	198	21.0
PSO877MT499	13.4	818	64.7	202	19.8
Pro 121-7126	13.8	956	64.4	204	22.8
Pro 131-7123	13.4	1070	64.5	158	22.4
Shamrock	15.7	1018	65.4	194	22.4
Viper	12.6	942	63.9	202	22.0
Mean	14.2	935	64.4	199.5	22.2
P-value	0.0068	0.0001	<0.0001	<0.0001	<0.0001
LSD (5%)	7.2	245	0.62	11.1	1.64
CV (%)	14.21	18.47	0.67	3.94	5.24

Dryland Yellow Dry Pea Variety Evaluation **EARC, Richland, MT**

Yellow Dry Pea Variety	Plant Height (in)	Adjusted Grain Yield (lb/ac)	Test wt (lb/bu)	TKW (gm)[1]	Protein (%)
AAC Carver	15.0	1077	64.9	212	21.6
AAC Lacombe	16.5	1064	64.7	242	23.5
AC Earlystar	15.0	1027	64.0	208	22.7
Bridger	13.8	863	65.1	190	22.1
CDC Amarillo	16.5	960	63.8	207	23.3
CDC Inca	16.5	972	64.6	196	24.5
CDC Meadow	13.0	971	65.7	190	22.2
CDC Saffron	13.0	932	65.2	192	22.2
CDC Treasure	16.5	495	65.4	200	21.7
DS Admiral	15.7	1004	63.6	217	23.4
Delta	11.0	911	65.2	208	24.4
Durwood	16.5	1291	63.8	214	23.3
Gunner	12.2	992	64.3	229	22.7
Hyline	13.0	1108	64.7	222	21.9
Jetset	15.7	1006	64.2	204	22.2
Korando	13.0	1078	64.1	227	23.8
LL 5053	14.2	1023	66.3	206	19.4
LL 5996	14.6	1029	64.2	234	24.4
LL 66	15.7	1127	63.6	199	23.3
Majestic	14.6	1169	64.7	207	24.1
Mystique	14.6	1059	63.8	217	25.7
Navarro	14.5	1200	63.8	224	24.0
Nette 2010	14.5	1177	65.4	209	20.5
PSO826MT460	14.5	901	63.9	234	22.5
PSO826MT492	14.4	1047	63.8	228	24.6
PSO877MT632	14.3	1122	65.0	204	23.8

Continued next page

Continued: Dryland Yellow Dry Pea Variety Evaluation **EARC, Richland, MT**

Yellow Dry Pea Variety	Plant Height (in)	Adjusted Grain Yield (lb/ac)	Test wt (lb/bu)	TKW (gm)[1]	Protein (%)
Pro 093-7410	14.3	1037	65.2	192	18.6
Pro 133-6243	14.4	890	65.2	245	22.2
Pro 143-6236	14.3	1055	64.8	184	21.6
SW Marquee	14.2	709	64.0	174	24.3
Salamanca	14.4	1172	64.5	218	22.6
Spider	14.3	719	64.2	218	23.8
Mean	14.5	1006	64.5	210.9	22.84
P-value	0.0017	<0.0001	<0.0001	<0.0001	<0.0001
LSD (5%)	8.3	263	0.63	10.0	1.62
CV (%)	16.11	18.68	0.70	3.38	5.06

Planted: April 26, 2017
Harvested: Aug. 7, 2017
Soil type: Farnuf Reeder Loam
Previous crop: Durum wheat
Applied fertilizer: None
No irrigation
Plot width: 6’

Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Valor, Sharpen, Roundup and Assure II
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
Statistical analysis was done separately for green and yellow dry pea cotyledon color group.
Precipitation April to August: 4.75”
TKW (gm)[1] = Thousand kernel weight

NORTH DAKOTA STATE UNIVERSITY

Williston Research Extension Center

Dryland Chickpea Variety Trial - NDSU **WREC, Williston, ND 2017**

Variety	Days to Flower	Days to Mature	Plant Height	Seed Size				1000 Seed Weight	Test Weight	Yield				
				<8mm	8-9mm	9-10mm	>10mm			2015	2016	2017	2-Yr Avg	3-Yr Avg
	DAP[1]	DAP[1]	inch	(%)	(%)	(%)	(%)	(g)	lb/bu	(lb/a)	(lb/a)	(lb/a)	(lb/a)	(lb/a)
Desi														
CDC Anna	56	87	10	100	0	0	0	175	31.5	2113	1545	810	1178	1489
Large Kabuli														
CDC Frontier	56	90	10	79	20	1	0	308	30.9	2094	1872	722	1297	1563
CDC Luna	56	88	9	74	29	6	0	324	30.9	1879	1564	598	1081	1347
Sawyer	57	96	10	52	36	11	0	376	30.3	1758	1392	582	987	1244
Sierra	60	97	10	22	44	29	4	342	29.5	1527	895	528	711	983
CDC Orion	53	87	8	57	38	4	0	376	29.9	-	-	874	-	-
Small Kabuli														
B-90	58	89	10	99	1	0	0	248	30.7	1739	1663	568	1115.4	1323.3
Mean	56.6	90.3	9.5	69.1	24.0	7.5	0.8	307.0	30.54	-	-	668.8	-	-
CV (%)	1.8	0.8	10.2	10.8	19.3	26.7	53.0	3.4	1.8	-	-	11.9	-	-
LSD (5%)	1.5	1.0	1.4	7.3	8.2	7.3	3.3	18.9	0.75	-	-	114.25	-	-
LSD (10%)	1.3	0.8	1.2	6.1	6.8	6.1	2.7	15.7	0.63	-	-	95.03	-	-

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

Planting Date: 5/6/2017 — Harvest Date: 8/21/2017

Soil test (0-6"): P=21 ppm; K=250 ppm; pH=6.9; OM=1.8% — Soil type: Williams-Bowbells loam

(0-24"): NO_3-N=34 lb/a

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

Chemical Applications: 1.4 pt./a Bravo Weatherstik with 5 oz./a Proline (fungicide) applied on 6/28/2017

6 oz./a Priaxor with 1.4 pt./a Bravo Weatherstik (fungicide) applied on 7/10/2017

DAP[1]= Days after planting

Varieties Sierra and Sawyer experienced moderate to severe wildlife damage

Dryland Chickpea Variety Trial **EARC, Sidney, MT**

Chickpea Variety	Days to Flower DAP[1]	Plant Height (in)	Adjusted Grain Yield (lb/ac)	TKW (gm)[2]	%seeds > 22/64
CDC Alma	73	9.8	76	303	20.7
CDC Frontier	71	11.8	113	309	20.7
CDC Orion	68	9.8	168	376	38.3
Myles	66	11.4	277	167	0.3
Nash	71	10.6	136	482	72.5
Royal	70	12.2	144	453	64.7
Sawyer	70	11.4	119	382	38.5
Sierra	72	11.0	140	387	44.7
Mean	70	11.0	145	346	36.0
P-value	<0.0001	0.2000	0.0180	<0.0001	<0.0001
LSD (5%)	0.7	NS	48	24.0	7.5
CV (%)	0.58	11.84	23.43	5.07	14.78

Planted: April 15, 2017
Harvested: Aug. 22, 2017
Soil type: William Clay Loam
Previous crop: Wheat
Residual Soil N to 3 ft: 57.5 lb/ac
Residual Soil P2O5 to 6 inch: 34 lb/ac
Applied fertilizer: None
No irrigation
DAP[1] = Days after planting
Plot width: 6'
Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Tank mix of Prowl H2O, Roundup and Outlook before planting
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
Precipitation April to August: 3.92"
TKW (gm)[2] = Thousand kernel weight

Irrigated Chickpea Variety Trial **EARC, Sidney, MT**

Chickpea Variety	Days to Flower DAP[1]	Plant Height (in)	Adjusted Grain Yield (lb/ac)	Test wt (lb/bu)	TKW (gm)[2]	%seeds > 22/64
CDC Alma	72	17.3	2186	63.7	353	18.0
CDC Frontier	69	20.9	2367	63.5	348	10.0
CDC Orion	71	21.3	2230	61.6	399	60.0
Myles	66	19.7	2228	59.4	198	0.0
Nash	73	20.9	2013	61.9	541	91.3
Royal	73	21.3	2213	61.8	495	84.7
Sawyer	69	21.3	2133	63.3	401	28.7
Sierra	71	20.9	1557	61.7	418	68.7
Mean	71	20.4	2115	62.1	394	45.0
P-value	<0.0001	0.0419	0.0015	<0.0001	<0.0001	<0.0001
LSD (5%)	0.5	6.5	293	0.85	12.3	8.7
CV (%)	0.44	7.09	7.93	0.78	1.78	10.96

Planted: April 18, 2017
Harvested: Aug 18, 2017
Soil type: Savage Silty Clay
Previous crop: Sugar beet
Residual Soil N to 3 ft: 21.8 lb/ac
Applied fertilizer: None
Precipitation April to August: 4.12"
DAP[1] = Days after planting
Irrigation (sprinkler): 5.81"Plot width: 6'
Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Tank mix of Prowl H2O, Roundup and Outlook before planting
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
TKW (gm)[2] = Thousand kernel weight

Dryland Chickpea Variety Trial **EARC, Richland, MT**

Chickpea Variety	Plant Height (in)	Adjusted Grain Yield (lb/ac)	TKW (gm)[1]	%seeds > 22/64
CDC Alma	9.1	409	363	36.3
CDC Frontier	9.4	294	363	40.0
CDC Orion	9.8	168	439	66.3
Myles	9.8	257	192	0.3
Nash	10.6	213	545	85.3
Royal	11.8	354	503	78.8
Sawyer	10.2	366	419	57.5
Sierra	10.2	438	448	76.3
Mean	10.1	306	405	55.0
P-value	0.0002	0.0011	<0.0001	<0.0001
LSD (5%)	2.3	81	33.4	17.2
CV (%)	6.19	18.77	5.84	21.29

Planted: April 26, 2017
Harvested: Aug. 21, 2017
Soil type: Farnuf Reeder Loam
Previous crop: Durum wheat
Applied fertilizer: None
No irrigation

Plot width: 6’
Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Valor, Sharpen, Roundup and Assure II
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
Precipitation April to August: 4.75”
TKW (gm)[1] = Thousand kernel weight

Irrigated Alfalfa Variety Trial **WREC, Nesson Valley, ND 2017**

Conventional Varieties		**Yield**	**Yield**	**2017 Yield**				**2 yr Avg**
		2015	**2016**	**1st cut**	**2nd cut**	**3rd cut**	**2017 total**	2016-17
Cultivar	**Company**	tons/a	tons/a	----------tons/a----------				tons/a
FSG 329	Allied	2.5	9.9	3.0	4.0	2.4	9.4	9.7
Persist III	Millborn	2.6	10.2	3.0	3.3	2.3	8.6	9.4
Crave	Legend	3.1	9.5	3.3	3.5	2.4	9.2	9.4
LegenDairy	Croplan	3.0	8.8	3.6	3.7	2.5	9.8	9.3
DG4210	Dyna-Gro	2.0	9.4	3.0	3.3	2.8	9.1	9.3
Phirst Extra Hybrid	Millborn	2.4	9.3	3.1	3.6	2.5	9.2	9.2
HybriForce-3400	Dow	2.8	9.5	3.4	2.9	2.4	8.7	9.1
AFX 429	Dow	2.1	9.4	3.2	3.1	2.5	8.8	9.1
4A420	Dow	3.0	9.6	3.0	3.1	2.3	8.4	9.0
Ladak II	Allied	2.3	8.8	2.7	3.9	2.3	8.9	8.9
Vernal	Millborn	2.6	9.5	3.3	3.0	1.9	8.2	8.9
AFX 469	Dow	2.6	8.7	2.9	3.7	2.4	9.0	8.9
55V50	Pioneer	2.3	9.1	2.7	3.2	2.2	8.1	8.6
AFX 457	Dow	2.8	8.8	2.0	3.6	2.4	8.0	8.4
54B66	Pioneer	2.6	8.6	2.6	3.1	2.3	8.0	8.3
55Q27	Pioneer	3.0	8.9	2.5	2.8	2.3	7.6	8.3
8420	Integra	2.6	8.7	2.4	2.6	1.6	6.6	7.7
HIGH MEAN		3.1	10.2	3.6	4.0	2.8	9.8	9.7
LOW MEAN		1.9	8.6	2.0	2.6	1.6	6.6	7.7
EXP MEAN		2.6	9.2	2.9	3.3	2.3	8.6	8.9
C.V. %		28.4	-	23.6	17.7	19.5	-	-
LSD 5%		1.0	-	1.0	0.8	0.5	-	-

Roundup Ready Varieties		**Yield**	**Yield**	**2017 Yield**				**2 yr Avg**
		2015	**2016**	**1st cut**	**2nd cut**	**3rd cut**	**2017 total**	2016-17
Cultivar	**Company**	tons/a	tons/a	----------tons/a----------				tons/a
DKA40-51	Monsanto	3.4	9.9	4.1	3.2	1.9	9.2	9.6
Stratica	Croplan	3.2	10.3	3.6	2.8	2.0	8.4	9.4
Presteez	Croplan	3.8	10.2	4.1	2.5	1.7	8.3	9.3
DKA44-16	Monsanto	3.4	10.0	3.3	3.0	2.0	8.3	9.2
MegaMaxx	Legend	3.5	10.0	3.2	2.9	2.0	8.1	9.1
54QR04	Pioneer	3.6	9.5	3.2	3.0	2.1	8.3	8.9
428	Allied	3.3	9.4	3.3	2.8	2.1	8.2	8.8
8444	Integra	3.0	8.3	3.2	2.4	2.0	7.6	8.0
HIGH MEAN		3.8	10.3	4.1	3.2	2.1	9.2	9.6
LOW MEAN		2.4	8.3	3.1	2.3	1.7	7.6	8.0
EXP MEAN		3.3	9.7	3.5	2.8	2.0	8.3	9.0
C.V. %		22.0	-	15.5	22.4	16.6	-	-
LSD 5%		n.s.	-	0.8	n.s.	n.s.	-	-

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

Dryland Crop Performance Comparisons – Williston, ND 2017

Gautam Pradhan, Jerald Bergman, Kyle Dragseth

Crop	Type	Variety	Yield 3 Year Avg. (bu/a)	Market Price† ($/bu)	Gross Return ($/a)	+ or - Bolles ($/a)
HR Spring Wheat		Bolles	33.7	6.47	218.01	0.00
HR Winter Wheat		Jerry	43.9	3.58	157.33	-60.68
Durum Wheat		Joppa	30.6	6.25	191.25	-26.76
Barley	(Feed)	Conlon	50.5	2.25	113.65	-104.36
	(Malt)	Hockett	63.5	4.40	279.24	61.23
Oats		Jury	70.2	2.46	172.72	-45.29
Corn		Average	59.6	2.44	145.52	-72.49
Flax		Average	20.2	9.50	191.62	-26.40
Soybeans	(Conventional)	Average	23.9	8.36	199.97	-18.04
Field Peas	(Green)	Arcadia	32.0	6.50	208.00	-10.01
	(Yellow)	Agassiz	34.1	7.00	238.70	20.69
			(lb/a)	($/CWT)		
Canola		Star 402	1552	16.80	260.74	42.73
Safflower		MonDak	1774	18.00	319.28	101.26
Sunflower	(Oil)	Cobalt II	2271	15.20	345.19	127.18
Lentils	(Medium green)	Avondale	1671	24.00	401.04	183.03
	(Small green)	ND Eagle	1475	23.00	339.25	121.24
	(Small red)	CDC Rouleau	1661	15.50	257.46	39.44
Chickpeas	(Large kabuli)	CDC Frontier	1563	32.00	500.16	282.15
	(Small kabuli)	B-90	1323	30.00	396.99	178.98

†The market price was obtained on 11/29/2017 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 the case of durum, the choice rate was used.

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

Dryland and Irrigated Horticultural Crops

Research Update

By: Kyla Splichal

Horticulture in 2017

Peony in Landscape. Photo taken by Kyla Splichal

What an odd year 2017 was, literally and figuratively, at least in terms of the weather. It was hot, it was dry, and it was windy! This summer was the ultimate test for many garden and ornamental plants. Some plants thrived while others failed. A popular topic of conversation this season, the severe drought conditions, will certainly go on record as one of the driest. The total rainfall from April to September was only 9.06 inches. The last spring frost for Williston was on May 18th, and while there were threatening minimum temperatures in mid-September, the first killing frost didn't occur until October 4th. Growing Degree Days accumulated from April 1st to October 1st totaled 2492.

Last year we introduced two new projects, both funded through the North Dakota Department of Agriculture Specialty Crop Block Grant Program. The first, a collaborative grant with Dr. Todd West, NDSU Woody Plant breeder, evaluating the winter hardiness of tree species; and the second, a collaboration with NDSU main campus to look at high tunnels and their effectiveness at extending the season to enhance the local foods market. A new project added this summer was a haskap or honeyberry cultivar trial, funded by the State Board of Agriculture Research and Education (SBARE) in conjunction with High-Value Crop Specialist, Harlene Hatterman-Valenti.

All America Selection hot pepper, 'Emerald Fire'. Photo taken by Kyla Splichal

All-America Selection Garden

While most of the flowers succumbed to the drought this year, the garden produce seemed to enjoy the heat. The AAS winners produced 756 pounds, and of that, 232 pounds were winter squash and 179 were pumpkins! Also harvested was 140 pounds of tomato, 37 pounds of peppers, and 39 pounds of beans. Other produce in WREC gardens this year included purple potatoes, asparagus, garlic, various perennial herbs and fruits. We look forward each year to the selections in which AAS has deemed winners and top performers in their class. Keep in mind the AAS selections as you begin receiving seed catalogs for next year's garden. You won't be disappointed!

Grapes

Grape Cultivar Demonstration							WREC - 2017
Variety	2015	2016	2017	3 yr. avg.	Brix[1]	pH[2]	# of plants
	---------- total pounds ----------						
Baltica	5.0	17.5	7.4	11.2	28.5	2.3	9
Bluebell	0.0	0.0	13.3	-----	22.0	2.4	9
Frontenac Gris	7.0	35.5	17.8	21.3	29.2	2.1	12
Frontenac	2.0	50.5	27.2	26.3	29.0	2.3	12
King of the North	8.2	45.1	20.0	26.6	26.2	2.1	12
La Crescent	4.2	54.1	49.7	29.2	26.0	2.4	12
Sabrevois	0.2	10.2	13.2	5.2	22.6	2.4	10
Somerset Seedless	0.0	9.7	3.4	4.8	-------	-------	11
Valiant	20.6	54.3	20.4	37.5	23.2	3.3	12
Total	47.2	276.9	172.4				99

[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

The table above illustrates the cultivars that were harvested for the past 3 years, as well as the Brix and pH readings.

Hops

Hop training date trial. Photo taken by Kyla Splichal

In the fall of 2014, WREC was awarded a USDA Specialty Crop Block grant for expansion of hop variety research and establishment of a new hop yard. A similar hops variety trial was established in Absaraka, ND as a result of collaborative efforts with Dr. Harlene Hatterman-Valenti in Fargo. The 2016 season marked the conclusion of that grant award.

In the fall of 2016, WREC was awarded a continuation grant through the Specialty Crop Block program to look at management practices on the established hop yards. A stringing date trial will be evaluated in the 2017-2018 seasons. The results of this 2-year study will become available after the 2018 season. The table below summarizes information on the varieties selected.

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

[1]DM = Domestic, UK = United Kingdom, GE = German as reported by Hopunion LLC	Mean	72.4
[2]A = Aroma, B = Bittering, D = Dual purpose as reported by Hopunion LLC	C.V. (%)	3.6
[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.	LSD (10%)	3.7

Master Gardener Pollinator Garden

Williams County and WREC again received additional funds through the Extension Master Gardener Pollinator Garden Grants. The purpose of these gardens are to provide Master Gardeners with volunteer opportunities, build a habitat that will nourish pollinators, and 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 Certified Pollinator Garden sign on display at the WREC gardens. Photo taken by Kyla Splichal.

Juneberries

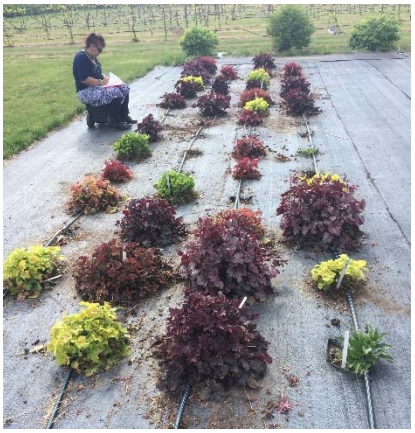
Juneberry Cultivar Trial						WREC - 2017
Plant ID	Diameter in mm	Brix	pH	Diameter in mm	Brix	pH
	---------- Average of 10 Berries ----------					
	---------- 2016 ----------			---------- 2017 ----------		
1-2	10.4	12.9	4.4	7.5	10.3	2.8
1-4	11.1	12.5	4.5	10.2	15.4	4.4
1-5	10.8	13.7	4.4	10.7	15.2	4.2
1-6	10.9	12.8	4.4	10.2	15.9	4.2
1-7	10.5	14.0	4.5	10.7	16.7	4.2
5-1	10.5	14.9	4.0	8.2	15.4	4.0
9-1	11.2	14.3	4.3	10.0	17.3	4.1
12-1	9.2	13.9	4.1	5.5	12.5	2.7
15-2	9.3	14.8	4.1	2.6	6.0	1.3
16-1	9.8	15.8	4.4	9.3	18.0	4.1
17-2	9.6	15.6	4.3	5.8	11.3	2.7
18-1	9.5	12.5	4.2	8.4	17.1	4.1
41-1	10.2	14.4	4.2	10.7	17.9	3.9
48-2	10.4	14.0	4.5	7.3	10.9	2.8
71-1	10.6	14.6	4.2	10.3	17.7	4.0
Buffalo	10.7	13.2	4.2	11.5	17.8	4.1
Honewood	11.9	12.8	4.4	7.6	13.0	2.9
Kelner	12.6	14.1	4.0	13.7	18.2	3.9
Parkhill	10.7	16.7	4.4	6.8	12.7	2.9
Regent	10.7	12.8	4.4	10.9	14.4	4.1
Planted: July 2012						

The juneberries were both a boom and a bust this season. They produced so many berries this year, we just couldn't keep up! The birds enjoyed the bounty from what we couldn't harvest. The berry ripening and timing of harvest always seem to coincide with Field Day each summer, making it hard to complete the harvest.

See harvest table for more information on average berry size, Brix and pH.

Perennial Trials

These two trials were established in collaboration with NDSU Extension Horticulturist Dr. Esther McGinnis that aimed to evaluate the cold hardiness of hybrid cultivars of *Echinacea* Coneflower (14 varieties) and *Heuchera* Coral Bells (16 varieties). On June 4th, 2015 the trial was planted and evaluated that fall for their aesthetic qualities in the landscape, which included ratings of ornamental value and pest incidence. These trials have now been evaluated for winter survival, spring growth, ornamental value, and pests for two growing seasons.



Rojee Pradhan taking notes on the 'Heuchera' coral bells trial. Photo taken by Kyla Splichal

Tree Trial

Under the direction of Dr. Todd West, NDSU Woody Plant Improvement, Williston REC and the cities of Dickinson, Bismarck, Minot and Williston received funding from a 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. In the spring of both 2016 and 2017, WREC along with the NDSU Woody Plant research team planted a total of 41 different tree species as part of the Western Tree Trial. The 2016 trial was planted at the WREC, while the 2017 trial was planted at Nesson Valley.

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, diversify and increase the inventory of usable landscape plants for USDA hardiness zones 3-4. This trial will also help enhance and expand the North Dakota Tree Selector website (http://www.ag.ndsu.edu/tree-selector/).

North Dakota Western Tree Trial cultivars

Bailey Nursery:
Silver Queen silver maple
Northwood red maple
Hot Wings Tatarian maple
Firefall Freeman maple
Red Baron crabapple
Swamp white oak
Boulevard American linden
Unity sugar maple
Fall Fiesta sugar maple
Regal Prince hybrid oak
Valley Forge American elm

J. Frank Schmidt Nursery:
Red November Amur maple
Prairie Stature hybrid oak
Prairie Gold aspen
Prairie Dream birch
Heartland catalpa
Chinkapin oak
Espresso Kentucky Coffee Tree
Marilee Crabapple
Urban Pinnacle Bur oak
Crimson Spire hybrid oak
His Majesty Cork Tree
Prairie Sentinel hackberry
Commemoration sugar maple

Carlton Plants:
Royal Red Norway maple
Sutherland caragana
Street Keeper honeylocust
Pink spires crabapple
Purple Robe black locust
Ivory Pillar Japanese tree lilac
Princeton American elm
New Horizon hybrid elm
Homestead buckeye
Ironwood (Ostrya)

Swedberg Nursery:
Gladiator crabapple
Harvest Gold Mongolian linden
Prairie Expedition elm
Amur maackia

Speer&Sons Nursery:
Northern Acclaim honeylocust

Unknown Source:
Autumn Gold ginko biloba
Mt. Frost Pear

NDSU Woody Plant Improvement Program

Irrigated

High Tunnel

Kyla Splichal giving a tour of the high tunnel at Nesson Valley to the Ray Garden Club in early July. Photo taken by Bethany Redcop.

In the fall of 2015, WREC along with NDSU High Value Crop Specialist, Harlene Hatterman-Valenti and Extension Horticulturist, Esther McGinnis were awarded a USDA Specialty Crop Block Grant through the North Dakota Department of Ag to look at high tunnels for season extension. The funding from this grant allowed for the construction of two high tunnels, one representing the eastern side of the state constructed at the Dale E. Herman Research Arboretum in Absaraka, ND and the other representing the western region, constructed at the Nesson Valley Irrigation site. The objectives were to evaluate traditional high tunnel vegetables tomatoes, peppers and cucumbers; to evaluate non-traditional high value crops, cut flowers; and to develop a communication center for regional 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).

Locally grown, fresh-cut flowers were considered non-traditional crops for this trial. Two varieties of dahlia, three varieties of lisianthus, two varieties of snapdragon and two varieties of delphinium were selected to be studied in the two trial locations. There were nine cultivars of slicing tomatoes, nine cultivars of bell peppers and nine cultivars of cucumbers, each set up in their own experiment and carried out at both trial locations as well. The experiments conducted inside the high tunnel were also facilitated in a field adjacent to each high tunnel.

Sustainable Agroecosystem for Soil Health in the Northern Great Plains (Williston, ND - 2017)

Gautam Pradhan[1], Jim Staricka[1], Jerry Bergman[1], Audrey Kalil[1], Don Tanaka[1], Upendra Sainju[2], Clair Keene[1], Dimitri Fonseka[1], Kyle Dragseth[1], Austin Link[1], Emma Link[1], David Weltikol[1], Cameron Wahlstrom[1], Lyn Soldberg-Rodier[2]

[1]NDSU Williston Research Extension Center, Williston, ND
[2]USDA-ARS Northern Plains Agricultural Research Laboratory, Sidney, MT

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 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 ft. x 200 ft.

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 numbers 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	Chickpea
Corn	Soybean	Durum	Corn	Soybean
Soybean	Sunflower	Barley	Pea	HRWW
Safflower	Barley	Pea	Durum	Lentil
Sunflower	HRSW	HRWW	Lentil	Durum
Pea	Durum	Safflower	Barley	HRSW

* HRSW = Hard Red Spring Wheat; HRWW = Hard Red Winter Wheat.

Measurements

- Crop Performance: leaf chlorophyll, canopy temperature, grain yield, protein or oil content, grain nitrogen and phosphorus, total dry matter, above ground biomass production, carbon and nitrogen ratio of above ground biomass, 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: Microbial Biomass Carbon, Potential Carbon Mineralization, AM fungi measurements.

Results

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

There were significant effects of treatments (crop rotation) on 2017 durum and pea yields but not on other crops. The durum yields in Treatment 1 (Durum-Fallow-Durum-Fallow-Durum), Treatment 3 (Durum-Durum-Durum-Durum-Durum), and Treatment 18 (Sunflower-SW-WW-Lentil-Durum) were 7.7, 8.5, and 7 bu/a more than in Treatment 10 (WW/BP2-Pea/BP3-Corn-Safflower-Durum), respectively. As Treatment 1 has fallow component, the revenue generated under this crop rotation shall be considered half of the normal return. The pea yield in Treatment 7 (Corn-Safflower-Durum-BP1-Pea) was about 15 bu/a more than in Treatment 12 (Corn-Safflower-Durum-WW/BP2-Pea/BP3). Differences are possibly due to soil water at seeding (BP2 needs to be managed better to prevent excess water use).

Figure 1. Crop yields under different crop rotations.

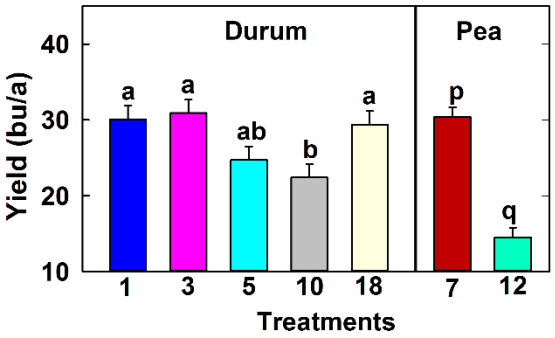


Table A1 shows the economic returns from cash crops in 2013, 2014, 2015, 2016, and 2017 under different crop rotations, and the average net return from each Treatment (crop rotation). The information is a report of observed results and is not intended to be used by producers in making financial decisions.

Averaged across the treatments, the winter wheat, corn and safflower yields were 41 bu/a, 35 bu/a, and 867 lb/a, respectively. The chickpea yield under Treatment 14 was 1053 lb/a; lentil yield under Treatment 17 was 785 lb/a, spring wheat yield under Treatment 19 was 27 bu/a; and soybean yield under Treatment 15 was 9.6 bu/a. The biomass yield of biological primers and perennial mix estimated from 9 square ft area were 5481 lb/a for BP1 (Treatment 6), 2408 lb/a for BP2 (Treatment 11), 2033 lb/a for BP3 (Treatment 12), and 2759 lb/a for Perennial Mix (Treatment 20). This year due to severe drought the yields of all the crops under all treatments were very low as compared to previous years.

Water use efficiency of durum in different crop sequences

In this research project, five different crop sequences include durum as a crop. The soil wetness at the time of durum planting varies depending on the water use characteristics of the preceding crop. This provides an opportunity to determine the effect of water availability on durum yield. Beginning in 2015, we measured soil water during the entire growing season at approximately weekly intervals.

The soil was wetter at planting this year than in either 2016 or 2015 (Table S1). Rainfall during the 2017 growing season was less than one-third the amount in 2016 or 2015. The crop was able to compensate somewhat by extracting a greater amount of water from the soil (one-third or more than in 2016 or 2015). This came at a cost, because when plants are dependent on water from dry soil, they are under more stress and cannot use water as efficiently. Water use efficiency (WUE), defined here as the bushels produced per inch of water used, was less this year than either of the two preceding years (Table S1). The yield increment, defined here as the additional bushels produced per inch of water after yield initiation, illustrates even more the detrimental effect of drought on water use. This year, durum yield only increased 4.3 bushels per inch of additional water, which was 40% less than the amount in 2016 and 2015.

Table A1. The Economic Returns from Different Crop Rotations.

Rotations		Treatments	2013		2014		2015		2016		2017						Avg Net Return From Last 5 yrs
#	Type	#	Crop	Net Return* ($/a)	Crop	Net Return ($/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	-23.35	Durum	30.10	6.25	94.06	135.64	-41.58	-14.81
	Fixed	2	Fallow	-19.76	Durum	46.15	Fallow	-23.09	Durum	7.61	Fallow	0.00	0.00	0.00	23.49	-23.49	-2.52
II	Fixed	3	Durum	202.15	Durum	202.15	Durum	64.28	Durum	150.13	Durum	30.91	6.25	193.19	135.64	57.55	135.25
III	Fixed	4	Durum	202.15	BP1	-58.46	Pea	68.62	Corn	-10.81	Safflower	837.30	0.18	150.71	123.20	27.51	45.80
	Fixed	5	BP1***	-63.09	Pea	175.16	Corn	-36.61	Safflower	116.88	Durum	24.73	6.25	154.55	135.64	18.91	42.25
	Fixed	6	Pea	422.30	Corn	30.21	Safflower	-6.08	Durum	121.66	BP1	0.00	0.00	0.00	48.88	-48.88	103.84
	Fixed	7	Corn	163.09	Safflower	54.89	Durum	8.54	BP1	-48.88	Pea	31.03	6.75	209.45	137.09	72.36	50.00
	Fixed	8	Safflower	280.96	Durum	145.15	BP1	-48.88	Pea	37.34	Corn	33.90	2.54	86.11	209.86	-123.75	58.16
IV	Fixed	9	Durum	202.15	WW/BP2	64.57	Pea/BP3	71.20	Corn	-14.72	Safflower	896.94	0.18	161.45	123.20	38.25	72.29
	Fixed	10	WW/BP2	56.26	Pea/BP3	211.64	Corn	-58.70	Safflower	95.49	Durum	22.41	6.25	140.03	135.64	4.39	61.81
	Fixed	11	Pea/BP2	372.20	Corn	14.82	Safflower	-44.11	Durum	110.14	WW/BP2	38.70	3.30	127.72	135.68	-7.96	89.02
	Fixed	12	Corn	163.09	Safflower	42.82	Durum	-10.37	WW/BP2	-15.03	Pea/BP3	14.53	6.75	98.08	137.09	-39.01	28.30
	Fixed	13	Safflower	280.96	Durum	145.15	WW/BP2	-29.24	Pea/BP3	82.08	Corn	35.67	2.54	90.60	209.86	-119.26	71.94
V	Fixed	20	Per. Mix#	-166.57	Per. Mix	-8.26	Per. Mix	-8.26	Per. Mix	85.15	Per. Mix	2,758.80	0.03	82.76	8.26	74.51	-4.69
VI	Dynamic	14	Durum	202.15	WW	55.72	Lentil	496.99	WW	8.39	Chickpea	1,052.58	0.30	315.77	246.30	69.47	166.54
VII	Dynamic	15	Corn	163.09	Soybean	16.64	Durum	98.17	Corn	-13.30	Soybean	9.65	8.72	84.12	143.83	-59.71	40.98
VIII	Dynamic	16	Soybean	203.17	Sunflower	121.10	Barley	7.55	Pea	87.28	WW	43.82	3.30	144.60	135.68	8.92	85.60
IX	Dynamic	17	Safflower	280.96	Barley	108.56	Pea	88.12	Durum	171.13	Lentil	785.07	0.25	196.27	157.86	38.41	137.43
X	Dynamic	18	Sunflower	133.95	SW	-36.48	WW	-22.49	Lentil	490.85	Durum	29.40	6.25	183.75	135.64	48.11	122.79
XI	Dynamic	19	Pea	412.65	Durum	226.15	Safflower	23.82	Barley	125.22	SW	27.00	6.75	182.27	133.54	48.73	167.31

†The market prices were obtained from grain elevators in and around Williston on November 29, 2017. ‡The direct costs were calculated from the estimations given in the 'North Dakota 2017 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.

Table S1: Relationship of durum yield and crop water use.

	2015	2016	2017
Soil water at Planting *(inches in top 4 ft)*	8.7	10.3	11.3
Soil water at Harvest *(inches in top 4 ft)*	5.7	6.3	5.9
Soil water extracted *(inches)*	3.0	3.9	5.4
Rainfall, planting to harvest *(inches)*	6.9	7.7	2.3
Total crop water use *(inches)*	9.9	11.6	7.7
Fraction of water from rain	70%	66%	30%
Durum yield *(bu/a)*	36.6	45.6	27.4
Durum WUE *(bu/inch)*	3.68	3.93	3.56
Yield Increment† *(bu/inch)*	7.5	7.4	4.3

† Determined by linear regression, a statistical analysis technique.

Soil Health Data

Background

Potential carbon mineralization (PCM) is a measurement of the active fraction of soil carbon. It is measured by wetting the soil and measuring the amount of carbon released after a 10-day incubation. Microbial biomass carbon (MBC) is a measurement to determine the amount of microbial biomass

present in the soil. High levels of both of these measurements are desirable and associated with a "healthy" soil.

Arbuscular mycorrhizal fungi (AM Fungi) are beneficial fungi that colonize plant roots and assist the plant in nutrient and water uptake. AM fungi also contribute to the formation of soil aggregates, a staple of healthy soil. Plants differ in their ability to from associations with AM fungi, with crops like sugar beet and canola being completely non-mycorrhized and crops like corn being heavily mycorrhized. Populations of AM fungi generally decline after fallow periods and when the land is cropped to non-mycorrhizal plant species. This is because AM fungi are obligate symbionts, and their life cycle depends on the plant host. Therefore, cropping systems can have a significant impact on the amount of AM fungi present in the soil. To determine the effect of crops, and the selected crop rotations on soil health we measured PCM, MBC and quantified soil populations of AM fungi.

Experimental Methods

Soil samples were collected from a depth of 2-4 inches at 5 locations within each plot after crop harvest in the fall of 2016. For PCM and MBC, the soil was air dried, sieved and stored at -4°F until analysis. PCM and MBC were measured by incubating wet soil and measuring amount of CO2 generated before and after treatment with chloroform. AM fungi were measured by quantification of Neutral Lipid Fatty Acids (NLFA) specific to this group of fungi by gas chromatography. Prior to NLFA analysis, collected soil was frozen immediately after collection and then lyophilized. Lyophilized samples were stored frozen until analysis.

Results

Table P1. Microbial biomass carbon (MBC), potential carbon mineralization (PCM) and arbuscular mycorrhizal fungi (AM Fungi) measurements from soil collected after each of these crops were grown*.

Crop	MBC	PCM	AM Fungi
	(mg CO_2-C/kg soil)		(ng/g soil)
Durum	241ab	71bc	97ab
Fallow	256ab	66bc	16b
Safflower	289a	117a	40b
Pea	267ab	102ab	24b
Corn	231b	81abc	167ab
Winter Wheat	256ab	53c	42ab
Perennial Grass	292ab	105abc	363a
Mean	257	85	100

*Statistically significant differences are indicated by different letters. ($\alpha<0.05$).

Conclusions from soil health data

Microbial biomass carbon in safflower was significantly higher than under corn; all other crop treatments were not significantly different from one another or from the perennial grass control. Potential carbon mineralization following safflower was significantly higher than after winter wheat, durum or fallow. No treatments different significantly from perennial grass in PCM. There was no observed rotational effect on MBC or PCM.

AM fungi populations were significantly highest in the perennial grass treatment, which could be explained by a lack of soil disturbance in that treatment. As one would expect, AM fungi populations were lowest under fallow treatment.

Effects of Cropping Sequence, Ripping, and Manure on Pipeline Reclamation in Western North Dakota (Williston, ND - 2017)

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Funding provided by the ND Industrial Commission – Oil & Gas Research Program

Summary

Soil disturbance during the construction of pipelines, roadways, and well pads has become a serious issue in western North Dakota. Within cropland, soil health and yields need to be restored during the reclamation process. Reclamation of pipelines in a cropland setting has not been extensively researched and little is known about the best management practices for restoring crop yields. During the spring of the 2015, installation of a 36” water pipeline was completed at the Williston-REC. We took advantage of this opportunity by planting a long-term experiment with five annual crop rotations and two perennial covers in pipeline, roadway, and undisturbed (control) areas. In addition to cropping sequence, ripping/manure is being tested as the subplot in a split plot design in efforts to decrease compaction and add organic matter. This study is designed to address barriers to successful pipeline reclamation. More specifically, this study aims to provide long-term management strategies for landowners to restore productivity to cropland. If economical reclamation options are available to stakeholders, more effective reclamation plans can be composed and more efficient pipeline installations will be possible. Preliminary results indicate soil compaction and crop yields are significantly different between disturbance areas. Additional soil and plant data collection will determine differences between ripping, ripping/manure, and no-till subplots.

Design

Sequence	2015	2016	2017 (Grant Yr 1)	2018 (Grant Yr 2)	2019 (Grant Yr 3)	2020 (Grant Yr 4)
	Min. till	Min. till	M	Min. till	Min. till	Min. till
1	Durum	Durum	Durum	Durum	Flax	Wheat
2	Durum	Peas	Barley	Safflower	Flax	Wheat
3	Peas	Barley	Safflower	Durum	Flax	Wheat
4	CC Mix*	Durum	CC Mix*	Durum	Flax	Wheat
5	Durum	CC Mix*	Durum	CC Mix*	Flax	Wheat
6	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Flax	Wheat
7	Per. Grass	Per. Grass	Per. Grass	Per. Grass	Flax	Wheat

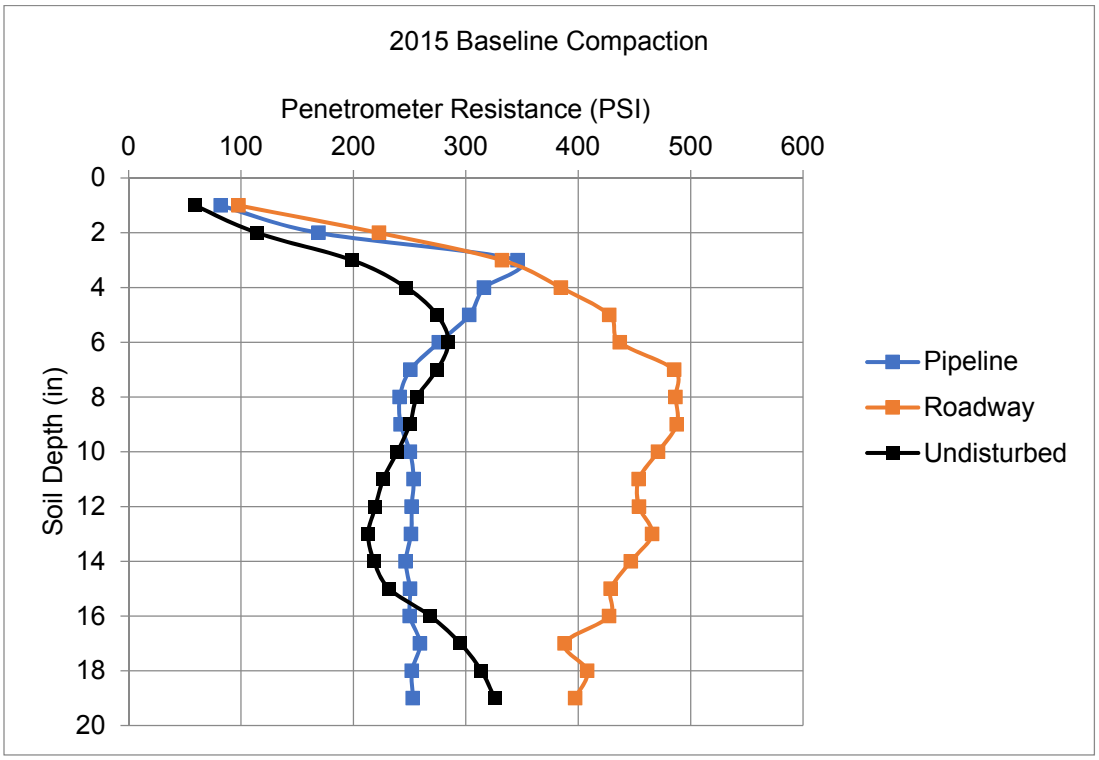
*CC Mix = Pearl Millet, Sorghum, Sudan, Turnip, Radish, Burseem Clover, Sunflower, Soybean, Cow Pea, Flax, Hairy Vetch, Phacelia, Mammoth Red Clover, Italian Ryegrass.

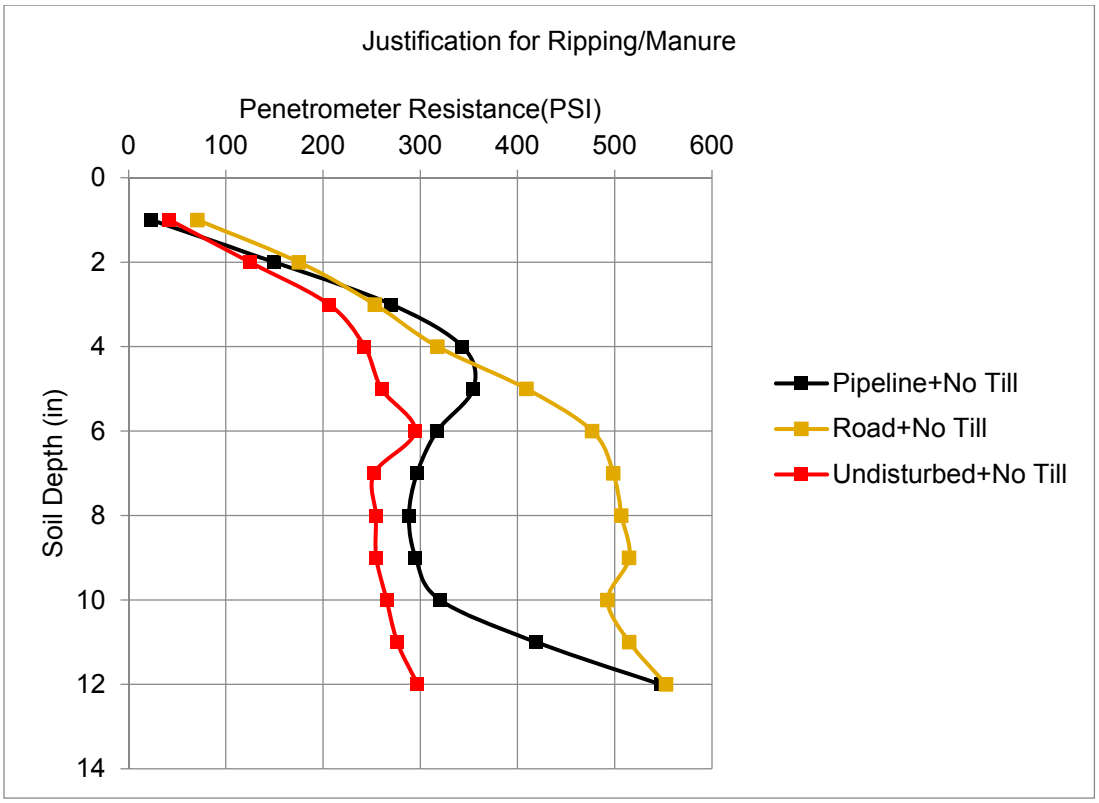
Undisturbed - Ripped	Road - Ripped	Pipeline - Ripped
Undisturbed – Ripped+Manure	Road – Ripped+Manure	Pipeline – Ripped+Manure
Undisturbed – No Till	Road – No Till	Pipeline- No Till

Design of each cropping sequence.

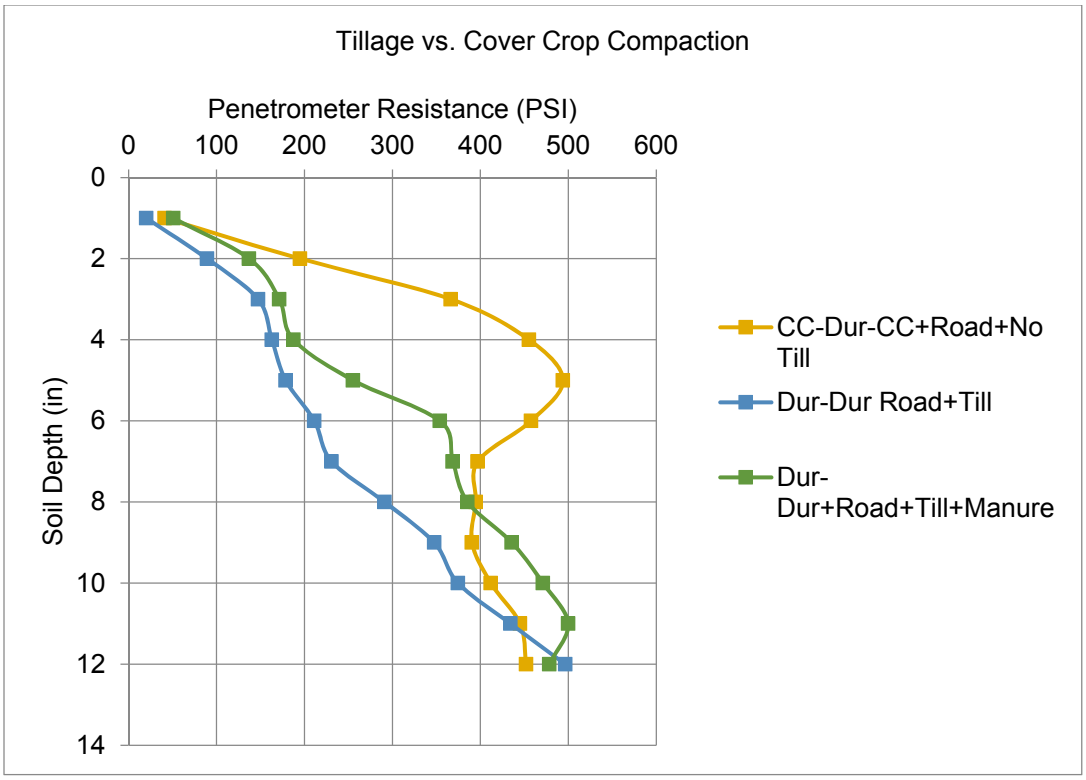
Manure application and tillage methods.

Results

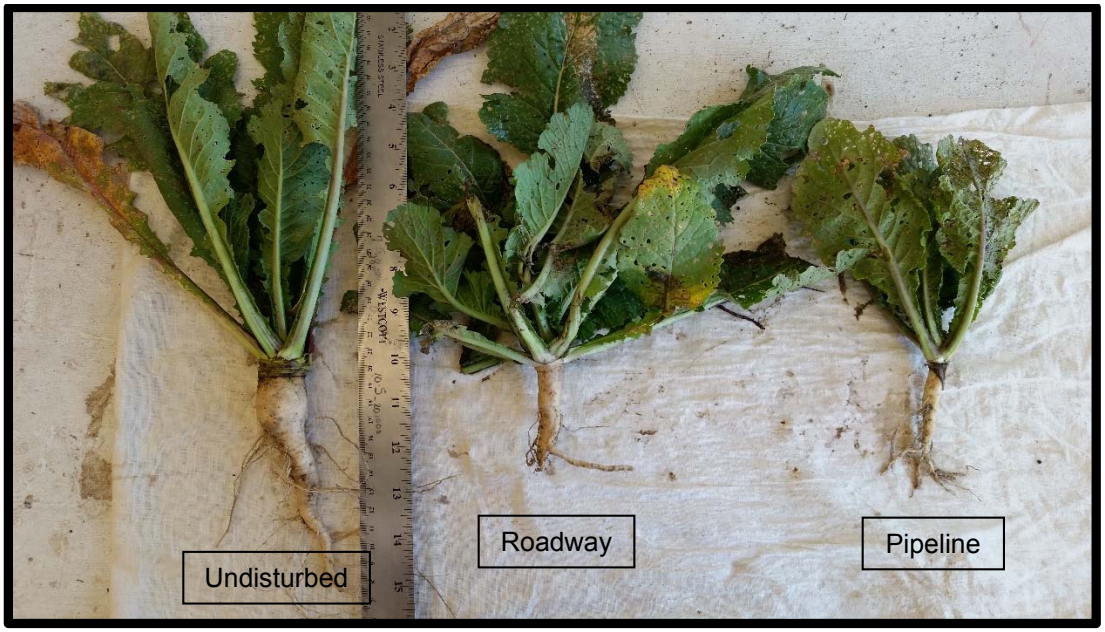




Between years one and three, no significant compaction improvement was observed. This data motivated the installation of ripping/manure treatments to further address excess compaction.



Ripping provided a greater reduction in compaction than a full season tap-rooted cover crop grown two of three years.



Conclusions

- In years one and two, annual crops yielded significantly less in road and pipeline areas ($P \leq .05$).
- In year two, alfalfa yielded significantly higher in the pipeline area ($P \leq .05$).
- In year three, alfalfa did not yield significantly different between disturbance areas ($P \leq .05$).
- DCP data trends suggests tillage treatments reduce compaction more effectively than deep-rooted annual cover crops; however, additional sampling will be conducted.

Comparing Tillage Systems (conventional, minimum, no-till) With Overhead Irrigation Using a 3-Year Crop Rotation of Corn, Soybean, and Barley (Nesson Valley 2017).

Tyler Tjelde and James Staricka

Introduction

Conventional tillage is used on more than 80% of the 300,000 irrigated acres in the MonDak region. The MonDak region consists of the northwest corner of North Dakota and northeastern portion of Montana. There is a large diversity of crops, greater than twenty, currently grown at various acreages throughout this region. The corn, soybean, barley rotation was chosen based on farmer interests, markets and increasing production acres of those crops. Controlling soil erosion has always been a major concern with conventional tillage. This project has been generated to provide agricultural producers of the MonDak region evidence that other viable tillage options exist within an irrigated environment.

Objectives

This project examines the interaction between crop production and tillage and the interaction between tillage systems and soil quality to better understand the benefits of production and tillage. Questions we hope to answer include: How is tillage going to affect the quality of our soil? Will soil quality affect crop production when irrigation is involved? What are the benefits of selecting the proper tillage to match the specific crop?

Methods

A three-year crop rotation of corn, soybean, and barley was initiated in the spring of 2008. The plot strips were 50' x 165', and replicated four times in a split block design. Tillage of the conventional plots was initiated in the fall following harvest. In the spring, additional tillage was done to the conventional tillage plots. Conventional tillage consisted of multiple passes (6 total) with a disc (2x), ripper (2x), and mulcher (2x) resulting in <30 % residue. Minimum tillage varied (≤ 2 passes) based on previous crop and was done in the spring prior to planting. Corn residue was aggressively disked at 5 mph cutting at a depth of 4 inches while maintaining >30% residue cover and then mulched for firmer seed bed. Barley residue was also disked but ground speed (3 mph) and depth (3 inches) were reduced to maintain the > 30% residue cover and then mulched to firm the soil seedbed. A disk was used to till the soil (depth 2 inch/speed 2.5mph) in soybean residue, leaving most of the residue on the soil surface and mulched to firm the soil seedbed. Only trash wipers (residue managers) were used in the no-till system of corn and soybean to move residue from seed row. Crops were seeded with commercial field equipment; corn and soybean planted with a John Deere 7200 Maxemerge with 30 inch spacing and barley planted with a John Deere 1790 no-till single disk grain drill. Corn varietal selection was

determined by growing degree days and an 80 day-length variety was selected. A 0.2 relative maturity soybean variety was used. Fertilizer was spring applied at recommended rates determined by soil testing. Each crop was managed the same regardless of the tillage system during the growing season. Weeds were managed with herbicides to minimize their impact on production. Percent residue cover, soil temperature, and stand counts were measured after planting/crop emergence. Residue amounts were measured after planting using the Line Transect Method. Soil water content was measured in all three crops and tillage systems to identify crop water needs. Representative areas within the plots were harvested with a plot combine for data collection. Each crop was harvested the same day across all tillage treatments. Grain yield, proteins, and test weights were measured after harvest.

Results

Table 1 shows yield associated with tillage treatment for the three crops, averaged across nine years for yield and test weight for each of the crops and the three tillage systems. The 2017 tillage treatments show no significant differences (P<0.05) in yield between treatments in soybeans or barley. Significant differences (P<0.05) between tillage treatments and yield were observed in corn.

Table 1. Comparing Tillage Systems **WREC - Nesson Valley 2017**

	Corn						Soybean				Barley					
	Yield		Test Weight		Harvest Moisture		Yield		Test Weight		Yield		Test Weight		Protein	
	--- bu/a ----		---- lb/bu ----		------- % -------		--- bu/a ---		---- lb/bu ----		--- bu/a ---		---- lb/bu ----		----- % -----	
Tillage System	2017	8 yr avg*	2017	8 yr avg*	2017	7 yr avg^	2017	9 yr avg	2017	9 yr avg	2017	9 yr avg	2017	9 yr avg	2017	9 yr avg
Conventional Till	163.3	170.5	55.8	57.0	14.7	15.9	49.9	44.9	57.5	56.8	151.6	104.7	51.3	50.5	11.2	12.7
Minimum Till	169.3	164.8	55.9	56.4	15.0	16.0	50.4	45.3	57.2	56.7	172.1	101.7	51.3	50.3	12.1	12.5
No Till	154.9	150.7	55.7	55.1	15.1	17.1	45.4	44.5	57.2	56.8	169.0	95.9	51.3	49.7	9.8	11.9
Mean	162.5	162.0	55.8	56.2	14.9	16.3	48.6	44.9	57.3	56.8	164.2	100.8	51.3	50.2	11.0	12.4
C.V.%	1.8	--	1.0	--	2.2	--	12.6	--	0.5	--	11.4	--	1.0	--	5.6	--
LSD 5%	6.6	--	N.S.	--	N.S.	--	N.S.	--	N.S.	--	N.S.	--	N.S.	--	1.1	--

*8 yr avg = 2009 excluded because of stand issues (2010-2017)

^7 yr avg = (2011-2017)

Conclusions

Comparing tillage systems with a three year crop rotation of corn, soybean and barley is proving to be as effective in minimum till as conventional till in a nine year average under irrigation. Other observations made are that the soybean no till system following corn is doing as well as the conventional till and minimum till systems. The results have demonstrated that in an irrigated environment, reduced tillage can be as productive as a conventional till system.

Saline Seep Reclamation Research Update

Clair Keene, Jim Staricka, Kyle Dragseth, Jerry Bergman, and
Jane Holzer (Montana Salinity Control Association)

The goal of this on-going research project is to reclaim and remediate a saline seep present in one of the Williston Research Extension Center's dryland fields.

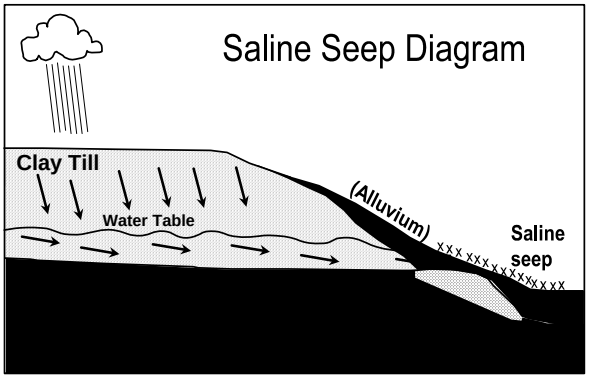
Background

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.

Monitoring Wells*:* 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-inch 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.

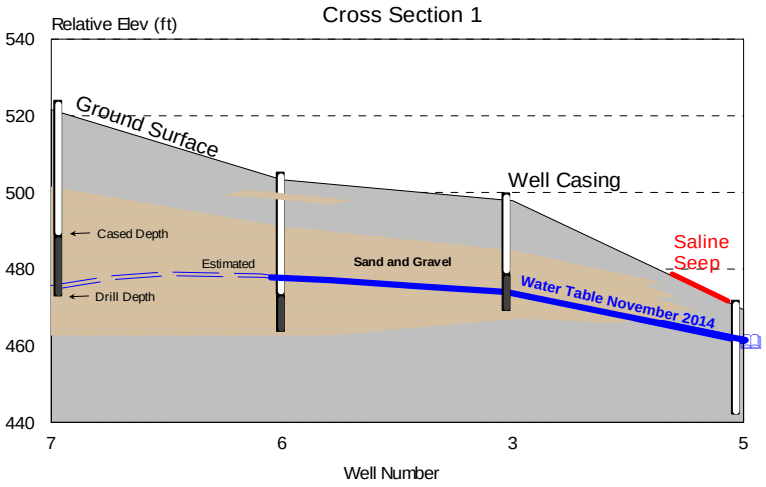
Soils: In the investigated area, the soil texture in the upper 0- to 5-foot soil profile is predominantly Clay or Sandy Clay Loam derived from Glacial Till left behind from the previous glacial periods. Glacial till in this area is mainly clay and clay loam soils.



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 of four alfalfa and two perennial grass varieties in the worst part of the saline seep. Alfalfa varieties are AFX 457, PGI 427, Magnum Salt, and Rugged. Perennial grasses are Garrison creeping foxtail and AC Saltlander.

2017 Varietal Results: Stand evaluations done on May 12 (2017) estimated all alfalfa varieties at approximately 90% ground cover with crop condition good to very good in the seep. The perennial grasses did not establish as well as the alfalfa in the variety trial and had approximately 50% ground cover with poor to fair stands.

The variety trial was cut twice, first on May 30 and again on July 21. A third cutting of the field was done in early September, but the plots were not cut. We note that three cuttings of alfalfa is exceptional given the severity of the 2017 drought. The dryland site received less than 1 inch of rainfall between early May and mid-July.

Table 1: Saline seep variety trial 2017 yields.

	1st cutting (May 30)			2nd cutting (Jul 21)			
	High yield	**Low yield**	**Avg yield**	**High yield**	**Low yield**	**Avg yield**	**Total yield**
	T/ac	*T/ac*	*T/ac*	*T/ac*	*T/ac*	*T/ac*	*T/ac*
Alfalfa variety							
AFX 457	2.7	1.2	2.0	2.1	1.3	1.7	**3.7**
PGI 427	2.5	1.2	1.9	1.9	0.6	1.2	**3.1**
Magnum Salt	2.4	1.0	1.7	1.7	0.9	1.3	**3.0**
Rugged	2.2	1.1	1.7	2.5	1.4	1.9	**3.6**
Grass variety							
Garrison foxtail	0.9	0.2	0.6	0.1	0.1	0.1	**0.7**
AC Saltlander	0.6	0.3	0.5	0.1	0.1	0.1	**0.6**

Alfalfa biomass was sampled twice in each plot: “High” yield values reflect where the alfalfa growth looked the best and “Low” yield values were taken from areas where the alfalfa stand was the poorest (Table 1). If an alfalfa variety exhibits high salt tolerance, there should be little difference between the High and Low values. If a variety is sensitive to salt, then we expect a large difference between the High and Low values. The Avg yield is the average of the High and Low values and is considered representative of the variety’s performance in the saline seep. There were no significant differences in average yield among the alfalfa varieties at either the first or second cutting. Total yields for the season were also similar across varieties.

When alfalfa varieties were pooled together and yields compared between the saline seep and check strips up-slope, the check strips yielded more than the seep at first cutting, but the seep area yielded more than the check strips at the second cutting (Table 2). As the drought progressed, alfalfa in the saline seep was darker green and taller than higher portions of the field (see Photo 1). The shallow water table underlying the seep contributed to enhanced alfalfa growth.

Photo 1: Alfalfa in the seep is dark green and vegetative while upslope alfalfa is flowering due to water stress.

Table 2: 2017 Yields in seep and check areas.

	1st cutting	2nd cutting
	T/ac	*T/ac*
Saline seep	1.8	1.5A
Check strip	2.1	0.9B

†Yield averaged across alfalfa varieties

Soil EC measurements: In October 2016 and 2017, soil cores (0 to 3-inch depth) were collected from the plots of the saline seep variety trial. The cores were brought into the lab, made into a saturated paste with deionized water, and electrical conductivity (EC) was measured using a Field Scout direct soil EC meter (Spectrum Technologies). High EC values indicate high levels of dissolved solids and high salinity and low EC values indicate low levels of dissolved solids and low salinity. In the graphs (Fig. 1), you can see that EC values were lower in 2017 than in 2016, indicating that salts had been leached below the 3-inch sampling depth. For alfalfa, the threshold salinity value (i.e., the maximum salinity value at which crop growth is not affected) is 2.0 dS/m. In 2016, 57% of the seep area had EC values exceeding the threshold value, but in 2017, only 30% of the area exceeded the threshold. These results show that we are making progress in reducing the concentration of salts on the soil surface in the seep.

Figure 1.

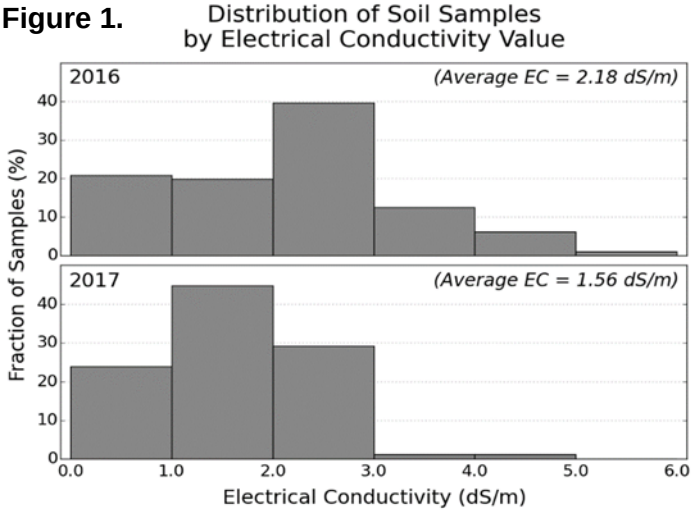


Photo 2: Soil core taken October 2017 showing white salt crystals present in the pore spaces.

Growth and Yield of No-Till Dryland Spring Wheat in Response to N and S Fertilizations

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

- Sulfur is an essential nutrient that plants use in the synthesis of amino acids, proteins, and oil.
- Sulfur deficiency in wheat causes uniform chlorosis of younger leaves and stunted growth (Picture 1).
- In recent years, producers of MonDak Region (the Western North Dakota and Eastern Montana) have observed sulfur (S) deficiencies in 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 because 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 the soil sulfate test is not reliable for S recommendation, and there is evidence that S deficiency might occur even in soil with high organic matter content.

Picture 1. Sulfur deficiency in wheat.

(Photo by Dave Mengel, K-State Research and Extension)

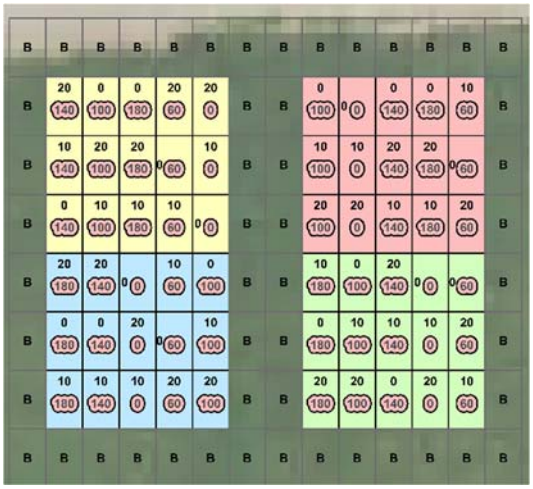
Objective

To determine an optimum amount of S and Nitrogen (N) for no-till dryland hard red spring wheat.

Materials and methods

- A hard red spring wheat variety “Velva” was planted at Williston Research Extension Center (WREC), Williston on April 21, 2017.
- 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 (Picture. 2).
- Canopy temperature and normalized difference vegetation index (NDVI) were measured weekly with a FLIR® E60 Thermal Imaging camera and a modified NDVI Sony camera using a forklift.
- Soil moisture was recorded in each plot using a neutron moisture meter.
- Yield and yield components were obtained at harvest.

Picture 2. Experimental design and randomization.

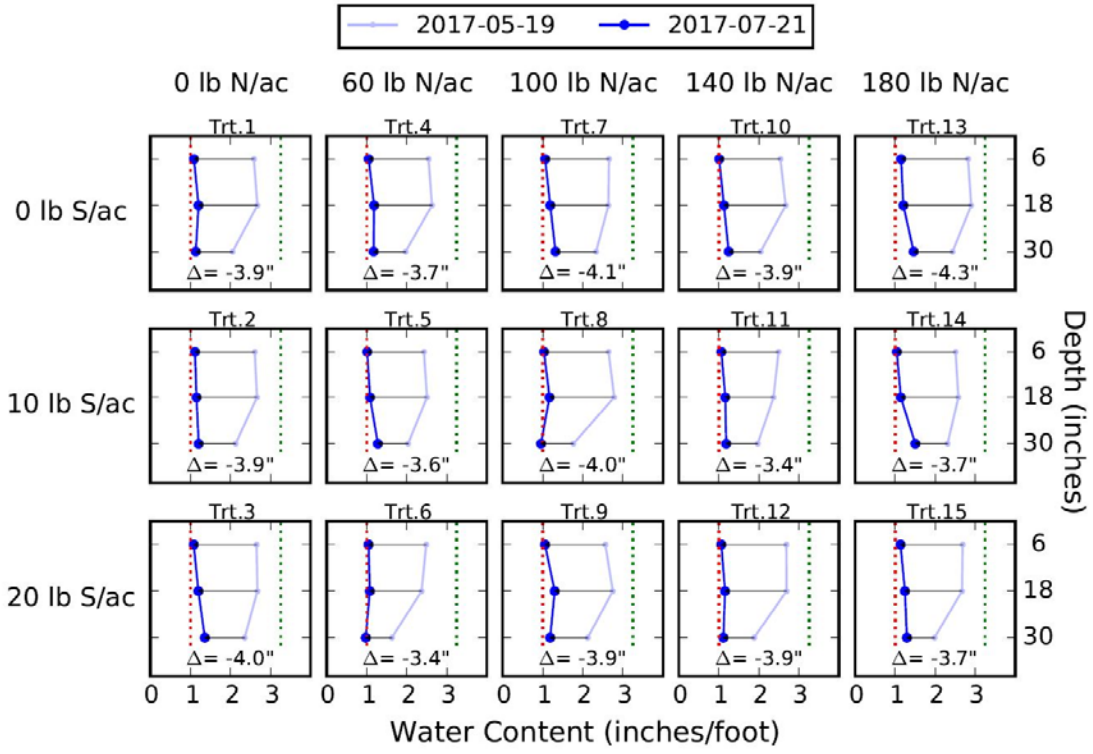


B stands for border; N and S rates are given in and outside of ovals, respectively.

Results

Soil water content measured on May 19 (28 days after planting) and July 21 (91 days after planting; Fig. 1) showed that, averaged across the treatments, there was about 3.83 inches of water depleted between two dates. There were about 1.43 inches of precipitation between two dates, which means wheat used only about 5.32 inches of water.

Figure 1. Changes in soil water profile.*



*The green and red dotted lines represent field capacity and wilting points, respectively.

There was no significant effect of N, S, and interaction effects of N and S on plant height, above ground biomass, spike number, grain number, and grain yield. Averaged across the treatments, the plant height was 20.3 inches, above ground biomass was 2871 lb/ac, spike count was 31.5 per sq. ft., kernel number was 27.3 per spike, and grain yield was 22.7 lb/ac.

There was a significant effect of N on grain protein and test weight. Application of 60 lb per acre of nitrogen increased protein content by one percent over the control (14.3%), and at least two percent increase in protein was observed when applied N rate was ≥ 100 lb/ac. In contrast, application of N decreased test weight by at least 0.7 lb per bushel over the control (54.9 lb/bu). The effect of S application was not evident on grain protein; however, application of 10 and 20 lb/ac of S decreased test weight by 0.41 and 0.47 lb/bu, respectively.

Table 1. Grain protein under different N rates.

N rate (lb/a)	Grain protein (%)	Test weight (lb/bu)
0	14.3 c†	54.9 a
60	15.3 b	54.2 b
100	16.4 a	53.7 bc
140	16.4 a	53.7 bc
180	16.8 a	53.5 c

†Within columns, means followed by the same letter are not significantly different at p≤ 0.05.

Summary

There was no effect of S and N on growth and yield of spring wheat. A season long drought may be the reason for the absence of the effect of S and/or N on growth, yield and yield traits of spring wheat.

Acknowledgments

We acknowledge the financial support of the Montana Wheat and Barley Committee.

2017 Integrated Pest Management Crop Scouting Results

Grace Dragseth, Taheni Gargouri-Jbir
Audrey Kalil, Janet Knodel, Andrew Friskop, and Sam Markell

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. Scouting crops regularly to track diseases and pests is essential for IPM, therefore the NDSU extension IPM team has developed an annual IPM scouting program. The data the North Dakota IPM scouts collect helps determine whether insect pest economic thresholds have been reached, identify hot spots of disease, and acts as an early warning system for growers as all of the data is posted online. 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 expressed as a percentage or using a numerical rating scale. Grasshopper and wheat stem sawfly populations are measured using a sweep. Grasshopper sweeps are conducted in field edges while sawfly sweeps are conducted at 5 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.

Results

During the 2017 growing season, the Williston IPM crop scouts surveyed 18 barley fields, 55 soybean fields, 21 sunflower fields, and 147 wheat/durum fields. They also put out and monitored insect pheromone traps for wheat midge, swede midge (brassica pest), corn insect pests and sunflower moths from late June to early August.

Disease: Levels of disease were generally low this year with the exception of Wheat Streak Mosaic Virus (WSMV) and Tan Spot. WSMV reached up to 47% incidence in four fields surveyed and was found at lower levels in ten more. Tan spot levels in some fields were fairly high with greater than 50% incidence, but severity levels stayed under 15%. Fusarium Head Blight (Scab) was not detected in any of the wheat fields surveyed.

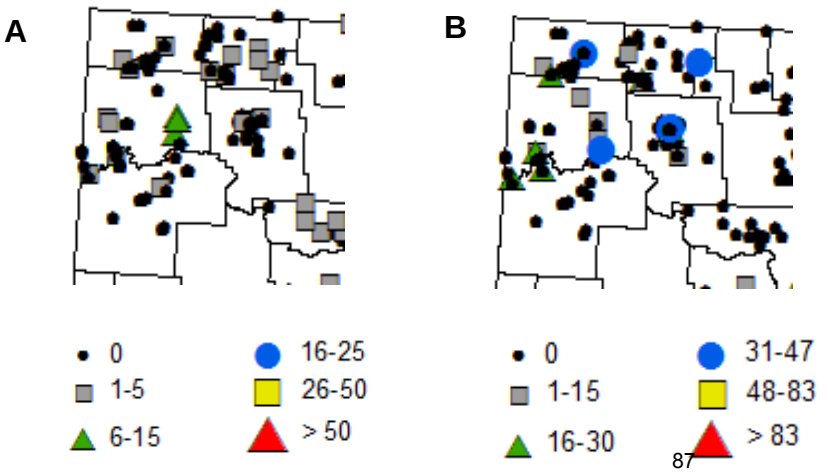


Figure 1. IPM Maps of disease levels during the 2017 growing season. A) Tan Spot percent severity 2017 season totals. Severity scale is indicated below the map. B) Wheat Streak Mosaic Virus percent incidence 2017 season total. Percent incidence scale is indicated below the map.

Insect Pests: Soybean aphids were only detected in three fields and in each case populations were below 40 aphids per plant **(Fig 2-A).** Levels of aphids were higher than normal this year (up to 25% of stems infested) on wheat with detectable aphid levels starting in late May **(Fig 2-B).** Wheat stem maggot levels were much higher than normal, with over 21% incidence in seven fields and above 11% incidence in nine others **(Fig 2-C)**. Soybean mites were detected in-field in eight out of the fifty-five fields surveyed. When mites are detected in the field as well as at the field edges this indicates a more severe infestation **(Fig 2-D).** While the hot, dry weather led to expectations of high grasshopper levels, populations remained fairly low throughout the season **(Fig 2-E).** Several growers reported severe wheat stem sawfly damage this season. During the IPM survey, sweeps conducted in the field found sawfly in Divide, Burke and Mountrail counties **(Fig 2-F)**. These levels are higher than have been detected in 2016 and 2015, where only 1-2 fields out of all surveyed typically have detectable levels of sawfly. Sunflower moths reached economic threshold at the Burke county location within the susceptible time period for that pest, indicating the need for management **(Fig 2-G).** Wheat midge was detected at very high levels (~500+ insects in the trap/week) in Divide County from 6/28 – 7/11. Wheat midge was present but at much lower levels in the other Counties.

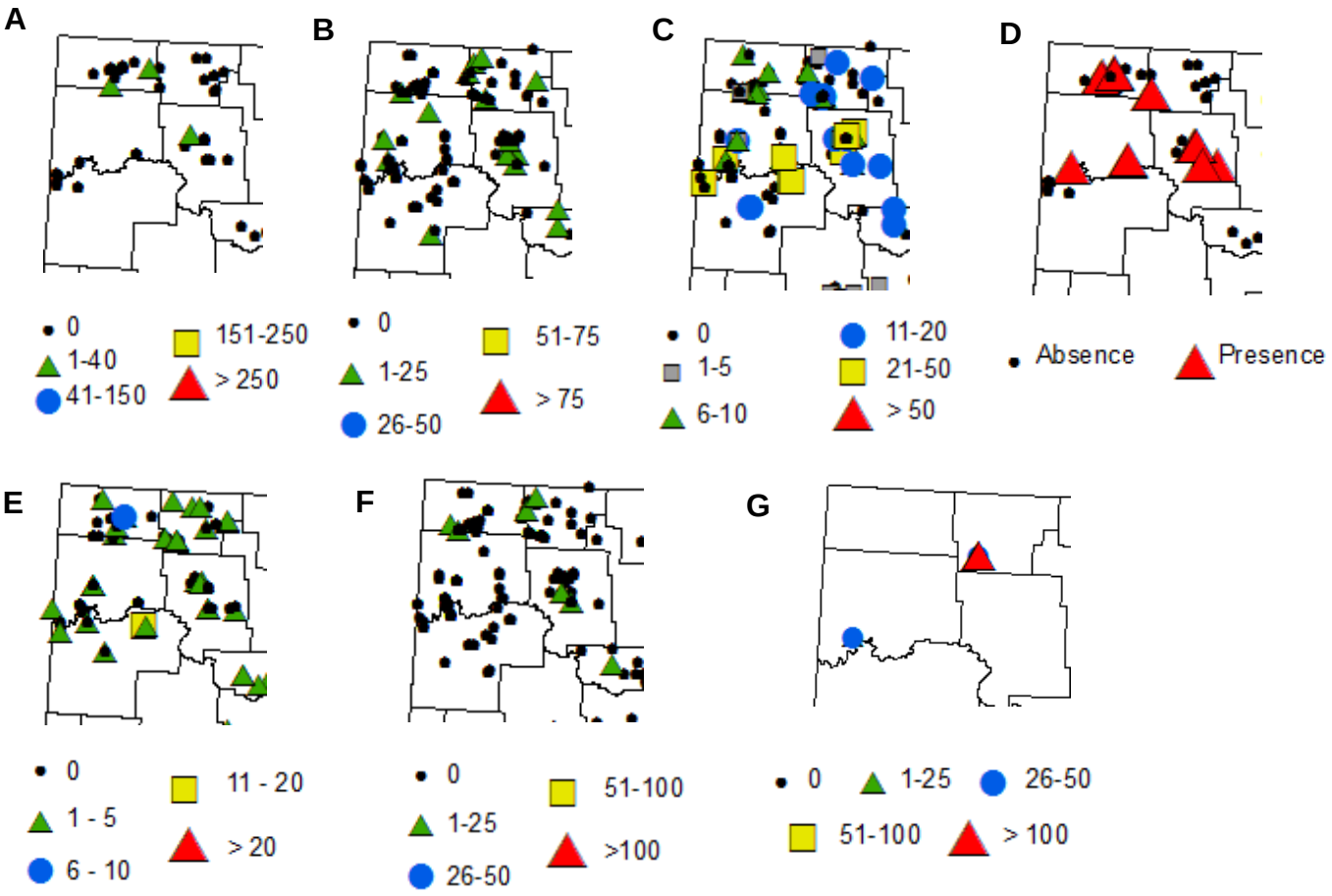


Figure 2. Insect pests during the 2017 growing season. A) Soybean aphids measured as average number of aphids per plant. B) Aphids in wheat measured as percentage of stems infested with aphids. C) Wheat Stem Maggot measured as percent incidence. D) Soybean mites measured within the field interior as present or absent. Relevant scales indicated below the maps. E) Grasshoppers present in field edges (adults/square foot) F) Wheat stem sawfly per 20 sweeps G) Number of Banded sunflower moth (*Cochylis hospes*) trapped per week. Maps indicate all of the data collected from May – August in 2017. Individual data points indicate numbers collected at one time point in one field

Thank you to all the participating growers. See you in 2018!

2017 Spring Wheat and Durum Yield and Quality Improved by Micronutrient Zn

EARC, Sidney, MT

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

Objectives: To improve the yield and quality of spring wheat and durum grown in dryland eastern Montana by application of Zn nutrient.

Materials and Methods:

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Pea
Planted: April 21, 2017
Harvested: August 15, 2017
Herbicide: Roundup – 2, 4-D
Precipitation April – August 2017: 4.1 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2016 – August 2017: 7.35 in
Three zinc treatments including 1) Zinc applied at Feekes 10.1 growth stage Zn1 (0.9 lbs/ac), 2) Zn2 (2.6 lbs/ac) of zinc (zinc sulfate monohydrate containing 35.5% zinc) applied at Feekes 10.1 and 10.5, and 3) control (No Zn application).

Results: Results showed a trend of increase in spring wheat grain yield with Zn application, but the means are not significantly different among Zn rates for yield and protein concentration (Table 1). Zinc concentrations in grain and straw of spring wheat increased with the increase of Zn application. Zn concentrations showed significant differences among Zn treatments and reached the maximum of 44.3 ppm in grain and 24.2 ppm straw. This counts for a 35.5% and 332% increase for grain and straw, respectively (Table 1). In durum, similar results were observed with a trend of increase of grain yield following Zn application but no statistical difference was obtained among Zn treatments on grain yield and protein concentration. The Zn application also increased Zn concentration in grain (19%) and straw (285%) with significant difference between Zn treatments (Table 2).

Conclusion: Our results showed that foliar application of Zn has the tendency to improve the yield and Zn concentration in grain and straw. Therefore, zinc micronutrient seems to have great potential to improve yield and quality of spring wheat and durum grown in the eastern Montana.

Funding Summary: The project was supported by Montana Wheat and Barley Committee.

Table 1: Effect of Zn application on spring wheat yield and quality

Treatment	Protein %	Grain Yield bu/ac†	Grain Zn ppm	Straw Zn ppm
Control	15.37	25.64	32.7c	5.6b
Zn 1	14.99	30.46	38.5b	10.7b
Zn 2	14.77	30.02	44.3a	24.2a
Level of significance	ns	ns	*	*
CV (%)	4.6	27.0	10.3	42.9

† Grain Yield adjusted to 12.0% moisture basis
* Significant at $P \leq 0.05$; ns: non-significant

Table 2: Effect of Zn application on durum yield and quality

Treatment	Protein Yield bu/ac	Grain Yield bu/ac†	Grain Zn ppm	Straw Zn ppm
Control	15.9	26.60	36.3c	5.4c
Zn 1	15.5	27.38	39.4b	10.9b
Zn 2	15.7	28.97	43.2a	20.8a
Level of significance	ns	ns	*	*
CV (%)	3.2	17.5	8.8	35.8

† Grain Yield adjusted to 12.0% moisture basis
* Significant at $P \leq 0.05$; ns: non-significant

Effect of Nitrogen and Sulfur on Yield and Quality of Spring Wheat EARC, Sidney, MT

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

Objectives: To determine the response of spring wheat yield and quality to nitrogen and sulfur.

Effect of Nitrogen and Sulfur on Measured Variables

Treatments	Protein %	Grain Yield bu/a †
Nitrogen		
N1	11.5e	36.7
N2	12.1d	37.5
N3	12.5c	37.9
N4	12.9b	39.1
N5	13.3a	39.0
Sulfur		
S1	12.6	37.7
S2	12.4	38.1
S3	12.4	38.3
Nitrogen (N)	*	ns
Sulfur (S)	ns	ns
N x S	ns	ns
CV (%)	2.4	8.3

† Grain Yield adjusted to 12.0% moisture basis

* Significant at $P \leq 0.05$; ns: non-significant

Location: EARC dryland farm
Soil type: Williams Clay Loam
Planted: April 22, 2017
Harvested: July 26, 2017
Previous crop: Fallow

Herbicide: Roundup – 2, 4-D
Precipitation April – July 2017: 2.6 in
The study consisted of five nitrogen fertilizer rates including 0, 60, 100, 140, 180 lb/ac N adjusted based on initial soil N, and three sulfur rates including 0, 10, 20 lb/ac S. Both fertilizers urea and ammonium sulfate were banded at planting.

Results: Due to severe drought, the results showed no significant effect of N on grain yield which reached a maximum under 140 lb N /ac. However, the effect of N was significant on test weight and protein. The more N applied, the high the protein content (Table 1). Although the slight increase of test weight and grain yield with sulfur increase, the results showed no significant effect on measured variables indicating that the soil has sufficient sulfur. The interaction effect of N and sulfur was also not significant on all variables.

Conclusion: Due to the severe drought, N did not show significant effect on grain yield of spring wheat. Sulfur application did not affect yield and protein suggesting that the soil is rich of S in this soil.

Funding Summary: The project was supported by Montana Wheat and Barley Committee.

Yield and Quality Responses of Spring Wheat and Durum to Nitrogen Management

EARC, Sidney, MT

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

Objectives: To improve the yield and quality of spring wheat and durum grown in dryland eastern Montana through nitrogen management.

Materials and Methods:

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Fallow
Planted: April 21, 2017
Harvested: July 26, 2017

Herbicide: Roundup – 2, 4-D
Precipitation April – August 2017: 4.1 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2016 – August 2017: 7.35 in

The experiment was designed in a randomized complete block design with three factorial arrangement and four replications. The treatments consisted of:

1. Two rates of nitrogen at 40 and 80lb N /acre
2. Two sources of nitrogen including urea and Super U fertilizers (super U is an improved fertilizer with urease and nitrification inhibitors)
3. Two methods of nitrogen application including banding in which fertilizers were banded 4 inches from the seeding rows before planting, and broadcasting which consisted of manually broadcasting the fertilizers on the soil surface on May 22, 2017.

Results: In spring wheat, the results showed no significant interaction effects between the N rate, N type and N application method. Due to the severe drought, nitrogen rate has only significant effect on protein content but not yield. As expected, high protein content was obtained under high rate of N. An increase of N rate from 40 to 80 lb/ac improved the protein content by 8.5% (Table 1). No significant effect was shown between urea and SuperU fertilizers on measured variables. Similarly, the banding and broadcasting methods have no significant effect on yield and quality of spring wheat (Table 1).
In durum wheat, due to the severe drought, the N rate has significant effect on test weight and protein content but no effect was found on grain yield (Table 2). Increasing N rate from 40 to 80 lb/ac improved protein content by 10.2%. No significant difference was obtained between urea and SuperU fertilizers on yield and quality. Similarly, except for test weight, the N application method showed no effect on measured variables (Table 2). In addition, no significant interactions were found between N rate, N type and application method.

Conclusion: The protein content of spring wheat and durum was improved by increasing N rate but there is minimal to no effect on yield, due to the severe drought in 2017 growing season. The banding of urea or SuperU before planting or broadcasting after planting seem to have minimal effect on improving the yield and quality of both spring wheat and durum.

Funding Summary: The project was supported by Montana Wheat and Barley Committee.

Table 1: Effect of Nitrogen Management on Yield and Quality of Spring Wheat

Treatments	Protein %	Test Weight lb/bu †	Grain Yield bu/ac †
N rate	12.3	62.9	31.5
N40	11.8b	63.1	31.0
N80	12.8a	62.7	32.0
N type	12.3	62.9	31.5
SuperU	12.1	63.1	31.7
Urea	12.5	62.7	31.2
Application method	12.3	62.9	31.5
Banding	12.3	62.9	31.3
Broadcasting	12.3	62.9	31.6
N rate	*	ns	ns
N type	ns	ns	ns
N method	ns	ns	ns
N rate x N type	ns	ns	ns
N rate x N method	ns	ns	ns
N type x N method	ns	ns	ns
N rate x N type x N method	ns	ns	ns
CV (%)	4.4	0.9	16.4

†Test Weight and Grain Yield adjusted to 12.0% moisture basis
* Significant at *P*≤0.05; ns: non-significant

Table 2: Effect of Nitrogen Management on Yield and Quality of Durum

Treatments	Protein %	Test Weight lb/bu †	Grain Yield bu/ac †
N rate	12.4	62.8	27.3
N40	11.8b	62.9a	27.7
N80	13.0a	62.6b	26.9
N type	12.4	62.8	27.3
SuperU	12.3	62.9	26.7
Urea	12.4	62.7	27.9
Application method	12.4	62.8	27.3
Banding	12.5	62.6b	27.9
Broadcasting	12.3	62.9a	26.7
N rate	*	*	ns
N type	ns	ns	ns
N method	ns	*	ns
N rate x N type	ns	ns	ns
N rate x N method	ns	ns	ns
N type x N method	ns	ns	ns
N rate x N type x N method	ns	ns	ns
CV (%)	6.1	0.5	15.9

†Test Weight and Grain Yield adjusted to 12.0% moisture basis
* Significant at *P*≤0.05; ns: non-significant

Improving Yield and Quality of Spring Wheat and Durum by Cropping and Nitrogen Management

EARC, Sidney, MT

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

Objectives: To improve the yield and quality of spring wheat and durum grown in dryland eastern Montana through cropping and nitrogen management.

Materials and Methods:

Location: EARC dryland farm
Soil type: Williams Clay Loam
Previous crop: Fallow or pea
Variety: Spring wheat Velva and durum Joppa
Planted: April 26, 2017
Harvested: July 27, 2017
Herbicide: Roundup – 2, 4-D
Precipitation April – August 2017: 4.1 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2016 – August 2017: 7.35 in

The experiment was designed in a randomized complete block design with two factorial arrangement and three replications. The treatments consisted of:

1. For spring wheat: two rotations including Fallow-Spring wheat and Pea-Spring wheat
   For durum: two rotations including Fallow-Durum and Pea-Durum
2. Eight nitrogen application timing and method treatments including N1 (60 lb/ac banded at planting), N2 (60 lb/ac broadcasted after emergence), N3 (60 lb/ac, in which 50% banded at planting and 50% broadcasted at stem elongation), N4 (60 lb/ac, in which 50% banded at planting, 30% broadcasted at stem elongation, and 20% as foliar application at flowering), N5 (120 lb/ac banded at planting), N6 (120 lb/ac broadcasted after emergence), N7 (120 lb/ac, in which 50% banded at planting and 50% broadcasted at stem elongation), N8 (120 lb/ac, in which 50% banded at planting, 30% broadcasted at stem elongation, and 20% as foliar application at flowering).

Results: The rotation of spring wheat with pea and fallow showed significant differences in grain yield. Planting of spring wheat following fallow improved the yield by 22% compared to spring wheat following pea. However, no significant effect was obtained on test weight and protein content (Table1). Due to the severe drought, no significant effect of N treatments was obtained on yield. Similarly, N has no effect on test weight and protein content. In addition, no interaction was observed between rotation and N treatments (Table 1).

For durum, rotation has significant effect on yield with 18.7% increase in durum following fallow compared to durum following pea (Table 2). No significant effect of rotation was found on test weight and protein content. Due to the severe drought, nitrogen has no significant effect on measured variables and no interaction was obtained between N and rotation (Table 2).

Conclusion: Rotation has significant effect on the grain yield of spring wheat and durum, but the quality was not affected by the cropping system in this drought year. Due to the severe drought, water is the major limiting factor and nitrogen treatments showed no significant effect on measured variables.

Funding Summary: The project was supported by Montana Wheat and Barley Committee.

Table 1: Effect of rotation and nitrogen on spring wheat yield and quality

Treatments	Protein %	Test Weight lb/bu †	Grain Yield bu/ac †
Rotation	15.6	61.4	22.6
Fall-SW	15.6	61.7	24.8a
Pea-SW	15.6	61.1	20.4b
Nitrogen	15.6	61.4	22.6
N1	15.2	61.8	22.4
N2	15.4	62.2	24.7
N3	15.8	61.3	21.9
N4	15.4	61.6	25.4
N5	15.8	60.7	20.9
N6	15.6	61.1	21.4
N7	15.8	61.7	22.8
N8	15.9	60.9	21.4
Rotation R	ns	ns	*
Nitrogen N	ns	ns	ns
R x N	ns	ns	ns
CV (%)	3.5	1.9	15.5

†Test Weight and Grain Yield adjusted to 12.0% moisture basis
* Significant at *P*≤0.05; ns: non-significant

Table 2: Effect of rotation and nitrogen on durum yield and quality

Treatments	Protein %	Test Weight lb/bu †	Grain Yield bu/ac †
Rotation	17.2	60.7	17.0
Fall-Durum	17.2	60.4	18.4a
Pea-Durum	17.2	60.9	15.5b
Nitrogen	17.2	60.7	16.9
N1	17.3	60.7	16.9
N2	17.2	61.1	17.4
N3	16.6	61.0	17.7
N4	16.6	60.6	17.9
N5	17.4	60.9	15.9
N6	17.4	60.2	15.7
N7	17.4	61.5	17.0
N8	17.6	59.4	17.0
Rotation R	ns	ns	*
Nitrogen N	ns	ns	ns
R x N	ns	ns	ns
CV (%)	6.7	2.5	26.4

†Test Weight and Grain Yield adjusted to 12.0% moisture basis
* Significant at *P*≤0.05; ns: non-significant

DON Accumulation in Durum Varieties

Audrey Kalil, 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 five location from 2015 through 2017: NDSU Williston Research Extension Center (WREC) in Williston, NDSU WREC at Nesson Valley, Crosby, Stanley 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. Grain from each plot (2016 & 2017) or pooled from all three plots (2015) 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 (2016 & 2017) or represent the pooled seed sample (2015).

Figure 1. Williston site in 2017

Results

Average DON (ppm) for each variety across sites and years (**Table 1**). DON was highest at the Crosby site in 2015. In 2017, there was no DON detected in any durum varieties at any of the four locations. There was no significant difference in DON accumulation among the durum varieties (**Table 1 & Fig 2**).

Durum Varieties	Stanley	Crosby			Arnegard			Williston		Nesson	
	2015	2015	2016	2017	2015	2016	2017	2016	2017	2016	2017
Alkabo	2.1	14.4	6.4	0	0.0	0	0	0	0	0.4	0
Carpio	2.7	11.6	4.9	0	0.1	0	0	0	0	0.6	0
Divide	2.2	6.6	6.1	0	0.2	0	0	0	0	0.5	0
Joppa	1.4	13.5	4.3	0	0.0	0	0	0	0	0.3	0
Lebsock	1.7	6.3	3.8	0	0.0	0	0	0	0	0.3	0
Mountrail	5.6	17.7	3.3	0	0.1	0	0	0	0	0.6	0
Tioga	5.4	14.7	5.5	0	0.0	0	0	0	0	0.7	0
Mean	3.0	12.1	4.9	0.0	0.1	0.0	0.0	0.0	0.0	0.4	0.0

Table 1. Average DON accumulation in durum varieties

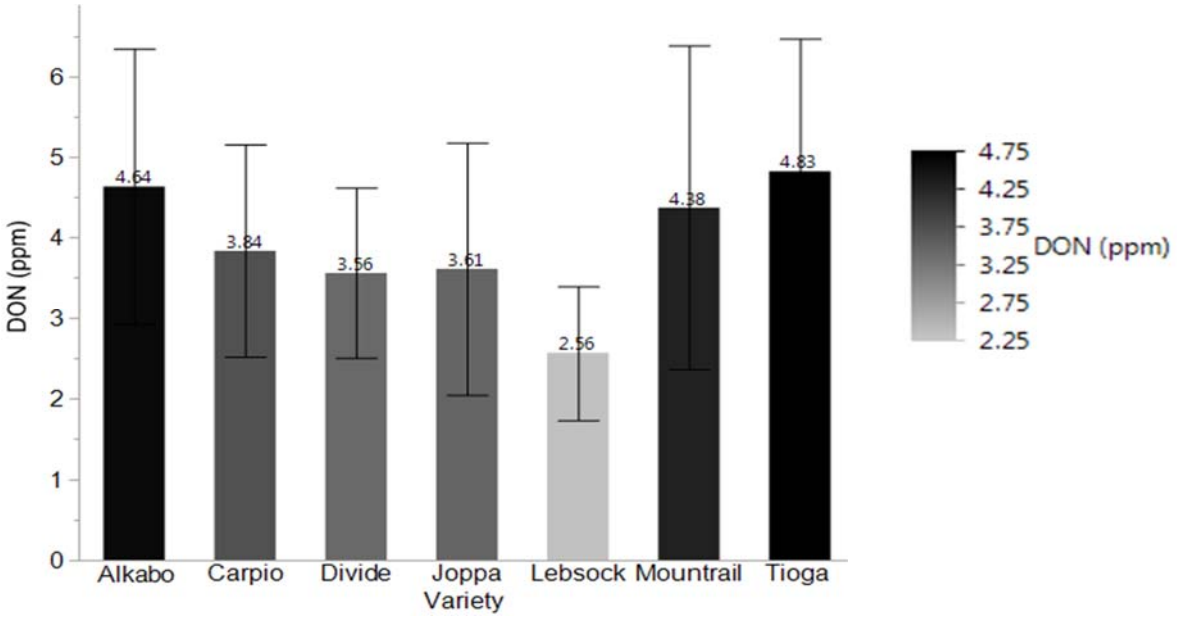


Figure 2. Average DON in durum varieties across sites and years. Only sites and years where all varieties had some detectable level of DON were included. Error bars indicate standard errors. Labels above bars indicate means. Lighter or darker shades of black indicates lower and higher levels of DON in varieties, however, variety means are not significantly different.

Conclusions

We were unable to detect any differences in DON accumulation among durum varieties based on this data set. Across years and locations, varieties varied in terms of DON accumulation relative to one another and so none performed consistently better or worse. Future work will include analysis of the new durum varieties ND Riveland and ND Grano to determine if these varieties will consistently out-perform current durum varieties in DON accumulation when grown at sites in NW North Dakota.

Effect of Planting Date and Maturity on Durum Yield and Disease

Audrey Kalil, Frankie Crutcher, John Rickertsen
Taheni Gargouri-Jbir, Tavin Schneider, Dimitri Fonseka, & Amber Ferda

Introduction

In recent years durum growers in western North Dakota and eastern Montana (Mon-Dak region) have dealt with extremes in both high and low precipitation. Years of high precipitation have resulted in a dramatic increase of disease in durum. Diseases new to the region such as stripe rust and ergot are also reducing yield and grain quality, especially in southwest North Dakota. Early planting, both in combination with early maturing varieties and alone, has been shown to reduce disease in barley and wheat. Thus, modification of planting date and varietal maturity has the potential to be a low-cost disease management strategy in durum. In 2017, drought severely reduced yields while disease pressure was low. Given that weather is unpredictable and extremes in low and high precipitation are possible, it is important to balance the need for disease avoidance with yield maximization. Our proposed research will allow us to determine the effect of planting date and maturity on yield and the severity of foliar and heading diseases at four sites in the Mon-Dak region, to provide growers with appropriate planting recommendations for their region to best avoid disease while still meeting yield goals.

Methods

Trials were planted in 2017 at the MSU EARC (Sidney, MT), NDSU Hettinger REC, Froid, MT and Crosby, ND in a randomized split-plot design with four replicates where planting date (early, middle, and late) was the main plot factor and variety the sub-plot factor. Varieties, indicated below, were selected that reflected a range of maturities, but had similar disease ratings and were susceptible where possible.

Variety	Maturity	Leaf Rust	Foliar Disease	Head Scab
Silver	Early	NA	M	S
Pierce	Medium	R	MS	S
Strongfield	Medium Late	R	MS	S
AC Commander	Late	R	MS	VS

Descriptions of variety characteristics. R = resistant, M = moderately resistant, MS = moderately susceptible, S = susceptible, VS = very susceptible NA = data not available Foliar disease indicates reaction to tan spot and septoria leaf spot complex.

The planting dates (below) were selected that reflected early, medium and late dates specific to the site.

Location	Planting Date 1	Planting Date 2	Planting Date 3	Harvest Date 1	Harvest Date 2	Harvest Date 3
Crosby	5-May	19-May	1-Jun	8-Aug	17-Aug	31-Aug
Hettinger	14-Apr	28-Apr	12-May	4-Aug	4-Aug	17-Aug
Sidney	21-Apr	5-May	19-May	31-Jul	11-Aug	21-Aug
Froid	28-Apr	12-May	25-May	21-Aug	31-Aug	3-Oct

Weather data (NDAWN) and agronomic measurements were collected to associate disease severity with growth stage and environmental conditions. Plots were assessed for severity of foliar diseases including leaf spot diseases and stripe rust at Feekes 2 and Feekes 10. Head blight and ergot were rated at Feekes 11.2 and 11.3 respectively. Yield data was collected and seed from all plots was assessed for DON, test weight and protein.

Results

Planting Date	Maturity	Yield (bu/A)			
		Hettinger	Froid	Sidney	Crosby
Early	Early	23.5bcd	3.8bc	30.0a	21.4bc
	Medium	25.6abcd	5.1ab	30.4a	25.7ab
	Medium late	34.0a	7.2a	34a	28.6a
	Late	30.8ab	5.7ab	33.7a	28.0a
Middle	Early	24.4abcd	0.2d	21.5bc	16.3de
	Medium	28.2abc	1.1d	19.3c	16.8cde
	Medium late	25.3abcd	0.6d	22.4bc	16.9cde
	Late	27.6abc	0.5d	23.47b	18.8cd
Late	Early	11.8e	0.3d	14.1d	8.4f
	Medium	13.4e	1.9cd	13.5d	8.5f
	Medium late	18.7cde	1.5d	14.6d	10.0f
	Late	16.4de	1.1d	14.7d	12.7ef
	Mean	23.31	2.40	22.66	17.67
	CV	29.42	61.09	13.24	20.13
	LSD (0.05)	9.86	2.11	4.32	5.12

Table 1. Yield by location across planting dates and maturity ratings. Highest yielding treatments are highlighted in green. Early planting dates typically had highest yields. Statistical differences indicated by lowercase letters within columns. (α = 0.05).

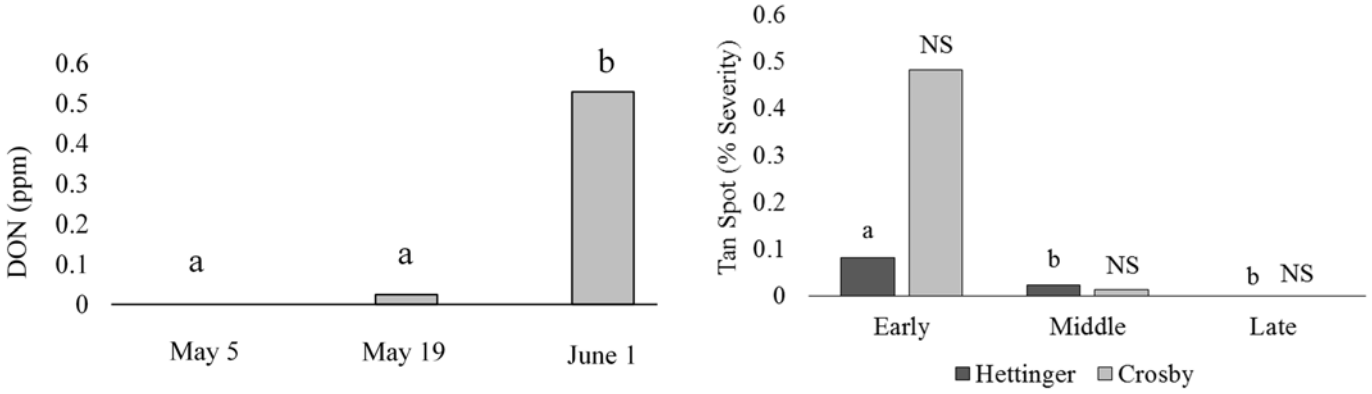


Figure 1. (Left) DON by planting date at the Crosby location. (Right) Severity of tan spot symptoms at the Feekes 2 growth stage at early, middle and late planting dates at two sites. Significant differences are indicated by different letters within sites (α < 0.05). NS = not significant.

Conclusions

The early planting date treatment yielded significantly higher at all four sites, likely due to drought conditions (**Table 1**). The middle planting date at the Hettinger site, which experienced higher rainfall in April than the other sites, did not yield significantly different than the early planting date (**Table 1**). Interestingly, at the early planting date later maturing varieties tended to yield higher (**Table 1)**. While early planting dates are necessary under drought conditions, early planting dates also experienced higher levels of tan spot disease (**Fig 1**). Fusarium head blight disease and DON was not found at Hettinger, Froid and Sidney sites. At the Crosby site, the late planting date had significantly higher DON than the earlier planting dates which had little to no DON accumulation (**Fig 1**). Data from the leaf wetness sensor placed at this site indicated 6+ hours of leaf wetness during flowering of varieties planted on the third planting date. This study will be repeated to confirm trial results.

Planting Scabby Seed:

Effect of DON on Durum Germination, Establishment and Yield

Audrey Kalil, Dimitri Fonseka, Taheni Gargouri-Jbir, and Kyle Dragseth

Introduction

Fusarium head blight (head scab) of wheat, durum and barley is caused by the fungal pathogen *Fusarium graminearum*. This fungus infects the seed and produces a mycotoxin called deoxynivalenol (DON). The result is "scabby" seed which can potentially contain high levels of both *F. graminearum* and DON. Planting such seed can result in poor stands due to low germination rates and seedling blight, however, recommendations on what levels of DON in the seed results in yield loss were not available. The objective of this research was to determine 1) how DON and *Fusarium* contamination in the seed effects germination, establishment and yield and 2) if a seed applied fungicide can improve establishment and yield.

Experimental Design

1. Obtained Alkabo durum with different levels of DON: < 0.3ppm, 1ppm, 3.1 ppm, 10.2 ppm and 19.9 ppm.
2. Samples assessed for percent of seed contaminated with *F. graminearum* by Lendon Seed (Regina, SK).
3. Durum lots were split and each received a different fungicide treatment. One lot (control) did not receive fungicide seed treatment for control of *Fusarium*, and the other lot was treated with tebuconazole. Germination was assessed after fungicide treatment by incubating 100 seeds in a petri dish contain a damp paper towel for 5-7 days.
4. Plots were planted 4/26/2017 using a no-till planter at a seeding rate of 1.6 million pure live seeds/ac. Stand count was performed 5/18/2017. Plots were harvested 7/31/2017.

Results

Treatment	DON (ppm)	*Fusarium* seed contamination (%)	Fungicide seed treatment†	Germination (%)
1	< 0.3	2	Control	62
2			Tebuconazole	74
3	1	2	Control	71
4			Tebuconazole	72
5	3.1	3	Control	66
6			Tebuconazole	54
7	10.2	3.5	Control	50
8			Tebuconazole	44
9	19.9	7.5	Control	45
10			Tebuconazole	38

Table 1. Germination and percent seed contamination with *Fusarium graminearum*. † Both control and tebuconazole treatments received metalaxyl seed treatment for control of *Pythium*.

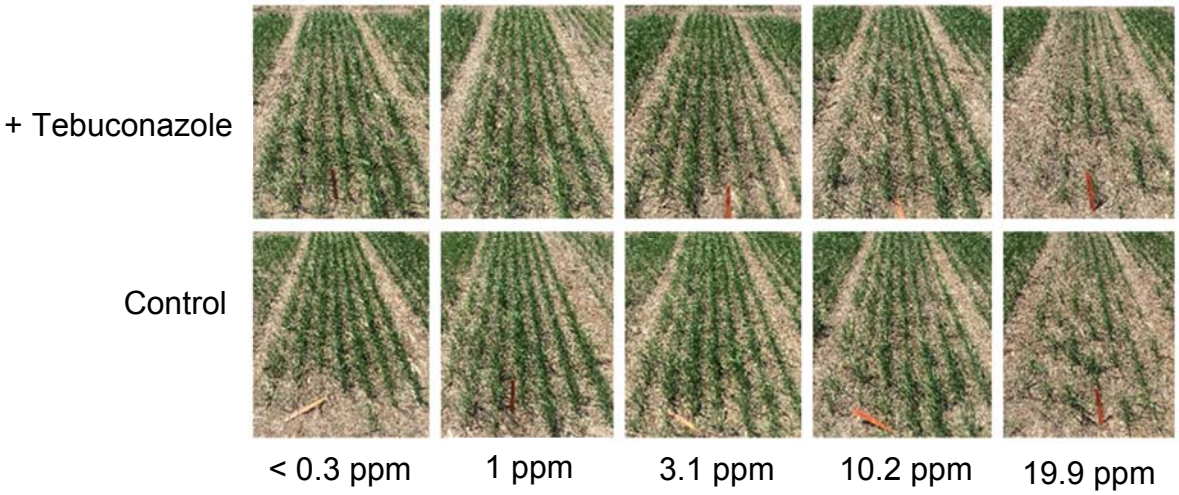
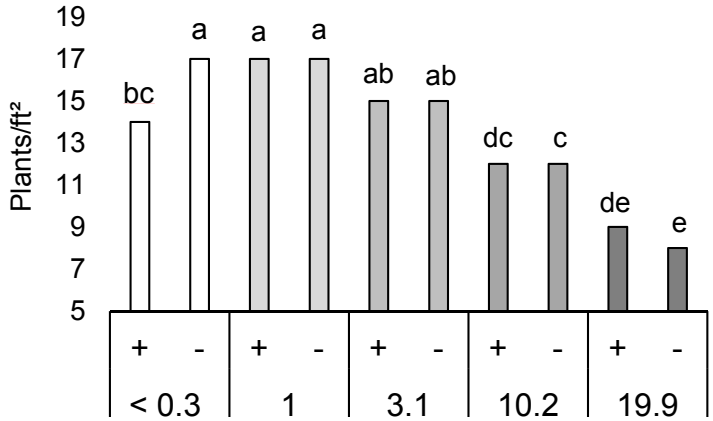


Figure 1. Plot photos taken 6/8/2017. DON levels indicated below the photos. Fungicide treatment indicated to the left of photo panels.



Treatment DON	Harvested Seed Yield (bu/ac)	TW (lb/bu)	Protein (%)	DON (ppm)
> 0.3 ppm	24.3a	66.5a	17.0a	> 0.3
1 ppm	23.9ab	66.5a	17.1a	> 0.3
3.1 ppm	23.1ab	66.3a	17.1a	> 0.3
10.2 ppm	22.9ab	66.5a	17.0a	> 0.3
19.9 ppm	19.0b	66.6a	17.0a	> 0.3

Figure 2 (left). Stand count is indicated for each treatment in plants/ft². Statistical differences indicated by letter above the bar (α<0.05). +/- indicates plus or minus tebuconazole seed treatment

Table 2 (right). Yield, Test Weight (TW), Protein and DON (parts per million) from each DON treatment regardless of fungicide treatment (n = 6). Yield and TW are adjusted to 13.5% moisture, protein is adjusted to 12% moisture. Statistical analysis using Tukey-Karmer HSD comparison of means (α<0.05).

Conclusions

Increasing levels of DON corresponded to decreasing seed germination where 19.9 ppm DON had approximately 20% less germination than the seed with undetectable levels of DON (**Table 1**). We did not observe a decrease in stand count with Alkabo durum seed DON levels of 1 – 3.1 ppm (2-3% *F. graminearum* contamination) (**Fig 1 and 2**). Stand count was slightly reduced when seed with 10.2 ppm DON (3.5% *Fusarium* contamination) was planted. DON levels of 19.9 ppm (7.5% *Fusarium* contamination) in the seed reduced the stand by 50% compared to the low DON treatments. Use of tebuconazole seed treatment for control of *Fusarium* did not significantly improve durum establishment. Yield was significantly reduced only in the 19.9 ppm DON treatment, which yielded 19 bu/ac as opposed to 24.3 bu/ac in the zero DON control (**Table 2**). There was no effect of planting DON contaminated seed on test weight, protein or DON, which was not present in the harvested grain.

Irrigated Durum Fusarium Head Blight Fungicide Trial — EARC, Sidney, MT

Frankie Crutcher, Amber Ferda, Samantha Hoesel

Objective: Test the ability of different foliar fungicides to control Fusarium Head Blight caused by *Fusarium graminearium* on durum.

Materials and Methods:

Variety: Silver
Planted: 04/18/2017
Harvested: 08/11/2017
Plot Size: 5 X10=50 ft²
Seeding Rate: 60 lb/A
Soil Type: Clay Loam
Previous Crop: Sugarbeet
Residual Soil N to 3 ft: 25.6 lb/A; P to 6 in: ~20 ppm
Applied Fertilizer: 46-0-0

Irrigated (sprinkler) on 04/11/2017, 05/18/2017, 05/31/2017, 06/29/2017
Chemical Applications: Maestro, Axial, Sharshield
Precipitation April – September, 2017: 5.98 inches
Vigor Observation Date: 05/18/2017
Phytotoxicity Observation Dates: 06/26/2017
Disease Assessments: 06/28/2017, 07/05/2017, 07/12/2017, 07/18/2017
Corn spawn application: 6/12/2017
Date of first application: 06/21/2017

Comments: Seed treated with Foothold. Used AI 3070 dual pattern flat spray tips. Rainfall from planting to harvest: 3.88 inches.

Results: Excessive drought negatively impacted ascospore dispersal and disease progression even with irrigation during the 2017 growing season. For this study, no differences in yield or disease incidence were observed. There were statistically significant differences in disease incidence and severity at timing 3, but the very low levels (0-9.17%), make it unlikely that these differences are biologically significant. There was also no statistical differences between percent disease kernels (%DK), which was measured by the percent of kernels out of 400 that were shriveled. We did not confirm that this was due to Fusarium. No phytotoxicity was observed.

Table 1: Fungicide Evaluation for Control of Fusarium Head Blight on Durum

Treatment #	Incidence 3 (%)[a]	Incidence 4 (%)	Severity 3 (%)[b]	Severity 4 (%)	% DK	Adjusted Yield (Bu/A) (13.5%)
1	5.83 AB	7.50 A	3.75 AB	7.50 A	22.63 A	76.62 A
2	9.17 AB	10.83 A	7.50 A	6.25 A	22.38 A	72.85 A
3	3.33 AB	9.17 A	2.50 AB	6.25 A	18.50 A	74.79 A
4	10.83 A	5.00 A	6.25 AB	5.00 A	19.63 A	74.04 A
5	2.50 AB	5.83 A	1.25 AB	5.00 A	21.75 A	72.58 A
6	2.50 AB	10.00 A	1.25 AB	3.75 A	22.00 A	71.92 A
7	0.00 B	6.67 A	0.00 B	3.75 A	16.63 A	77.78 A
Mean	4.88	7.87	3.21	5.36	20.5	74.37
CV (%)	149.25	93.24	159.62	94.80	29.09	9.25
LSD (0.05)	10.47	11.72	7.35	8.18	9.26	10.94

Letters in common did not differ significantly according to a t-test at a significance level of 5%.
[a]Pest Incidence: Percent of 30 plants with FHB.
[b]Pest Severity: Average percent area of 30 plants covered by disease.

Table 2: Fungicide Treatments for Fusarium Head Blight on Durum

Treatment #	Fungicide	Rate
1	Untreated Control	None
2	Caramba	15 fl oz/A
3	Prosaro	6.5 fl oz/A
4	Folicur 3.6F	4 fl oz/A
5	Adepidyn + Tilt 3.6 EC	8.55 fl oz/A + 3.36 fl oz/A
6	Miravis Ace	11.5 fl oz/A
7	Miravis Ace	13.7 fl oz/A
All treatments contain 0.25% v/v (NIS) Induce.		

Effect of Rotation and Tillage on DON accumulation in Barley

Audrey Kalil, Bart Stevens, Dimitri Fonseka, Bill Iverson, and Jack Wang

Introduction

Fusarium head blight (FHB) is a disease of barley caused by the fungal pathogen, *Fusarium graminearum*. *F. graminearum* produces a toxin called deoxynivalenol (DON) in the grain which makes it unsuitable for human or animal consumption. This pathogen can grow and survive on the residue of many crops, but is most prolific on corn. Previous studies have shown that cropping corn before a small grain crop can increase FHB disease. Given that *F. graminearum* survives on crop residue, no-till is also thought to increase risk of FHB and grain DON accumulation but results on this are inconclusive. Residue break down is much quicker under moist environments, and so results from irrigated fields may be different from dryland environments. Data under irrigation is lacking, so this study sought to quantify the effect of no-till and a crop rotation including corn on DON accumulation in barley under irrigation.

Methods

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. 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 in the spring.

- Rotations (main plot)
  - Sugarbeet-barley
  - Sugarbeet-corn-soybean-barley
- Tillage (split-plot)
  - No-till
  - Tilled

100g sub-samples were collected out of harvested barley seed for DON analysis. Approximately 20g of seed was ground in a coffee mill until a fine powder was achieved. Ground grain (10g) from each plot was analyzed for DON using the Reveal Q+ mycotoxin extraction protocol and AccuScan II GOLD reader (Neogen). The detection threshold of this device is 0.3 ppm, so less than that amount is transformed to a 0 in the data set. Data was assessed for normality and analyzed for significance using the least squares method in JMP statistical software.

Results

		DON (ppm)	
Rotation	Tillage	2016	2017
Beet-Barley	CT	0.00a	0a
Beet-Barley	NT	0.72b	0a
Beet-Corn-Soy-Barley	CT	0.46b	0a
Beet-Corn-Soy-Barley	NT	0.70b	0a
	Mean	0.47	0.00

Conclusions

Both rotation and tillage had a significant effect on barley DON accumulation in 2016. Under a barley-beet rotation, no-till plots had significantly higher DON (0.72 ppm) than conventional till plots (< 0.3 ppm). Both no-till and conventional till beet-corn-soy-barley rotation treatments resulted in higher levels of DON in the barley than the conventional tilled barley-beet rotation, but had similar levels of DON as barley in the no-till barley-beet rotation treatment. Tillage did not decrease barley DON in the 4 year rotation. This data might be explained by quicker degradation of barley residue compared to corn residue even when tillage is employed. In 2017, disease pressure was low and none of the treatments had detectable levels of DON.

Malt Barley Fusarium Head Blight Fungicide Trial — EARC, Sidney, MT

Frankie Crutcher, Amber Ferda, Samantha Hoesel

Objective: Test the ability of different foliar fungicides to control Fusarium Head Blight caused by *Fusarium graminearium* on malt barley.

Materials and Methods:

Irrigated:

Variety: Conlon
Location: Sidney, MT
Planted: 04/18/2017
Harvested: 08/10/2017
Plot Size: 5 X 10=50 ft²
Seeding Rate: 60 lb/A
Soil Type: Clay Loam
Previous Crop: Sugarbeet
Residual Soil N to 3 ft: 25.6 lb/A
Residual Soil P to 6 in: ~ 20 ppm
Applied Fertilizer: 46-0-0

Irrigated (sprinkler) on 04/11/2017, 05/18/2017, 05/31/2017, 6/29/2017
Chemical Applications: Maestro, Axial, Sharshield
Precipitation April – September, 2017: 5.98 inches
Vigor Observation Dates: 05/18/2017
Disease Assessments: 06/28/2017, 07/05/2017, 07/14/2017
Corn spawn application: 6/12/2017
Conidia application: 6/21/2017
Treatments: Caramba, Prosaro, Folicur, Miravis Ace Date of first application: 06/16/2017

Comments: Seed treated with Foothold. - Average plant height was 27.4 inches. - AI 3070 dual pattern flat spray tips used. - Rainfall from planting to harvest: 3.57 inches.

Results: Excessive drought negatively impacted ascospore dispersal and disease progression even with irrigation during the 2017 growing season. For this study, no differences in yield or disease incidence were observed. There was also no statistical differences between percent disease kernels (%DK), which was measured by the percent of kernels out of 400 that had fungal growth on the surface. We did not confirm that this fungal growth was due to *Fusarium*. No phytotoxicity was observed.

Table 1: Fungicide Evaluation for Control of Fusarium Head Blight on Malt Barley

Treatment #	Test Wt (Bu/A)	% DK	Adjusted Yield (lb/A) (13%)
1	51.5 A	18.4 A	132.3 A
2	51.1 A	17.3 A	135.9 A
3	51.0 A	14.5 A	131.7 A
4	51.2 A	16.8 A	130.0 A
5	51.2 A	14.6 A	132.2 A
6	51.2 A	14.3 A	131.0 A
Mean	51.18	15.96	132.19
CV (%)	0.77	20.07	4.90
LSD (0.05)	0.61	4.65	10.42
Letters in common did not differ significantly according to a t-test at a significance level of 5%.			

Table 2: Fungicide Treatments for Fusarium Head Blight on Malt Barley

Treatment #	Fungicide	Rate
1	Untreated Control	None
2	Caramba	15 fl oz/A
3	Prosaro	6.5 fl oz/A
4	Folicur 3.6F	4 fl oz/A
5	Miravis Ace	11.5 fl oz/A
6	Miravis Ace	13.7 fl oz/A
All treatments contain 0.25% v/v (NIS) Induce.		

Safflower Variety Susceptibility to Spartan Herbicide Injury

Clair Keene

This study was conducted to evaluate safflower varietal differences in susceptibility to Spartan (sulfentrazone, Group 14) herbicide injury. Study conducted at WREC under dryland conditions.

Safflower variety susceptibility to Spartan injury **WREC, Williston, ND 2017**

Safflower variety	Herbicide	Rate	Injury 4WAE†	Injury 6WAE	Weed control 4WAE	Height 10 WAE	Stand 4WAE	Yield	Test weight	Oil content
		(/ac)	(%)	(%)	(%)	(in)	(#/ft^2)	(lb/a)	(lb/bu)	(%)
Cardinal	Spartan	2 oz	2	0	73	15	4	680	44.1	35.0
Cardinal	Spartan	3.5 oz	3	1	76	16	5	661	44.2	35.2
Cardinal	Spartan	5 oz	2	1	73	15	5	702	38.3	35.3
Cardinal	WF‡		0	0	100	16	5	861	44.1	35.4
Hybrid 1601	Spartan	2 oz	1	2	75	15	7	661	39.3	36.5
Hybrid 1601	Spartan	3.5 oz	2	1	71	17	6	657	39.4	36.7
Hybrid 1601	Spartan	5 oz	5	1	81	17	5	778	39.2	36.5
Hybrid 1601	WF		0	0	100	16	7	719	39.5	36.8
Hybrid 9049	Spartan	2 oz	2	2	73	14	8	546	43.7	32.2
Hybrid 9049	Spartan	3.5 oz	3	2	78	15	7	715	43.1	32.2
Hybrid 9049	Spartan	5 oz	7	2	84	15	7	824	43.5	32.2
Hybrid 9049	WF		1	0	100	14	8	870	44.0	32.2
MonDak	Spartan	2 oz	4	4	64	15	6	458	43.4	35.2
MonDak	Spartan	3.5 oz	3	2	79	15	6	535	43.4	34.6
MonDak	Spartan	5 oz	5	3	76	15	6	540	43.4	34.6
MonDak	WF		1	1	100	15	6	585	44.1	34.3
NutraSaff	Spartan	2 oz	2	1	78	15	6	516	38.1	48.4
NutraSaff	Spartan	3.5 oz	2	1	78	15	6	466	38.2	48.3
NutraSaff	Spartan	5 oz	2	1	82	15	6	310	38.7	47.9
NutraSaff	WF		0	0	100	15	6	362	38.6	47.3
		Mean	2.2	1.2	81.9	15.1	6.1	623	41.5	37.3
		CV	108.1	101.3	16	6.2	25.3	36	8	14.9
		LSD 5%	1.2	1.0	4.7	1.0	0.4	269	3.6	0.9

Planted: 5-8-2017 Harvested: 8-31-2017

Herbicides applied: 5-11-2017

Soil pH=6.5; OM=1.7% Soil type: Williams-Bowbells loam

†WAE = weeks after emergence

‡WF = weed free, treated with 32 fl oz/ a Dual II Magnum + hand weeding

Western North Dakota experienced an extreme drought in 2017 with less than 1” of precipitation between planting in early May and mid-July at the site. Lack of moisture inhibited herbicide activation and contributed to much lower levels of injury observed in this study in 2017 as compared to 2016. Injury levels at 4 weeks after emergence (WAE) were generally low but did

show that the 5 oz Spartan rate resulted in more injury than the 3.5 and 2 oz rates across varieties. Hybrid 9049 and MonDak exhibited the greatest early season injury in 2017, compared to Hybrid 1601 and Hybrid 9049 exhibiting the most injury in 2016. By 6 WAE, all herbicide treatments exhibited a similar, low level of injury but varietal differences persisted. MonDak and Hybrid 9049 continued to exhibit more injury than Cardinal, which exhibited the least injury while Hybrid 1601 and NutraSaff were intermediate between Hybrid 9049 and Cardinal. Despite exhibiting the highest levels of injury, Hybrid 9049 stands were higher than any other variety. Cardinal had the lowest stands and the other varieties were intermediate. Interestingly, Hybrid 1601 exhibited a decrease in stand with increasing Spartan rate, despite not consistently showing a corresponding increase in injury symptoms.

Safflower yields were negatively impacted by the drought and were approximately one-third to one-half of those observed in 2016. Safflower yield in 2017 differed by variety but not by herbicide treatment, suggesting that no yield loss was associated with increasing Spartan rate. Despite exhibiting the highest levels of early-season injury, Hybrid 9049 was the highest yielding variety at 739 lb/ac and was similar to Cardinal, the variety that exhibited the least injury, at 726 lb/ac. Weed free yields were not significantly different from the different herbicide treatments suggesting that neither weed competition nor Spartan injury influenced safflower yield in 2017.

Primary weeds in the study plots were Russian thistle and kochia. The 5 oz rate of Spartan exhibited 79% control which was higher than the 2 oz rate with 72% control. The 3.5 oz rate was intermediate between the two at 76% control.

When considering the trade-off between using Spartan for weed control and safflower injury, a grower may want to select a variety based on the need for weed control in a particular field. If you have a weedy field, selecting a variety like Cardinal that exhibits low injury potential should allow you to use a higher rate of Spartan and increase control of problematic broadleaf weeds. Varieties like Hybrid 9049 and Hybrid 1601 are a little more difficult to predict as they exhibited early season injury but grew out of it. Hybrid 9049, despite early season injury in both years, was one of the top two yielding varieties both years. NutraSaff exhibited low injury in both years but also the lowest yields, a trade-off with its high oil content. Results for MonDak are somewhat unclear as it showed some early season injury but no consistent yield or stand response to increasing Spartan rate. Safflower growers should also be aware of their soil pH before using Spartan. These studies were conducted on soil with a pH of 6.5 and the risk of crop injury with Spartan increases in soils with a pH greater than 6.5. If your soils are pH 7.0 or higher, selecting a variety with good Spartan tolerance and using a lower rate of Spartan may be necessary to avoid crop injury.

Evaluating Zidua as a New Herbicide Option for Safflower

Clair Keene

This study was conducted to evaluate Zidua SC (pyroxasulfone, Group 15) for crop safety as a potential new herbicide for use in safflower. Expanding the number of labeled herbicides for use in safflower is important because growers currently lack herbicide options to control broadleaf weeds. Safflower variety Cardinal was used and crop safety data were collected at the WREC dryland site during the summer of 2017.

Zidua timing and rate in safflower **WREC, Williston, ND 2017**

Herbicide treatment	Rate	Application timing	Injury 4WAE†	Injury 6WAE	Height 10WAE	50% bloom delay	Yield	Test weight	Oil
			(%)	(%)	(in)	(days)	(lb/a)	(lb/bu)	(%)
Weed free			0	0	16	0	622	43.6	36.2
Weedy check			1.5	1.8	15	1	506	43.5	35.9
Zidua SC	14.8 fl oz/a	Pre-plant	7.3	2	17	1	566	44.6	36.0
Zidua SC	3.29 fl oz/a	Pre-emerge	2.5	1.3	16	0	510	43.5	35.9
Zidua SC	6.58 fl oz/a	Pre-emerge	2.8	1.5	15	0	569	44	36.0
Zidua SC	9.87 fl oz/a	Pre-emerge	3.3	2.5	16	1	550	44	36.3
Zidua SC	13.16 fl oz/a	Pre-emerge	3.3	1.3	16	2	568	43.9	36.0
Zidua SC + MSO	6.58 fl oz/a + 2.0v/v	Emergence	3.8	1.5	15	0	462	43.4	36.3
Zidua SC + MSO	6.58 fl oz/a + 2.0v/v	Post 2-3 leaf	3.5	2.3	15	0	441	43.8	36.3
Outlook	10 fl oz/a	Pre-emerge	5	1	15	2	467	43.4	35.6
Outlook	20 fl oz/a	Pre-emerge	4.3	2.3	15	2	426	44.0	36.1
		Mean	3.4	1.6	15.6	0.8	517	43.8	36.1
		CV	84.8	75.8	8.3	101.8	28.5	1.5	1.2
		LSD 5%	3.4	1.5	2.0	1.0	201	0.9	0.6

Location: WREC, dryland

Planted: 5-2-2017 Harvested: 8-31-2017

Soil pH=6.5; OM=1.7% Soil type: Williams-Bowbells loam

†WAE = weeks after emergence

Injury at 4 weeks after emergence (WAE) was higher at 7.3% for Zidua SC applied pre-plant at 14.8 fl oz/ ac than the weed free, untreated check. All other herbicide rates and timings exhibited similar, low levels of injury. No significant differences in injury at 6 WAE or height were observed. Both rates of Outlook and Zidua SC at 13.16 fl oz/a applied pre-emergence exhibited a slight delay in 50% bloom. Safflower yield was similar across all treatments suggesting that despite some low incidence of early-season injury, the crop recovered and yields were not affected. This trial suggests that Zidua SC is a potential candidate for labeling as a pre-emergence herbicide in safflower. It should be noted that injury observed at 4 WAE with Zidua SC applied pre-plant indicates that there is some injury potential and that different rates applied pre-plant should be investigated to better gauge the risk posed by this application timing. Higher rates of Zidua SC suppressed kochia and controlled common lambsquarters.

Effects of Sugarbeet Factory Spent Lime on Crop Production in a Crop Rotation of Wheat, Sugarbeet, Barley, Sugarbeet (Sidney Sugars).

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' worth 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 the 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 to low 8, compared to eastern ND and northwestern MN where the soil pH is low 7.

Methods and Experimental Design

The study is being 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 is 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. Soil samples were taken from each plot prior to lime application and each year following harvest. Lime application occurred in the spring 2016 for each plot at the treatment rate. Lime was incorporated using a mulcher prior to planting wheat. Soil analysis includes nitrogen, phosphorus, potassium, sodium, calcium, zinc, manganese, iron, copper, magnesium, sulfur, EC, pH, and organic matter.

Year 1 Results

Wheat was planted May 3, 2016 and after emergence, plant growth was observed to identify any differences between treatments. Plant heights prior to harvest and yields were measured from each plot and data statistically analyzed. Spent lime showed no significant effects on plant growth or yield (Table 1). Significant differences ($P<0.05$) between protein and test weight were observed among treatments but the relationship between treatments did not reflect the addition of spent lime. Soil sampling occurred following harvest and the most notable change was an increase in calcium and pH.

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

Year 2 results

Sugarbeet was planted April 28, 2017. Stand counts were taken after emergence and no differences observed between the treatments. No visual differences in crop growth were observed throughout the growing season. Root samples were taken from ten feet of row in each plot on August 10th, August 30th and September 19th. Stand counts, percent sugar, and yields were measured for each treatment from these samples. Significant differences (P<0.1) between yield and recoverable sugar were observed among treatments in the August 10 and 30th root samples (Table 2 and 3). The September 19th final harvest sample did not show any statistical differences between treatments (Table 4).

Spent lime had no effect on soil nutrients except calcium and pH increased with increased rates of applied lime (see graphs below).

Table 2. Sugarbeet (August 10) — **WREC - Nesson Valley 2017**

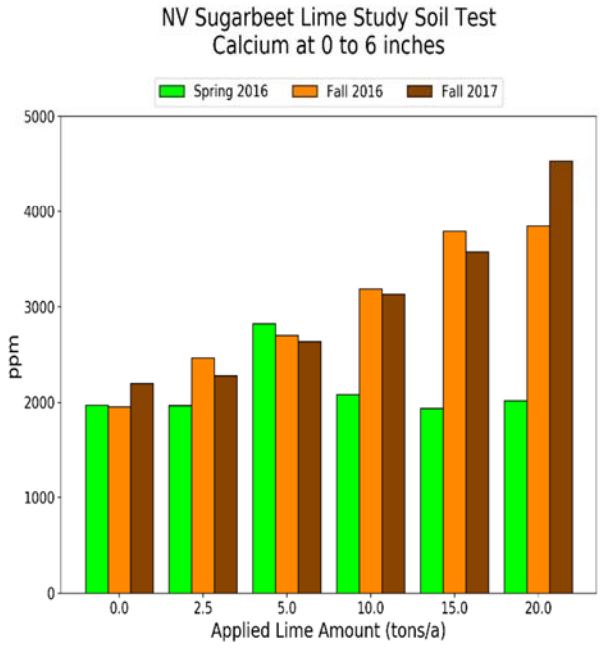
Treatment Spent Lime	Plant Stand	Sugar 2017	Yield 2017	Recoverable Sugar
tons/a	beets/10ft	%	ton/a	lb/a
0	14	13.6	27.4	7486
2.5	13	13.4	29.1	7794
5	14	13.4	28.1	7547
10	12	13.3	32.6	8669
15	14	13.2	31.7	8374
20	13	13.1	30.9	8112
Mean	13.2	13.3	30.0	7997.0
C.V.%	24.4	3.3	8.2	8.6
LSD 10%	n.s.	n.s.	3.0	848.0
Planted: 4/28/2017			Harvested: 9/19/2017	

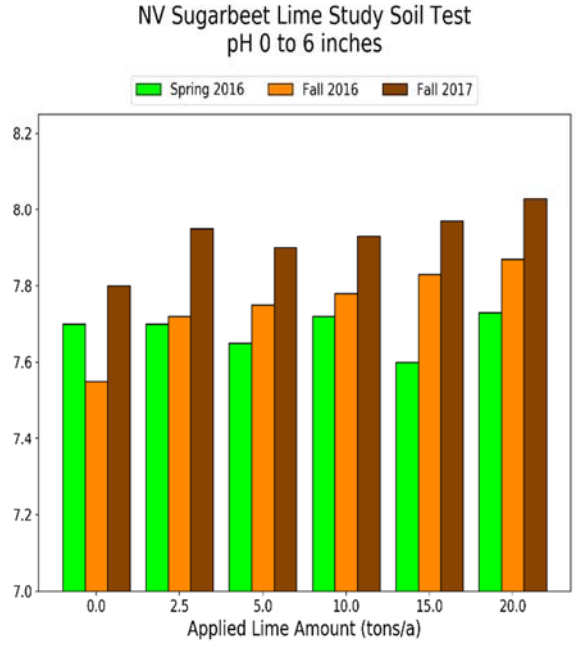
Table 3. Sugarbeet (August 30) — **WREC - Nesson Valley 2017**

Treatment Spent Lime	Plant Stand	Sugar 2017	Yield 2017	Recoverable Sugar
tons/a	beets/10ft	%	ton/a	lb/a
0	12	16.3	32.0	10413
2.5	13	16.1	35.2	11320
5	12	16.2	32.4	10507
10	11	16.1	38.4	12366
15	11	16.6	33.5	11143
20	11	15.8	30.7	9684
Mean	11.8	16.2	33.7	10905.4
C.V.%	27.3	2.3	9.7	9.4
LSD 10%	n.s.	0.46	4.0	1543.6

Table 4. Sugarbeet (September 19) — **WREC - Nesson Valley 2017**

Treatment Spent Lime	Plant Stand	Sugar 2017	Yield 2017	Recoverable Sugar
tons/a	beets/10ft	%	ton/a	lb/a
0	9	17.1	38.4	13111
2.5	9	17.5	37.1	12947
5	10	17.0	42.6	14440
10	11	17.1	40.2	13704
15	11	17.3	39.6	13698
20	10	17.2	37.3	12814
Mean	10.2	17.2	39.2	13452.4
C.V.%	25.0	2.9	14.2	12.9
LSD 10%	n.s.	n.s.	n.s.	n.s.





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

Audrey Kalil, Bart Stevens, Bill Iverson, Dimitri Fonseka, Lyn Soldberg-Rodier, & Jack Wang

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* anastomosis group (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 and root rot disease 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. 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 in the spring. 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.* In 2017, NT plots received seed treatment on both sub-sub plots mistakenly but did no fungicide plots did not receive a foliar fungicide for control of *R. solani* AG 2-2.

- Rotations (main plot)
  - Beet-barley (B-Ba)
  - Beet-corn-soybean-barley (B-C-S-Ba)
- 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 where 0 is no disease and 7 is completely rotted. 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 per year. Isolations were performed from disease beets to confirm *R. solani* AG2-2 as the primary root rotting pathogen.

Results

Treatments			2016		2017		2016 & 2017	
Rotation	Tillage	Fungicide	Crown Rot (%)	Root Rot (0-7)	Crown Rot (%)	Root Rot (0-7)	Crown Rot (%)	Root Rot (0-7)
B-Ba	CT	+	2.0*a*	0.36*a*	6.1*a*	0.20*a*	4.0*a*	0.25*a*
B-Ba	NT	+	*6.0a*	0.46*a*	9.5*ab*	0.32*a*	7.8*ab*	0.39*a*
B-C-S-Ba	CT	+	6.7*a*	0.14*a*	32.8*ab*	0.76*a*	19.8*abc*	0.33*a*
B-C-S-Ba	NT	+	8.8*ab*	0.60*a*	25.5*ab*	0.37*a*	17.2*b*	0.5*a*
B-Ba	CT	-	15.8*ab*	0.15*a*	20.4*ab*	0.52*a*	18.1*ab*	0.45*a*
B-Ba	NT	-	24.0*ab*	0.36*a*	2.6*a*	0.41*a*	13.3*ab*	0.36*a*
B-C-S-Ba	CT	-	41.2*b*	0.48*a*	38.3*b*	0.81*a*	39.8*c*	0.65*a*
B-C-S-Ba	NT	-	38.2*b*	1.35*a*	52.3*b*	0.83*a*	45.3*c*	1.09*a*
		Mean	17.84	0.49	23.4	0.53	20.6	0.51

Table 1. Mean root rot (0-7) and crown rot (% wilted leaves). Data is combined average root rot ratings from 2016 and 2017 (n = 5). Significance is indicated by different letters. Data analyzed using Wilcoxon non-parametric comparison of means ($\alpha<0.05$).

Rotation	Tillage	Fungicide	*R. solani* AG2-2 (g/g soil x 10^{-7})
B-Ba	CT	+	14.87*a*
B-Ba	NT	+	0.83*a*
B-C-S-Ba	CT	+	3.46*a*
B-C-S-Ba	NT	+	11.77*a*
B-Ba	CT	-	6.41*a*
B-Ba	NT	-	23.6*a*
B-C-S-Ba	CT	-	34.99*a*
B-C-S-Ba	NT	-	111.81*a*
		Mean	25.97

Table 2. Results of qPCR analysis on soil samples collected from sugar beet plots after the 2016 harvest. (n = 5). Data is grams of *R. solani* AG2-2 per gram of soil. Significance is indicated by different letters. Data analyzed using Wilcoxon non-parametric comparison of means ($\alpha<0.05$).

Conclusions

A significant effect of rotation was observed on crown rot severity, where the sugar beet-corn-soybean-barley had higher foliar disease levels than the barley-beet rotation in both years and in combined data set (**table 1**). This trend was strongest when fungicides were not applied. Tillage does not appear to have a significant effect on crown rot severity, and neither rotation nor tillage had a significant effect on root rot. Given the crown rot data, however, this may be due to lack of statistical power, as root rot is consistently higher in the four year rotation, no till, and no fungicide treatment. *Rhizoctonia solani* AG 2-2 DNA isolation from the soil and qPCR analysis was successful and data from fall 2016 post-harvest soil samples are shown (**table 2**). We were unable to detect a significant difference among treatments with this sample size but more data (from 2017 and beyond) may allow us to do so. Work will continue next year to confirm current results, and determine how soil populations of *R. solani* AG2-2 change across seasons and are influenced by other crops in these rotations.

Nitrogen Management in Sugarbeet under Different Tillage Practices EARC, Sidney, MT

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

Objectives: To improve the yield and quality of sugarbeet in eastern Montana through nitrogen management under different tillage practices.

Materials and Methods:

Location: EARC irrigated farm
Soil type: Savage Clay Loam
Previous crop: Spring wheat
Variety: Crystal S498 GEM 100
Planted: May 1, 2017
Harvested: September 20, 2017
Herbicide: Glyphosate
Precipitation April – August 2017: 4.1 in
Ave (65 yr) precipitation April – August: 9.67 in
Precipitation September 2016 – August 2017: 7.35 in

The experiment was set up as a randomized complete block design in a two factors factorial arrangement with four replications. The treatments consisted of:

1. Tillage systems including conventional tillage (CT), strip tillage (ST), and no-till (NT).
2. Nitrogen rates including 50, 100, 150, and 200 lb N/acre.

Results: The results showed no significant interactions between tillage and N. Although tillage showed significant effect on sugar concentration, the differences among the tillage treatments were very small (16.8% in CT, 16.3% in ST, and 16.6% in NT) (Table 1). No significant effect of tillage was observed on the other measured variables suggesting that no-till practice can be adapted to reduce the expenses of labor and fuel as well as reducing the impact of soil erosion. Except the number of plants per acre, N has significant effect on measured variables (Table 1). Sugarbeet root yield increased with N rate increasing, but sugar concentration decreased with N rates. With N rate increasing, the impurity of sugar juice also increased, and the percentage of sugar loss to molasses also increased.

Conclusion: In summary, no-till practice showed similar yield and sugar concentration compared to strip-till and conventional tillage suggesting that no-till can provide benefits to the soil and reduce the expenses of farmers. Nitrogen increased the root yield, but reduced sugar concentration of the beets. The impurity of sugar juice and the percentage of sugar loss to molasses also increased with increasing N input. Therefore, N rate needs to be optimized.

Funding Summary: The project was supported by Western SARE.

Table 1: Effect of Tillage and Nitrogen on Sugarbeet Yield and Quality

Treatment		Stand/ac	Sugar %	Impurity Value %	SLM †	Root Yield US ton/ac	Sucrose Yield lb/ac	Extractable Sugar lb/ac
Tillage	CT	32035	16.8a	0.53	0.80	42.8	14344	13656
	ST	30311	16.3b	0.54	0.81	45.2	14687	13947
	NT	32443	16.6a	0.52	0.79	43.8	14542	13852
Nitrogen	N 50	35508	16.9a	0.50b	0.76b	37.8c	12791c	12218b
	N 100	30822	16.9a	0.52b	0.78b	44.0b	14842ab	14163a
	N 150	31152	16.4b	0.54ab	0.81ab	44.0b	14398b	13683ab
	N 200	29370	16.1b	0.57a	0.85a	49.6a	16007a	15163a
Tillage (T)		ns	*	ns	ns	ns	ns	ns
Nitrogen (N)		ns	*	*	*	*	*	*
T x N		ns	ns	ns	ns	ns	ns	ns
CV %		14.78	2.64	8.30	8.30	12.18	12.45	12.57

† SLM: Sugar loss to molasses
* Significant at $P \leq 0.05$; ns: non-significant

Treatment Evaluation Control of *Rhizoctonia* Root Rot of Sugarbeet EARC-Sidney, MT

Frankie Crutcher, Jessica Rupp, Myron Bruce and Amber Ferda

Variety: Betaseed 39RR8N
Planted: 05/09/2017, Harvested: 10/12/2017
Plot Size:180 ft², Seed Rate: 43,560 beets/A
Soil Type: Clay Loam, Prev. Crop: Sugarbeet
Residual Soil N to 3 ft: 3.7 lb/A
Residual Soil P to 6 in: ~20 ppm
Applied Fertilizer: 46-0-0, 11-52-0
Irrigated (flood) on 05/18/2017, 05/19/2017, 06/29/2017, 07/17/2017, 07/26/2017
Chemical Applications: Durango, Powerhouse
Precipitation April – September, 2017: 5.98 inches
Observation dates: 05/31/2017, 06/16/2017, 06/29/2017, 07/14/2017, 07/31/2017
Date of application: 06/16/2017

Comments: Inoculation with *Rhizoctonia solani* AG2-2 infested barley seed occurred at planting. Foliar applications applied at 13 GPA. Collected plants and plated samples 07/03/2017. Rainfall from planting to harvest: 6.56 in.

Results: Overall, seed treatments lowered disease index, increased yield, increased percent beets that can be stored, and decreased pre-emergence damping off. No seed treatments had any effect on post-emergence damping off, most likely due to the fact that seed treatments only last 35-45 days. None of the foliar diseases had any statistically significant effect on traits examined. A very high disease incidence, overall 42.9% in untreated plots inoculated with *Rhizoctonia*, may have been too much disease pressure to be overcome by one foliar fungicide application. The presence of such high levels of the pathogen likely occurred for two reasons: the study was located in a field that had sugarbeet in 2016 and another *Rhizoctonia* study was performed in the field in 2014.

Table 1: Seed Treatment and Foliar Application Evaluations for *Rhizoctonia* on Sugarbeet

Foliar Fungicide	Seed Treatment	Disease Index (0-100)[a]	% Ruppel class 0-3	Yield (tons/acre)	% Pre-emergence damping off	% Post-emergence damping off
Untreated Control (none)	None (w/o *Rhizoc)*	57.2 A	41.4 A	29.8 A	19.7 B	28.0 A
	None (w/ *Rhizoc*)	75.4 A	22.2 A	25.1 A	40.7 A	23.8 A
	Kabina 14	59.3 A	38.9 A	29.5 A	25.8 AB	18.7 A
	Vibrance	69.7 A	27.6 A	30.1 A	24.2 AB	22.8 A
	Stamina + Systiva 2.5	59.9 A	36.7 A	32.9 A	26.7 AB	14.6 A
	Stamina + Systiva 5.0	54.9 A	34.2 A	30.0 A	29.4 AB	18.5 A
	Metlock + Rizolex	71.4 A	26.4 A	25.4 A	29.4 AB	31.0 A
Priaxor (0.37 fl oz/1000 ft row)	None (w/o *Rhizoc)*	42.8 B	56.1 A	35.4 A	25.6 A	6.2 B
	None (w/ *Rhizoc*)	64.5 A	33.1 B	27.2 A	33.6 A	19.0 AB
	Kabina 14	64.4 A	34.2 B	27.7 A	40.0 A	23.0 AB
	Vibrance	60.9 A	36.0 B	29.4 A	22.3 A	25.3 AB
	Stamina + Systiva 2.5	70.3 A	28.1 B	26.5 A	38.6 A	15.1 AB
	Stamina + Systiva 5.0	63.0 A	34.2 B	28.8 A	32.8 A	13.2 AB
	Metlock + Rizolex	70.0 A	26.9 B	29.6 A	27.0 A	29.4 A
Quadris (0.38 fl oz/1000 ft row)	None (w/o *Rhizoc)*	33.3 C	64.7 A	36.5 A	11.0 C	12.9 A
	None (w/ *Rhizoc*)	72.7 A	25.8 B	26.2 B	36.4 AB	30.6 A
	Kabina 14	54.6 B	42.5 B	33.8 AB	19.6 ABC	26.8 A
	Vibrance	56.4 AB	40.8 B	31.9 AB	19.2 BC	17.7 A
	Stamina + Systiva 2.5	64.8 AB	33.1 B	31.1 AB	23.3 ABC	15.4 A
	Stamina + Systiva 5.0	63.9 AB	34.2 B	30.9 AB	27.5 ABC	14.3 A
	Metlock + Rizolex	73.2 A	26.1 B	24.4 B	40.3 A	29.4 A
Elatus (0.547 fl oz/1000 ft row)	None (w/o *Rhizoc)*	36.7 B	66.4 A	35.3 A	14.7 B	4.8 B
	None (w/ *Rhizoc*)	73.8 A	24.4 B	25.0 B	36.0 A	24.9 AB
	Kabina 14	63.3 A	34.4 B	27.9 AB	21.9 AB	18.8 AB
	Vibrance	68.8 A	28.6 B	25.2 B	23.3 AB	16.4 AB
	Stamina + Systiva 2.5	66.9 A	30.1 B	31.8 AB	32.3 A	16.1 AB
	Stamina + Systiva 5.0	67.3 A	30.1 B	28.9 AB	34.2 A	13.3 AB
	Metlock + Rizolex	67.3 A	30.8 B	28.9 AB	30.7 AB	29.32 A

Letters in common within treatment grouping and column did not differ significantly according to a t-test at a significance level of 5%.
[a]Calculated based on Ruppel Scale (0-7), where 0% is no disease and 100% is completely rotten roots.

Table 2: Effect of Seed Treatments on *Rhizoctonia* Root Rot

Seed Treatment	Disease Index	% Ruppel 0-3	Yield (ton/A)	Pre-emergence damping off (%)	Post-emergence damping off (%)
None	42.49 C	57.15 A	34.24 A	17.95 D	12.28 A
None + *Rhizoc*	71.59 A	26.39 C	25.89 C	36.52 A	25.60 A
Kabina 14	60.37 B	37.5 B	29.71 ABC	26.30 BCD	21.49 A
Vibrance	63.94 AB	33.26 BC	29.15 BC	22.20 CD	20.54 A
Stamina + Systiva 2.5	65.49 AB	32.15 BC	30.57 AB	30.45 ABC	15.26 A
Stamina + Systiva 5.0	62.27 AB	33.16 BC	29.66 ABC	30.97 ABC	14.82 A
Metlock + Rizolex	70.47 A	27.57 C	27.08 BC	32.12 AB	-3.33 A

Letters in common within treatment grouping and column did not differ significantly according to a t-test at a significance level of 5%.
[a]Calculated based on Ruppel Scale (0-7), where 0% is no disease and 100% is completely rotten roots.

Soybean Biotechnology Varieties and their Response to Selenium under No-Till Dryland Condition

Gautam Prasad Pradhan, Jerald W. Bergman, James A. Staricka, Emma Link, Austin Link, Kyle Dragseth, and David Weltikol

Importance of the research project

- Soybean acreage has been steadily increasing in the western North Dakota, which has exceptionally drier climate than the eastern part. It receives about 15" of precipitation annually as compared to 21" in the east (Fig. 1), and average annual evapotranspiration is 5 inches higher than the east.
- In 2016, 95% of 5.9 million acres of ND soybean was planted with herbicide resistant biotechnology varieties (RR1, RR2Y, and/or RR2X).
- The patents of RR1 expired in 2015, so farmers may now save harvested RR1 seed and dramatically reduce seed input cost by more than $45 per acre (Fig. 2). It is to be noted that, as per Plant Variety Protection Act, one should acquire license from a breeder before saving and replanting any RR1 variety. The NDSU RR1 variety is available to replant with minimum regulatory hassles.
- Drought is the main soybean yield limiting factor in western ND.
- Selenium (Se), an essential antioxidant for human, has been recently recognized for delaying senescence of soybean plants and for alleviating drought stress in wheat, corn, and barley.

Objectives

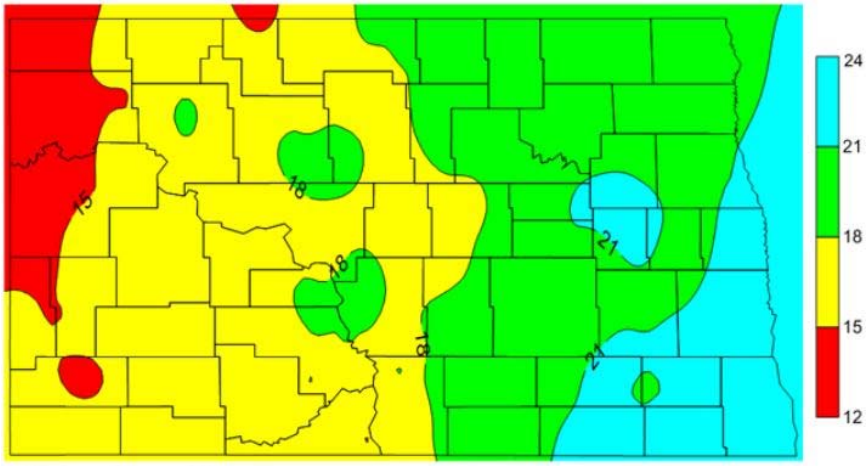
- To determine the most profitable soybean biotechnology varieties for western ND.
- To find out the effect of foliar application of selenium on physiology (NDVI), growth (plant height, biomass), yield, and quality of soybean biotechnology varieties.

Materials and methods

- A RR1, RR2Y, and RR2X soybean variety with a maturity group of 0.09 was planted at WREC on May 18, 2017.
- Selenium as sodium selenite at 100 ppm and deionized water as control were sprayed in the afternoon of August 10, 2017.
- Canopy temperature and normalized difference vegetation index (NDVI) were measured weekly with a FLIR® E60 Thermal Imaging camera and a modified NDVI Sony camera using a forklift.

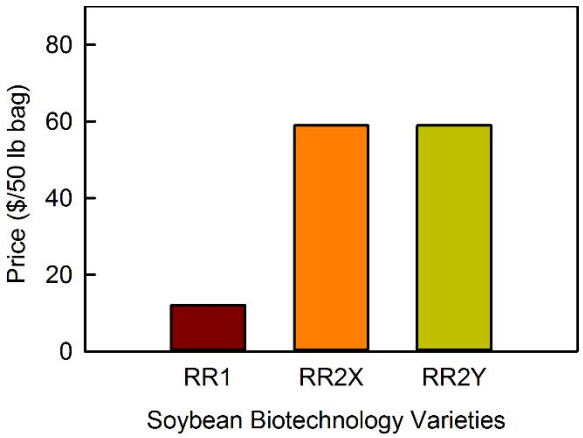
Figure 1. North Dakota Annual 1981-2010 Precipitation (inches).

(Data from NWS Cooperative Network)



NDSCO: https://www.ndsu.edu/ndsco/data/30yearaverage/precipitation/#c343112

Figure 2 Recent price of soybean biotechnology varieties.



Note: Price of RR2X and RR2Y was obtained from the Horizon resources, Fairview, MT

- Biomass was collected from ~9 sq. ft. area on September 21st, 2017 and data on plant height, above ground biomass, yield, and yield components were recorded and analyzed.

Results and summary

- Preliminary results showed that there was no effect of selenium on soybean yield and yield component. Selenium may need to be applied early in the morning when the ambient condition is not too hot and dry.
- There was no difference among the biotechnology varieties for growth and yield. Averaged across biotechnology varieties treated with deionized water and harvested from 9 sq. ft., the above ground biomass yield was 2945 lb/a, pod number was 16 per plant, grain number was 39 per plant, and grain yield was 28.9 bu/a.
- This study showed that RR1 varieties performed similarly to other biotechnology varieties, and planting of RR1 varieties may be economically beneficial to the no-till dryland soybean producers of western ND.
- We will repeat the experiment in 2018 to validate the findings.

Acknowledgements

We acknowledge the financial support of the North Dakota Soybean Council.

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

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Importance of the research project

- North Dakota is the fourth largest soybean grower in the nation. Recently, the state has a tremendous increase in soybean acreage (269% more in 2017 from about 1.87 million acres in 2000), which is due to increases in acreage in all parts of the state including the western region (Fig.1 and 2).
- 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.
- Plant population and row spacing are two important agronomic parameters that affect resource (radiation, water, nutrient) use efficiency, growth, and yield of every field crop including soybean.

Objectives

To determine an optimal row spacing and plant population of soybean for no-till dryland condition of Western ND that ensure sustainable higher yield and farm income.

Materials and methods

- A RR2Y soybean variety (LS03R22) with a maturity group of 0.3 was planted at WREC on June 2, 2017.
- Row spacings of 7½, 15, 22½, and 30 inches were maintained as main plots and plant populations of 90, 120, 140, and 180 thousand per acre were considered as sub-plots.
- Canopy temperature and normalized difference vegetation index (NDVI) were measured weekly with a FLIR® E60 Thermal Imaging camera and a modified NDVI Sony camera using a forklift.
- Soil moisture was recorded from each plot using a neutron moisture meter.
- Biomass was collected from ~15 sq. ft. area on October 10, 2017 and data on above ground biomass, yield and

Figure 1. ND county level soybean acreage in 2000.

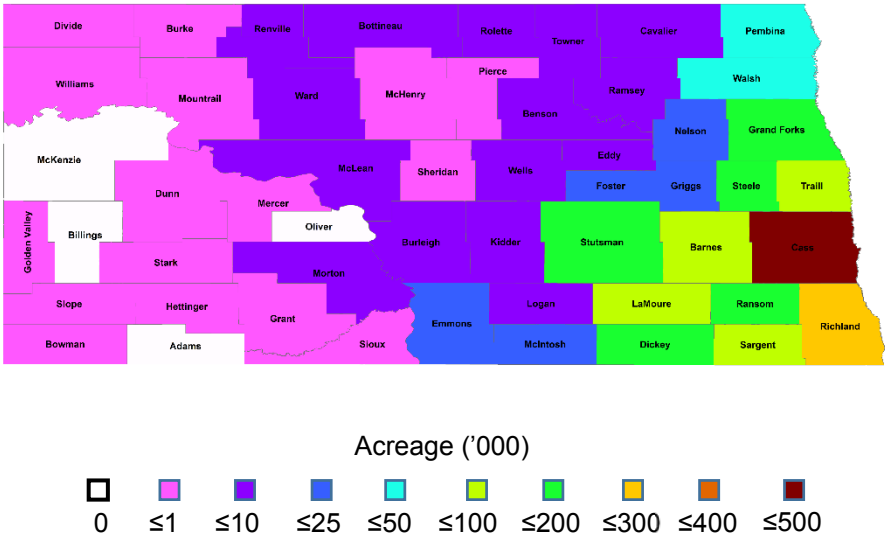
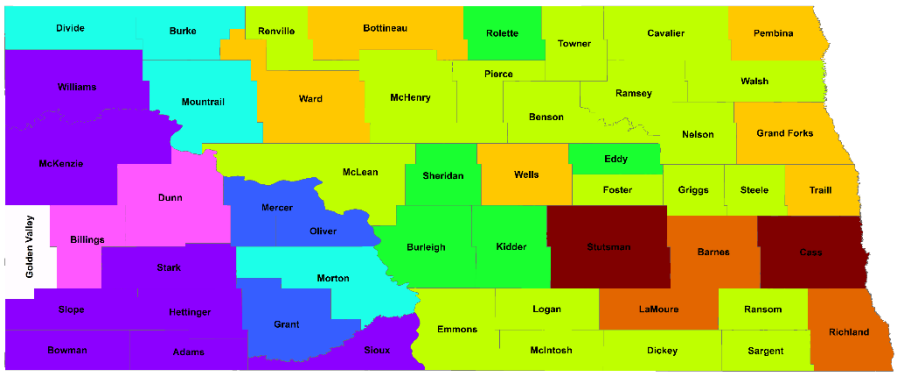


Figure 2. ND county level soybean acreage in 2017.



https://www.fsa.usda.gov/news-room/efoia/electronic-reading-room/frequently-requested-information/crop-acreage-data/index

yield components were recorded and analyzed.

Results

- Preliminary results showed that the 30” row spacing produced about 1-1½” taller plants than narrow row spacings (Fig. 3A), and the 7½” row spacing produced about 485 to 540 lb more biomass per acre than wider row spacings (Fig. 3B).
- There was no effect of row spacing on pod number and the average pod number produced per plant was 27 (Fig. 4A). The effect of row spacing was evident on grain yield, the row spacing of 7½” produced about 3-4 bushels more grain per acre than wider row spacings (Fig. 4B).
- The plant population of 90 thousand per acre produced about 5-10 more number of pods per plant than higher plant population (Fig. 5A); however, effect of plant population was not evident on grain yield and the average grain yield produced was about 31 bushels per acre (Fig. 5B).

Figure 3. Plant height and above ground biomass under different row spacings.

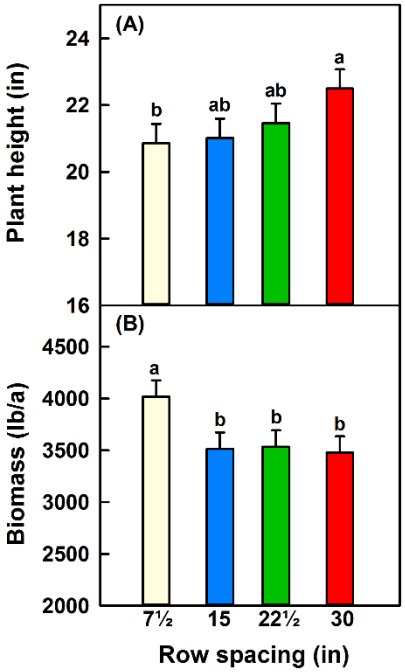


Figure 4. Pod number and grain yield under different row spacings.

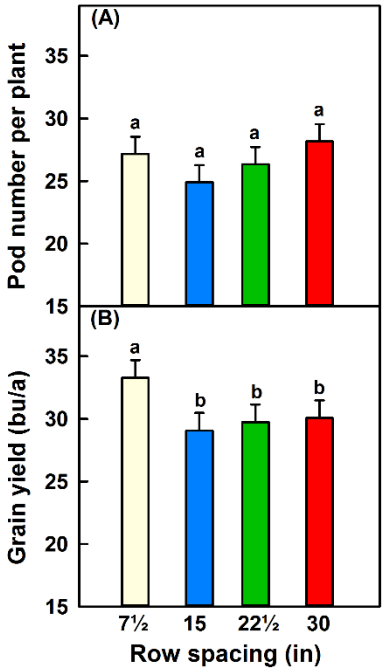
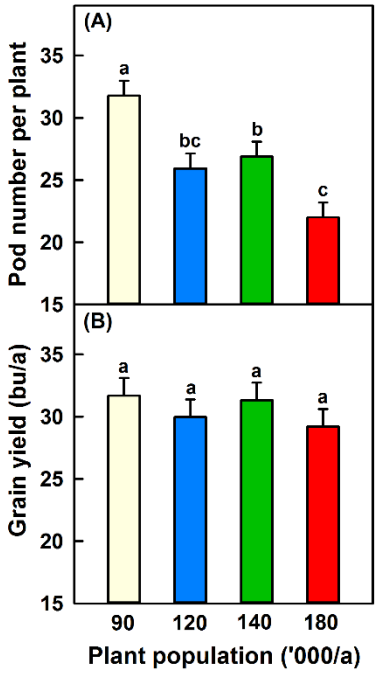


Figure 5. Pod number and grain yield under different plant population.



Summary

The growth and yield results mentioned above showed that a row spacing of 7½ inches and plant population of 90 thousand per acre is more suitable than other planting geometries for no-till dryland soybean production in western ND. We had similar findings in 2016.

Acknowledgements

We acknowledge the financial support of the North Dakota Soybean Council.

Micro-Nutrient Fertilization of Dry Pea — EARC, Sidney, MT

Yesuf Assen Mohammed, Chengci Chen, Thomas Gross

Materials and Methods:

Richland:

Planted: April 26, 2017
Harvested: Aug. 8, 2017
Soil type: Farnuf Reeder Loam
Previous crop: Durum wheat
Applied fertilizer: None
No irrigation

Plot width: 6'
Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Valor, Sharpen, Roundup and Assure II
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
Precipitation April to August: 4.75"

Sidney Dryland:

Planted: April 14, 2017
Harvested: July 21, 2017
Soil type: William Clay Loam
Previous crop: Wheat
Residual Soil N to 3 ft: 57.5 lb/ac
Residual Soil P2O5 to 6 inch: 34 lb/ac
Applied fertilizer: None
No irrigation

Plot width: 6'
Seed treated with Apron Maxx and Cruiser Maxx
Herbicide: Tank mix of Prowl H2O, Roundup and Outlook before planting
The grain yield was adjusted to 13% grain moisture content before statistical analysis.
Precipitation April to August: 3.92"

The objective of this experiment was to determine the effects of boron (B), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo) and Zinc (Zn) application rates on the yield and quality of dry pea. The trial was planted at Sidney Dryland and Richland sites.

Comments: Sidney dryland was too dry to get response. Laboratory results to show the effect of micronutrient application on grain yield quality was not ready for this report.

Results: The mean soil pH, OM and N were 6.9, 3.45% and 0.205% for Richland and 7.1, 2.45% and 0.151% for Sidney dryland, respectively. The soil test result showed that soil B, Mo and in most cases Zn were below the critical values (both in 2016 and 2017) at both sites showing deficiency based on soil test results.

Soil Micro-Nutrient Status (0-6 inch depth) at Sidney Dryland and Richland at Planting Time in 2016 and 2017 — **Sidney and Richland, MT**

Sites	Soil micronutrient content (mg kg^{-1} soil)											
	B		Cu		Fe		Mn		Mo		Zn	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Richland	0.4	0.6	0.4	1.5	22	28	22	10	<1	<1	0.5	0.7
Sidney Dryland	0.6	0.4	0.6	1.1	7	32	6	13	<1	<1	0.4	0.5
Critical Values	1		0.5		5		1		2		0.5	

A grain yield increase from 4 to 89% was recorded at Richland site due to micronutrient fertilization but the response to micronutrient application at Sidney dryland site was not clear mainly due to extreme low soil moisture stress. Even if soil test results showed above critical values, in some cases response to micronutrient application was recorded indicating to revisit the current soil test based fertilization guide.

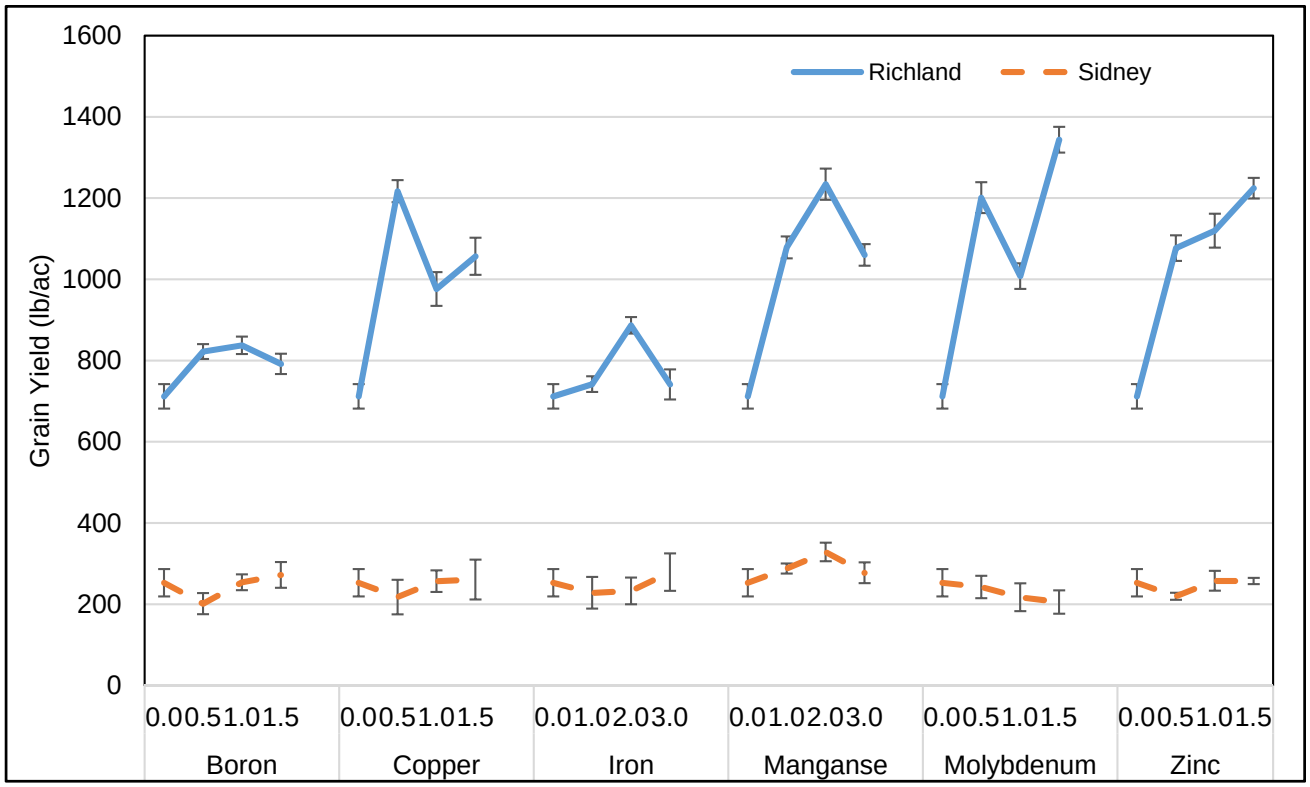


Figure 1: The effect of foliar application rates (lb/ac) of micronutrients on grain yield (lb/ac) of dry pea at Richland and Sidney dryland, MT in 2017. Error bars are standard error of the mean (n=4).

Irrigated Field Pea Fungicide Trial — EARC, Sidney MT

Frankie Crutcher and Amber Ferda

Objective: Test the efficacy of different fungicide combinations for control of *Ascochyta rabiei* on field pea under irrigation.

Materials and Methods:

Variety: Aragon
Planted: 04/21/2017
Harvested: 07/26/2017
Plot Size: 5 X 20=100 ft²
Seeding Rate: 8 LS ft²
Soil Type: Clay Loam
Previous Crops: Sugarbeet
Residual Soil N to 3 ft: 14.9 lb/A
Residual Soil P to 6 in: ~20 ppm
Applied Fertilizer: 46-0-0

Irrigated (sprinkler) on 04/09/2017, 04/11/2017, 05/26/2017, 06/01/2017, 06/09/2017, 06/20/2017
Chemical Applications: Prowl, Roundup, Outlook, Powerhouse
Precipitation April – September, 2017: 5.98 inches
Observation dates: Germination: 05/17/2017, Disease Assessments: 06/27/2017, 07/04/2017, 07/11/2017
Treatments: Aprovia Top, Proline, Propulse, Priaxor, Delaro, Miravis Top, Bravo Weather Stik
Date of first application: 06/20/2017
Date of second application: 07/06/2017

Comments: Seed treated with Apron Maxx RTA and Cruiser 5FS. Spray #3 not applied due to early maturity of pea plants. Root rot present, but no foliar disease found at flowering on 06/19/2017. Rainfall from planting to harvest: 2.04 inches.

Results: Excessive drought negatively impacted ascospore dispersal and disease progression even with irrigation during the 2017 growing season. Thus, there were no differences noted for yield or disease incidence. There were statistically significant differences in disease severity at time 3 between treatments, but the very low severity levels (2.5-10%), make it unlikely that these differences are biologically significant. No phytotoxicity was observed.

Table 1: Fungicide Evaluation Control of *Ascochyta* on Pea

Treatment #	Incidence (%)[a]	Severity (%)[b]	Yield (lb/A)
1	10.83 A	3.75 BC	3661.2 A
2	5.83 A	2.5 C	3162.6 A
3	16.67 A	7.5 AB	3620.5 A
4	8.33 A	5.0 BC	3706.3 A
5	10.83 A	7.5 AB	3574.8 A
6	10.0 A	5.0 BC	3543.3 A
7	9.17 A	3.75 BC	3435.3 A
8	15.83 A	10.0 A	3406.2 A
Mean	10.94	5.63	3513.77
CV (%)	71.47	66.79	14.84
LSD (0.05)	11.61	4.83	819.47

Letters in common did not differ significantly according to a t-test at a significance level of 5%.
[a]Pest Incidence (Time 3): Percent of 30 plants with *A. rabiei*.
[b]Pest Severity (Time 3): Average percent area of 30 plants covered by disease.

Table 2: Fungicide Treatments for *Ascochyta* on Pea

Trt #	Fungicide	Application Timing	Rate
1	Untreated Control	None	None
2	Aprovia Top	A, B	11 fl oz/A
3	Proline	A, B	5.7 fl oz/A
4	**A**-Aprovia Top **B**-Miravis Top **C**-Bravo Weather Stik	A, B, C	**A**-11 fl oz/A, **B**-13.7 fl oz/A, **C**-1.5 pt/A
5	**A**-Propulse, **B**-Delaro, **C**-Bravo Weather Stik	A, B, C	**A**-10.3 fl oz/A **B**-12 fl oz/A **C**-1.5 pt/A
6	Priaxor	A	4 fl oz/A
7	Propulse	A	8.6 fl oz/A
8	Delaro	A	12 fl oz/A

All treatments contain (NIS) Induce 0.25% v/v except Bravo Weather Stik.

Control of Seed-borne *Ascochyta* of Pea — EARC, Sidney, MT

Frankie Crutcher and Amber Ferda

Objective: Test the efficacy of different seed treatments for control of seed-borne Ascochyta blight on field pea under irrigated conditions.

Materials and Methods:

Irrigated:

Variety: Meadows (yellow)
Planted: 4/21/17
Harvested: 07/26/2017
Plot Size: 5 X 20=100 ft²
Seeding Rate: 8 LS ft²
Soil Type: Clay Loam
Previous Crops: Sugarbeets
Residual Soil N to 3 ft: 14.9 lb/A
Residual Soil P to 6 in: ~20 ppm

Applied Fertilizer: 46-0-0
Irrigated (sprinkler) on 04/09/2017, 04/11/2017, 05/26/2017, 06/01/2017, 06/09/2017, 06/20/2017
Chemical Applications: Prowl, Roundup, Outlook, Powerhouse
Precipitation April – September, 2017: 5.98 inches
Observation dates: 05/17/2017, 05/31/2017, 06/13/2017
Treatments: Apron Maxx RTA, Vibrance Maxx, Vibrance Maxx + Mertect, Obvius, Evergold Energy

Comments: Seeds had an initial *Ascochyta* infestation of 11.5%. Average plant height was 28.6 inches. 06/19/2017 started flowering. 06/26/2017 flags removed. Stands tall and thick, pods forming. Rainfall from planting to harvest: 2.04 inches.

Results: Excessive drought negatively impacted ascospore dispersal and disease progression even with irrigation during the 2017 growing season. Thus, there was no significant differences in treatment, pest incidence, including stem lesions, root rots, or yield. No data trends were noted. No phytotoxicity was observed.

Table 1: Seed Treatment Evaluation Control of *Ascochyta* on Pea

Treatment #	Stem Lesion (%)	Root Rot (%)	% Pest Incidence[a]	Yield (lb/A)
1	40.0 A	40.0 A	6.34 A	2790.9 A
2	60.0 A	30.0 A	-1.71 A	2912.6 A
3	57.5 A	22.5 A	20.54 A	3029.1 A
4	40.0 A	17.5 A	18.79 A	3164.9 A
5	52.5 A	20.0 A	12.06 A	3084.5 A
6	42.5 A	25.0 A	3.27 A	3028.3 A
Mean	4.875	25.83	9.88	3001.72
CV (%)	37.92	60.31	206.29	12.9
LSD (0.05)	27.6	22.83	31.33	616.62

Letters in common did not differ significantly according to a t-test at a significance level of 5%.
[a]% Post-emergence seedling infection.

Table 2: Seed Treatments for *Ascochyta* on Pea

Treatment #	Seed Treatment	Rate
1	Untreated Control	None
2	Apron Maxx RTA	5 fl oz/cwt
3	Vibrance Maxx	1.54 fl oz/cwt
4	Vibrance Maxx + Mertect	1.54 fl oz/cwt + 1.02 fl oz/cwt
5	Obvius	4.6 fl oz/cwt
6	Evergold Energy + Gaucho 600 FS	1 fl oz/cwt + 1.6 fl oz/cwt

Chemical and Chemical Free Chickpea Production — EARC, Sidney, MT

Yesuf Assen Mohammed, Chengci Chen, Thomas Gross

Materials and Methods - Dryland:

Planted: May 2, 2017
Harvested: Aug. 23, 2017
Soil type: William Clay Loam
Previous crop: Wheat and Fallow
Plot width: 6'
Seed treated with Apron Maxx and Cruiser Maxx for chemical side only.

Applied fertilizer: None
Herbicide: Tank mix of Prowl H2O, Roundup and Outlook before planting for chemical side only.
Precipitation April to August: 3.92"
The grain yield was adjusted to 13% grain moisture content before statistical analysis.

This trial was planted under chemical free and with chemical to control weed for organic chickpea production. The trial was planted after fallow and after wheat. The chemical free side had three factors, variety (Black and CDC Orion), weed control methods (flaming and shallow tillage just one week after planting but before chickpea germinate, and control) and two seed rates (100% recommended rate (1X) and 50% more than 100% recommendation (1.5X). The chemical side had only three varieties (Myles, Black and CDC Orion) as treatments. Only the chemical side was sprayed with herbicides and seeds were treated with fungicide and insecticide as well. This trial was planted at Sidney Dryland site after wheat and after fallow.

Comments: There were few weeds at the time of shallow tillage and flaming under chemical free treatment. Therefore, the effect of flaming and cultivating on weed control was minimal.

Results: When chickpea was seeded either after fallow or after wheat and under chemical free management (organic production), the effect of varieties on grain yield was significant with higher grain yield from the black cultivar compared with CDC Orion but other factors and their interactions had no effect on mean grain yield. Similarly, under chemical management, grain yield difference among cultivars was significant with higher grain yield recorded from Myles than the other two cultivars both after fallow and as well as after wheat.

The Effect of Different Weed Management for Organic Chickpea Production after Fallow

Factors	Chickpea Seedling count/m2	Chickpea Biomass Fresh wt (gm/m2)	Weed Biomass Fresh wt (gm/m2)	Chickpea Biomass Dry wt (gm/m2)	Weed Biomass Dry wt (gm/m2)	Grain Yield (lb/ac)
Variety (V)						
Black	42	351.3	111.1	107.2	33.5	418
CDC Orion	9	148.9	345.7	42.1	96.3	41
P-Values	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Seed rate (S)						
1X	22	228.5	248.2	68.2	70.8	204
1.5X	29	271.7	208.5	81.1	59.0	255
P-Values	0.0007	0.1962	0.2538	0.1804	0.2372	0.2346
Weed control (W)						
Control	23	223.0	311.2	67.2	90.6	252
Flame	27	270.6	201.5	81.7	56.6	224
Shallow cultivator	27	256.6	172.4	75.0	47.5	211
P-Values	0.2305	0.4817	0.0055	0.4578	0.0026	0.7228
Interaction P-Values						
V*S	0.0396	0.8148	0.9741	0.8100	0.9541	0.3687
V*W	0.7267	0.8304	0.0347	0.8648	0.0201	0.5269
S*W	0.1924	0.7112	0.3357	0.6985	0.3294	0.4805
V*S*W	0.0571	0.2341	0.4980	0.2572	0.4816	0.4366
Mean	26	250	228	74.6	64.9	229
C.V. (%)	25.96	45.32	51.83	43.57	52.21	63.55

The Effect of Different Weed Management for Organic Chickpea Production after Wheat

Factors	Chickpea Seedling count/m2	Chickpea Biomass Fresh wt (gm/m2)	Weed Biomass Fresh wt (gm/m2)	Chickpea Biomass Dry wt (gm/m2)	Weed Biomass Dry wt (gm/m2)	Grain Yield (lb/ac)
Variety (V)						
Black	39	240.8	53.9	79.4	15.0	259
CDC Orion	20	193.1	103.7	61.6	30.7	50
P-Values	<0.0001	0.0108	0.0049	0.0029	0.0010	<0.0001
Seed rate (S)						
1X	26	206.0	86.1	67.3	24.4	146
1.5X	33	227.9	71.5	73.6	21.3	163
P-Values	0.0003	0.2218	0.3837	0.2639	0.4753	0.1720
Weed control (W)						
Control	31	226.9	100.8	73.7	30.2	149
Flame	27	218.6	52.5	70.6	16.4	157
Shallow cultivator	30	205.4	83.1	67.1	22.0	157
P-Values	0.2108	0.6074	0.0680	0.6317	0.0460	0.8357
Interaction P-Values						
V*S	0.2342	0.4039	0.0809	0.5802	0.0597	0.4807
V*W	0.9785	0.1898	0.3972	0.1294	0.3751	0.4553
S*W	0.0422	0.1405	0.4876	0.1742	0.4305	0.4117
V*S*W	0.1264	0.2778	0.6129	0.1626	0.5350	0.4201
Mean	29	217	78.8	70	22.8	154
C.V. (%)	20.15	28.17	72.62	27.27	66.02	27.92

The Effect of Chickpea Cultivars on Weed Control and Yield under Chemical Management and after Fallow

Factors	Chickpea Seedling count/m2	Chickpea Biomass Fresh wt (gm/m2)	Weed Biomass Fresh wt (gm/m2)	Chickpea Biomass Dry wt (gm/m2)	Weed Biomass Dry wt (gm/m2)	Grain Yield (lb/ac)
Variety (V)						
Black	45	621.3	2.2	175.8	0.6	427
CDC Orion	28	646.6	3.6	207.5	0.7	182
Myles	31	618.9	0.0	206.6	0.0	548
P-Values	0.3231	0.9806	0.6396	0.3312	0.6624	0.0050
Mean	35	629	1.92	196.6	0.433	385
C.V. (%)	43.72	34.73	269.88	15.89	265.83	25.36

The Effect of Chickpea Cultivars on Weed Control & Yield under Chemical Management & After Wheat

Factors	Chickpea Seedling count/m2	Chickpea Biomass Fresh wt (gm/m2)	Weed Biomass Fresh wt (gm/m2)	Chickpea Biomass Dry wt (gm/m2)	Weed Biomass Dry wt (gm/m2)	Grain Yield (lb/ac)
Variety (V)						
Black	43	296.5	5.8	86.4	1.6	162.0
CDC Orion	44	363.3	2.1	76.9	0.8	89.8
Myles	48	346.8	5.4	97.0	4.0	256.0
P-Values	0.6989	0.4815	0.6905	0.6087	0.5148	0.0003
Mean	45	335.5	4.43	86.8	2.13	169
C.V. (%)	19.46	22.81	145.89	31.62	180.46	15.04

Irrigated Chickpea Fungicide Trial — EARC, Sidney MT

Frankie Crutcher and Amber Ferda

Objective: Test the efficacy of different fungicide combinations for control of *Ascochyta rabiei* on chickpea under irrigation.

Materials and methods:

Variety: Sierra
Planted: 04/21/2017
Harvested: 08/23/2017
Plot Size:5 X 20=100 ft²
Seeding Rate:4 LS ft²
Soil Type: Clay Loam
Previous Crop: Sugarbeet
Residual Soil N to 3 ft: 14.9 lb/A
Residual Soil P to 6 in: ~20 ppm

Applied Fertilizer: 46-0-0
Irrigated (sprinkler) on 04/09/2017, 04/11/2017, 05/26/2017, 06/01/2017, 06/09/2017, 06/20/2017
Chemical Applications: Prowl, Roundup, Outlook, Powerhouse
Precipitation April – September, 2017: 5.98 inches
Stand Counts: 05/17/2017
Disease assessments: 06/27/2017, 07/05/2017, 07/11/2017, 07/19/2017, 07/25/2017
Date of applications: 06/28/2017; 07/12/2017; 07/25/2017

Comments: Seed treated with Apron Maxx RTA and Cruiser 5FS. Average plant height: 16 inches. Rainfall from planting to harvest: 3.83 inches.

Results: Excessive drought negatively impacted ascospore dispersal and disease progression even with irrigation during the 2017 growing season. For this study, no differences in yield or disease incidence were observed. There were statistically significant differences in disease severity between treatments, but the very low severity levels (3.75-11.25%), make it unlikely that these differences are biologically significant. No phytotoxicity was observed.

Table 1: Effect of Fungicide Treatments on *Ascochyta* for Irrigated Chickpeas

Treatment #	Incidence (%)[a]	Severity (%)[b]	Adjusted Yield (lb/A) (13%)
1	9.17 A	6.25 AB	2465.4 A
2	15.83 A	11.25 A	2468.9 A
3	8.33 A	3.75 B	2533.0 A
4	10.00 A	6.25 AB	2549.2 A
5	6.67 A	3.75 B	2583.2 A
6	14.17 A	7.50 AB	2551.8 A
7	9.17 A	5.00 AB	2554.3 A
8	8.33 A	3.75 B	2490.6 A
9	14.17 A	7.50 AB	2456.8 A
10	10.83 A	6.25 AB	2366.3 A
11	12.50 A	6.25 AB	2417.6 A
Mean	10.83	6.14	2494.27
CV (%)	66.40	72.16	6.77
LSD (0.05)	10.86	6.38	256.17

Letters in common did not differ significantly according to a t-test at a significance level of 5%.
[a]Pest Incidence: Percent of 30 plants with *A. rabiei*
[b]Pest Severity: Average percent area of 30 plants covered by disease

Table 2: Fungicide Treatments for Irrigated Chickpeas

Trt #	Fungicide	Application Timing	Rate
1	Untreated Control	**None**	None
2	Aprovia Top	**A, B**	11 fl oz/A
3	Proline	**A, B**	5.7 fl oz/A
4	**A**-Aprovia Top; **B**-Miravis Top; **C**-Bravo Weather Stik	**A, B, C**	**A-**11 fl oz/A; **B-**13.7 fl oz/A; **C-**1.5 pt/A
5	**A**-Propulse; **B**-Delaro; **C**-Bravo Weather Stik	**A, B, C**	**A**-10.3 fl oz/A; **B**-12 fl oz/A; **C**-1.5 pt/A
6	Elatus	**A**	4.76 oz wt/A
7	Priaxor	**A**	6 fl oz/A
8	Miravis Top	**A**	13.7 fl oz/A
9	Miravis Neo	**A**	13.7 fl oz/A
10	Propulse	**A**	8.6 fl oz/A
11	Delaro	**A**	12 fl oz/A

All treatments contained 0.25% v/v (NIS) Induce except Bravo Weather Stik.

Control of Damping-off and Root Rot of Chickpea — EARC, Sidney, MT

Frankie Crutcher and Amber Ferda

Objective: Test the efficacy of different seed treatments for control of *Rhizoctonia* on chickpea under irrigated conditions.

Materials and methods:

Irrigated:

Variety: Frontier
Planted: 05/10/2017
Harvested: 10/06/2017
Plot Size: 5 X 20=100 ft²
Seeding Rate: 4 LS/ ft²
Soil Type: Clay Loam
Previous Crop: Sugarbeet

Residual Soil N to 3 ft: 4.8 lb/A
Residual Soil P to 6 in: 20.7 ppm
Applied Fertilizer: 46-0-0, 11-52-0
Chemical Applications: Prowl, Outlook. Roundup, Powerhouse, Satellite
Precipitation April – September, 2017: 5.98 inches
Observation dates: Stand counts: 06/01/2017, 06/13/2017, 06/28/2017
Treatments: Apron Maxx RTA, Vibrance Maxx, Cruiser Maxx Vibrance Pulse, Evergol Energy, Obvius, Generic Blend, Gaucho + Evergol Energy

Comments: Late rainfall prevented synchronous germination, effecting stand counts.
Chickpeas did not fully mature due to excessive rainfall late in the season. A square meter was taken from each plot, dried, and biomass measurements recorded.
Rainfall from planting to harvest: 6.56 inches.
Not enough chickpeas within each plot to assess 10 plants for severity.
Not enough chickpeas to pull roots to assess incidence and severity at 28-35 days after emergence.
Plots 105 and 205 tags may have been switched during processing.

Results: Late rainfall prevented synchronous germination, effecting stand counts. Thus, we were unable to calculate useful pre- and post-emergence damping off numbers. Instead, a total damping off was calculated that did show significant differences between controls. For the control treatments (1-4), there was significant differences between those treated with and without Rhizoctonia inoculum. All seed treatments lowered root rot severity when compared to the untreated control. No phytotoxicity was observed for any of the treatments.

Table 1: Seed Treatment Evaluation Control of *Rhizoctonia* on Chickpea

Treatment #	Total Damping-off	Yield (lb/A)
1	48.06 C	2710.1 A
2	80.35 A	1914.5 B
3	48.27 C	2727.0 A
4	73.03 AB	1939.8 B
5	59.61 BC	2242.9 AB
6	61.74 BC	2020.0 B
7	68.11 AB	1822.4 B
8	67.40 AB	1683.3 B
9	68.11 AB	2078.7 B
10	66.96 AB	2126.0 AB
Mean	64.17	2126.47
CV (%)	21.94	25.91
LSD (0.05)	14.39	619.43
Letters in common did not differ significantly according to a t-test at a significance level of 5%.		

Table 2: Seed Treatments for *Rhizoctoni* on Chickpea

Treatment #	Seed Treatment	Rate
1	Untreated Control w/o *Rhizoc*	None
2	Untreated Control	None
3	Apron Maxx RTA w/o *Rhizoc*	6.25 ga/100 kg
4	Apron Maxx RTA	6.25 ga/100 kg
5	Vibrance Maxx	11.3 ga/100 kg
6	Cruiser Maxx Vibrance Pulse	56.25 ga/100 kg
7	Evergol Energy	11.5 ga/100 kg
8	Obvius	18 ga/100 kg
9	Generic Blend	9.78 ga/100 kg
10	Evergol Energy + Gaucho	1 fl oz/cwt + 1.6 fl oz/cwt
All treatments except #6 and #10 contain Cruiser at 30 ga/100 kg.		

Control of Damping-off and Root Rot of Lentil — EARC, Sidney, MT

Frankie Crutcher and Amber Ferda

Objective: Test the efficacy of different seed treatments for control of *Rhizoctonia* on lentil under irrigated conditions.

Materials and Methods:

Variety: Richlea
Planted: 05/10/2017
Harvested: 10/09/2017
Plot Size: 5 X 20=100 ft²
Seeding Rate: 12 LS/ft²
Soil Type: Clay Loam
Previous Crop: Sugarbeet
Residual Soil N to 3 ft: 4.8 lb/A; P to 6 in: 20.7 ppm
Applied Fertilizer: 11-52-0, 46-0-0
Chemical Applications: Prowl, Roundup, Outlook, Powerhouse, Satellite
Precipitation April – September, 2017: 5.98 inches
Stand counts: 06/01/2017, 06/13/2017, 06/26/2017

Comments: *Rhizoctonia solani* was inoculated on infested barley at time of planting. 06/16/2017 Root rot evaluations, average 7 out of 10 plants for all plots. 06/19/2017 Plated 7 lentil samples from field for *Rhizoctonia* confirmation. 06/21/2017 Observed *Rhizoctonia* on 6 out of 7 samples. Plots 101, 105, 309, 408 tested positive. One sample from 101 did not grow *Rhizoctonia*. Rainfall from planting to harvest: 6.56 inches.

Results: Late rainfall prevented synchronous germination, effecting stand counts. Thus, we were unable to calculate useful pre- and post-emergence damping off numbers. A total damping off was calculated, but there was no significant differences between treatments. For the control treatments (1-4), there was significant differences between those treated with and without *Rhizoctonia* inoculum. All seed treatments lowered root rot severity when compared to the untreated control. There were also significant differences in yield, with the two *Rhizoctonia* free treatments having the highest yield, Evergol Energy + Gaucho at number two, Apron Maxx having the lowest yield, and the other treatments falling in between. No phytotoxicity was observed for any of the treatments.

Table 1: Seed Treatments and Evaluation Control of *Rhizoctonia* on Lentil

Trt #	Seed Treatment	Rate	Root Rot (%)	% Pest Incidence (Pre-emergence)	% Pest Incidence (Post-emergence)	Yield (lb/A)
1	UTC w/o *Rhizoc*	None	52.0 C	48.30 B	-16.43 A	900.3 A
2	UTC	None	82.0 A	60.0 AB	-5.69 A	384.1 BCD
3	Apron Maxx RTA w/o *Rhizoc*	6.25 ga/100 kg	64.0 BC	71.70 AB	-38.85 A	823.0 A
4	Apron Maxx RTA	6.25 ga/100 kg	70.0 AB	77.69 A	-26.83 A	261.2 D
5	Vibrance Maxx	11.3 ga/100 kg	66.0 ABC	59.18 AB	-40.22 A	458.6 BC
6	Cruiser Maxx Vibrance Pulse	56.25 ga/100 kg	72.0 AB	54.83 AB	-3.15 A	452.7 BC
7	Evergol Energy	11.5 ga/100 kg	62.0 BC	61.36 AB	-8.42 A	412.3 BCD
8	Obvius	18 ga/100 kg	62.0 BC	68.16 AB	-61.40 A	337.7 CD
9	Generic Blend	9.78 ga/100 kg	60.0 BC	58.91 AB	-12.99 A	433.5 BC
10	Evergol Energy + Gaucho	1 fl oz/cwt + 1.6 fl oz/cwt	60.0 BC	51.56 AB	-23.56 A	518.5 B
Mean			65	61.17	-23.75	498.2
CV (%)			21.37	34.58	-251.89	46.26
LSD (0.05)			16.22	27.28	-80.85	170.75

Letters in common did not differ significantly according to a t-test at a significance level of 5%.
All treatments except #6 and #10 contain Cruiser at 30 ga/100 kg.

Dryland Lentil Foliar Fungicide Trial — EARC, Plentywood, MT

Frankie Crutcher and Amber Ferda

Objective: Test the efficacy of different fungicide combinations for control of White Mold (*Sclerotinia sclerotiorum*) on lentil under dryland conditions.

Materials and Methods:

Variety: Richlea
Planted: 05/05/2017
Harvested: 08/22/2017
Plot Size:5 X 20=100 ft²
Seeding Rate: 12 LS ft²
Soil Type: Vida-Zahill Loam
Previous Crops: Lentil
Applied Fertilizer: Urea

Chemical Applications: Sonalan
Precipitation April – September, 2017: 4.03 inches
Observation dates: Vigor: 06/02/2017, Stand Observation: 06/26/2017 about 10% flowering.
Disease Assessments: 07/07/2017, 07/12/2017, 07/21/2017
Treatments: Miravis Top, Priaxor, Endura, Propulse, Delaro, Aprovia Top, Miravis Neo, Bravo Weather Stik
Date of applications: 06/29/2017 & 07/12/2017

Comments: Average plant height is 6.4 inches.
Seed treatments used were Apron Maxx RTA and Cruiser 5FS.
Application #3 was not applied due to plant maturity, little precipitation and lack of disease.
Fungicides sprayed at 13 GPA. All treatments except Bravo Weather Stik contained a NIS (Induce) at 0.25%. At harvest, some samples too small for test weights. Smaller samples had a larger % moisture than the larger samples, despite being under the same time and conditions. The sample size may have been too small for an accurate number for the machine to produce.
Rainfall from planting to harvest: 2.19 inches.

Results: Due to exceptional drought conditions, no disease was observed at any of the evaluation dates. There was no significant difference between treatments for yield. No data trends were noted. No phytotoxicity was observed.

Table 1: Fungicide Evaluation Control of White Mold on Lentil

Trt #	Incidence (%)[a]	Severity (%)[b]	Adjusted Yield[c]
1	-	-	108.9 A
2	-	-	126.2 A
3	-	-	133.4 A
4	-	-	193.8 A
5	-	-	186.9 A
6	-	-	125.8 A
7	-	-	176.7 A
8	-	-	203.1 A
Mean	-	-	156.85
CV (%)	-	-	71.69
LSD (0.05)	-	-	177.17

Letters in common did not differ significantly according to a t-test at a significance level of 5%.
[a]Pest Incidence: Percent of 30 plants with white mold.
[b]Pest Severity: Average percent area of 30 plants covered by disease.
[c]Adjusted yield was measured at 13% moisture.

Table 2: Fungicide Treatments of White Mold on Lentil

Trt#	Fungicide	Application Timing	Rate
1	Untreated Control	None	None
2	A. Miravis Top B. Aprovia Top C. Bravo Weather Stik	A, B, C	A. 13.7 fl oz/A B. 11 fl oz/A C. 1.5 pt/A
3	A. Miravis Top B. Aprovia Top C. Miravis Neo	A, B, C	A. 13.7 fl oz/A B. 11 fl oz/A C. 13.7 fl oz/A
4	A. Priaxor B. Proline C. Bravo Weather Stik	A, B, C	A. 6 fl oz/A B. 5.7 fl oz/A C. 1.5 pt/A
5	A. Endura B. Proline C. Bravo Weather Stik	A, B, C	A. 11 oz wt/A B. 5.7 fl oz/A C. 1.5 pt/A
6	Priaxor	A	6 fl oz/A
7	Propulse	A	8.6 fl oz/A
8	Delaro	A	12 fl oz/A

All treatments contain (NIS) Induce 0.25% v/v except Bravo Weather Stik

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 2017 growing season and are getting geared up for another great year in 2018. 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 to continue a cooperative effort with the North Dakota Game and Fish Department, on an acquired lease of 1,015 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 serves 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	Soybeans
ND Genesis	Barlow	Decade	Joppa	Mystique	ND-Eagles	CDC Glas	ND17009GT
	Elgin		Carpio				
	Bolles		Tioga				
	Vit-Pro		Divide				
			Lebsock				
			ND Gran				
			ND Riveland				

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 msu.earc@montana.edu.

Save The Date!

2018 Field Day Schedule

Williston Research Extension Center Dryland Tour

0.6 miles West of Hwy 2 and 85 Junction

Wednesday, July 11th 3:00 pm- 7pm (CST)

3:00 pm- Registration

4:00 pm- Dryland Tour Begins

7:00 pm- Dinner

Nesson Valley Irrigation Tour

23 miles East of Williston on Hwy 1804

Thursday, July 12th 8:30 am- 12:00 pm (CST)

8:30 am- Coffee and Rolls

9:00 am- Irrigation Tour

12:00- Lunch

Eastern Ag Research Center Field Day

1 mile north of Sidney on Hwy 200

Tuesday, July 17th 8:30 am- 12:00 pm (MST)

8:30 am- Coffee and Rolls

9:00 am- Field Tour

12:00- Lunch

Disease Focus

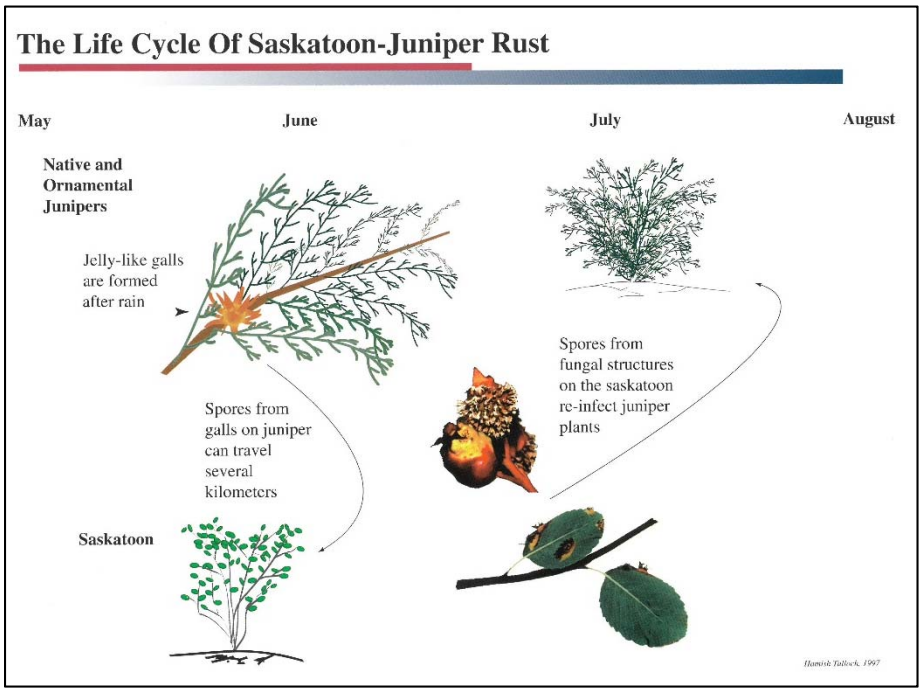
Saskatoon-Juniper Rust

Photo 1. Upper leaf surface

Photo 2. Lower leaf surface showing fruiting bodies.

Photo 3. Spore producing tubes on fruit.

Saskatoon-Juniper rust is caused by a group of fungi in the *Gymnosporangium* genus. Host plants include Hawthorn, Saskatoon also known as Juneberry or Serviceberry, and other plants in the rose family. Symptoms, as shown in the surrounding pictures start off as rust colored legions on the upper leaf surface. (Photo 1). As the infection progresses, long spikey outgrowths appear on the underside of leaf surfaces as well as on the fruit. (See Photo 2 and 3). These outgrowths produce and release the rust spores, which infect the alternate host, Juniper, needed in order to complete the life cycle for this particular type of rust.



Management strategies include careful consideration of host-plant locations. Planting Juneberry near a row of Juniper species is not recommended, although this is not always feasible. If juniper plants are nearby, simply pruning out the galls will help. Fungicides with the active ingredient cholorothalonil or myclobutanil are effective at managing the symptoms. Always follow label instructions.

References:

Agriculture and Agri-Food Canada;Government of Canada. "Gymnosporangium Rust."*Agriculture and Agri-Food Canada;Government of Canada*, 10 Aug. 2015, www.agr.gc.ca/eng/science-and-innovation/agricultural-practices/agroforestry/diseases-and-pests/gymnosporangium-rust/?id=1367259418651.

Guy, St Pierre Richard, et al. "Growing Saskatoons: a Manual for Orchardists." *Growing Saskatoons: a Manual for Orchardists*, Native Fruit Development Program, Dept. of Plant Sciences, University of Saskatchewan, 1999

Upcoming Events for 2018

January 4	Diversity Direction & Dollars - Ramada Grand Dakota Lodge - Dickinson
January 9-10	Manitoba - North Dakota Zero Till Conf - Grand Hotel - Minot
January 22-23	Northern Pulse Growers Assn. Conf. - Riverside Holiday Inn - Minot
January 24-26	Ag Expo - North Dakota State Fair Center - Minot
February 2-3	2018 NDFMGA & Local Foods Conference - Grand Hotel - Mandan
February 6-8	National Hard Spring Wheat Show - Grand Williston Hotel - Williston
February 9-10	GATE - Eastern Plains Event Center - Glendive
February 6 & 7	Agri International Trade Show - Bismarck Event Center - Bismarck
February 13	MonDak Pulse Day - Elks Club - Wolf Point, MT
March 1 & 2	MonDak Ag Days - Richland County Event Center - Sidney
March 6-7	Western Crop/Pest Management School - Williston ARC
March 13-14	KUMV-TV Ag Expo - Raymond Center - Williston
March 16-17	KATQ Northeast Montana Farm Expo - Plentywood
June 19	Southern Ag Research Center Field Day - Huntley
June 21	Northern Ag Research Center Field Day - Havre
June 20-24	UMVF – Williston
June 26	Western Triangle Ag Research Center Field Day - Conrad
July 10	Hettinger Research Extension Center Field Day - Hettinger Northwestern
July 10	Ag Research Center Field Day - Kalispell
July 11	Dickinson Research Extension Center Field Day - Dickinson
July 11	Williston Research Ext. Center Field Day (4:00 PM) - Williston
July 12	Nesson Valley Irrigation Field Day - Nesson Valley
July 12	Central Ag Research Center Field Day - Moccasin
July 16	Agronomy Seed Farm Field Days - Casselton
July 17	Carrington Research Extension Center Field Days - Carrington
July 17	Eastern Ag Research Center Field Day - Sidney
July 18	North Central Research Extension Center Field Day - Minot
July 19	Langdon Research Extension Center Field Day - Langdon
July 20-28	North Dakota State Fair - Minot
July 26	Western Ag Research Center Field Day - Corvallis
August 1-4	Richland County Fair - Sidney
October 12	Northeast Montana Ag Expo - Valley Event Center - Glasgow
November 14	MonDak Ag Research Summit - Richland County Event Center - Sidney