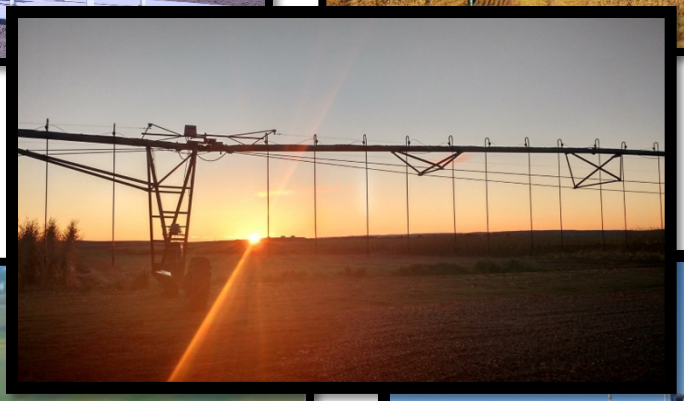
2021 Agricultural Research Update

NDSU Williston Research Extension Center

****

MSU Eastern Agricultural Research Center

Serving the MonDak Region



NDSU North Dakota State University ND Agricultural Experiment Station

Regional Report No. 27 – December 2021

MONTANA STATE UNIVERSITY Montana Agricultural Experiment Station

NDSU | WILLISTON RESEARCH EXTENSION CENTER

Dr. Jerry Bergman
Director

Violeta Hobbs
Administrative Assistant

Dr. Gautam Pradhan
Dryland Research Agronomist

Cameron Wahlstrom
Dryland Research Specialist

Kyle Dragseth
Farm and Seedstocks Manager

David Weltikol
Mechanic/Ag Technician

Justin Jacobs
Irrigation Research Specialist

Tyler Tjelde
Irrigation Scientist

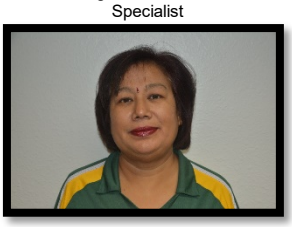
Andrina Turnquist
Irrigation Research Specialist

Dr. Jim Staricka
Soil Scientist

Dr. Audrey Kalil
Plant Pathologist

Taheni Gargouri-Jbir
Plant Pathology Research Specialist

Christy Sperling
Ag Research Technician



Rojee Pradhan
Horticulture Technician

Lynn Staricka
Part-Time Seed Processing Technician

Kaleb Cornell
Part-Time Ag Technician

Evana Somlyay
Plant Pathology Technician

Lauren Holman
Research Technician

Katherine Troutman
Part-Time Technician

John Teixeira
Plant Pathology Technician

Marguerite Wheeler
Part-Time Technician

Gabe Hobbs
Part-Time Technician

Vacant Positions:

Irrigation Technician-Mechanic

Horticulture Research Specialist

Weed Extension Specialist

Plant Pathology Research Specialist

Weather Information

Weather Summary
Williston, ND

Month	Precipitation 2021	Precipitation Avg	Temperature 2021	Temperature Avg	*
	- inches -		- degrees F -		
Oct-Dec. 2020	1.35	1.74			
January-March	0.45	0.15			
April	0.43	1.11	43.88	46.0	0
May	1.45	2.17	53.30	57.0	0
June	3.61	2.68	69.90	65.0	6
July	0.90	2.23	76.85	72.0	16
August	1.44	1.56	69.73	71.0	9
September	0.23	1.45	64.60	60.0	4
April-July	6.39	8.19			
April-Sept	8.06	11.20			
Total-Oct 20-Sept 21	9.86	13.09			

*Number of Days over 89° F

Last Spring Frost – May 06, 2021 (30.5° F)

First Fall Frost – October 11, 2021 (30.9° F)

Weather Summary
Sidney, MT

Month	Precipitation 2021	Precipitation Avg	Temperature 2021	Temperature Avg	*
	- inches -		- degrees F -		
Oct-Dec. 2020	0.86	1.83			
January-March	0.23	1.29			
April	0.17	1.12	42.6	44.4	0
May	1.64	2.14	53.0	55.9	0
June	2.07	2.70	68.4	64.6	6
July	0.02	2.05	75.4	70.2	18
August	1.07	1.45	68.1	68.7	8
September	0.41	1.37	61.8	58.0	4
April-July	3.90	8.01			
April-Sept	5.38	10.83			
Total- Oct 20-Sept 21	6.47	13.95			

*Number of Days over 89° F

Last Spring Frost – May 11, 2021 (31.8° F)

First Fall Frost – October 19, 2021 (27.2° F)

Off-Station Precipitation*
North Dakota

Site	April	May	June	July	Aug	Total
Beach	0.15	2.07	0.70	1.39	1.08	5.39
Crosby	0.14	2.22	3.42	1.34	0.92	8.04
Nesson Valley	0.13	1.79	4.96	0.95	1.42	9.25
Watford City	0.16	2.33	2.31	1.57	0.89	7.26

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

Off-Station Precipitation*
Montana

Site	April	May	June	July	Aug	Total
Dagmar	0.29	1.94	2.66	1.72	1.29	7.90
E Fairview	0.38	1.81	2.38	0.01	1.34	5.92
Poplar	0.17	2.33	2.06	1.00	1.13	6.69
Richland	0.17	2.25	0.41	0.57	1.87	5.27
Savage	0.17	2.17	1.49	0.01	NR	3.84

*Actual rainfall received at plot location may have been more or less.
NR: No Report

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

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

NDSU North Dakota State University ND Agricultural Experiment Station

NDSU Extension Service North Dakota State University

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

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

MONTANA STATE UNIVERSITY Montana Agricultural Experiment Station

MONTANA STATE UNIVERSITY Extension

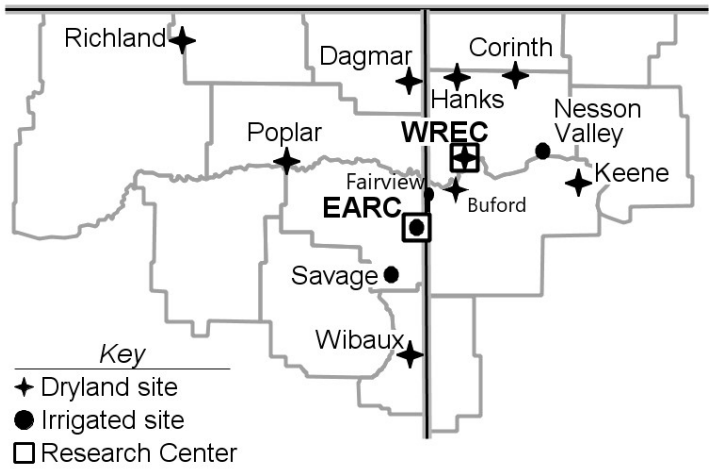
Off-Station Cooperators – Producers – CES Agents

MONTANA
SMALL GRAIN--PULSES:
Dagmar - Brian Kaae - Agent Jack Bazemore
Poplar - Mark Swank - Agent Wendy Becker
Richland - Richard Fulton - Agent Shelley Mills
Wibaux - Rick Miske - Agent Danielle Harper

SUGARBEET:
East Fairview - Texas-Red Enterprises, Inc.
Savage - Conradsen Land & Livestock, Inc.
Sidney – Steffan Farm, Inc.

NORTH DAKOTA
SMALL GRAIN--PULSES--OIL SEEDS:
Keene - Beau Wisness - Agent Devon Leo
Corinth - Don Schilke - Agent Travis Binde
Grenora - Lavern Johnson - Agent Travis Binde
Buford – Ken Kjos – Agent Kelly Leo

Location of Test Sites



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

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

Disclaimer: The information given herein is for educational purposes only. Any reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement is implied by the Williston Research Extension Center or the Eastern Agricultural Research Center. NDSU and MSU do not endorse commercial products or companies even though reference may be made to tradenames, trademarks or service names.

NDSU and MSU are equal opportunity institutions. This publication will be made available in alternative formats for people with disabilities upon request, 701-774-4315 and 406-433-2208.

North Dakota State University does not discriminate on the basis of age, color, disability, gender expression/identity, genetic information, marital status, national origin, public assistance status, race, religion, sex, sexual orientation, or status as a U.S. veteran. Direct inquiries to: Vice Provost for Faculty and Equity, Old Main 201, 701-231-7708 of Title IX/ADA Coordinator, Old Main 102, 701-231-6409.

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
AAC Brandon	Canada	2014	M TALL	M EARLY	M	NA	MR	NA	M	NA	M HIGH	M HIGH
AAC Goodwin	Canada	2018	M TALL	M EARLY	M	NA	MR	NA	NA	NA	NA	NA
AAC Concord	Canada	2019	Medium	Medium	M	R	R	M	MR	R	Medium	HIGH
AAC Starbuck VB	canada	2020	M SHORT	M EARLY	M	M	M	M	MR	R	M HIGH	M HIGH
AAC Wheatland VB	canada	2020	M TALL	M EARLY	MR	R	R	M	M	M	M HIGH	M HIGH
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	MR	R	NA	NA	NA	R	MEDIUM	MEDIUM
Egan3	MT	2014	MEDIUM	M LATE	MR	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
CP 3100	Croplan	2016	MEDIUM	MEDIUM	MR	R	MR/MS	NA	MS	NA	NA	NA
CP 3419	Croplan	2014	M SHORT	LATE	MR	NA	MR	MR	MR	NA	M HIGH	MEDIUM
CP 3504	Croplan	2015	M SHORT	MEDIUM	MR	R	R	NA	MS	NA	NA	NA
CP 3530	Croplan	2015	TALL	LATE	MR	NA	NA	NA	NA	NA	M HIGH	HIGH
CP 3616	Croplan	2016	MEDIUM	MEDIUM	MR	NA	NA	NA	NA	NA	NA	NA
CP 3888	Croplan	2017	M TALL	MEDIUM	MR	NA	R	NA	MR	NA	NA	NA
Lang-MN	MN	2017	M TALL	MEDIUM	MR	R	MR	NA	MS	NA	M HIGH	MEDIUM
Lanning	MT	2017	MEDIUM	MEDIUM	MR	NA	NA	NA	M	NA	NA	NA
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 Cannon	Limagrain	2018	M SHORT	EARLY	MR	NA	MS	NA	M	NA	NA	NA
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	MR	MR	S	MS	MS	R	MEDIUM	MEDIUM
MS Barracuda	Meridian	2018	MEDIUM	M EARLY	MR	NA	MR	NA	NA	NA	NA	NA
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 Frohberg	ND	2020	M TALL	MEDIUM	MR	R	MR	NA	MR	NA	NA	NA
ND VitPro	ND	2016	MEDIUM	M EARLY	MR	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
Shelly	MN	2016	MEDIUM	MEDIUM	MR	NA	MR/MS	NA	M	NA	NA	NA
SK Rush	CANADA	2020	M TALL	MEDIUM	MR	MR	R	NA	MR	NA	MEDIUM	MEDIUM
SY Ingmar	Syngenta	2014	MEDIUM	MEDIUM	MR	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	MR	MR	MR	NA	MR	S	M HIGH	M LOW
SY Soren	Syngenta	2011	M SHORT	M EARLY	MR	R	MR	M	M	S	M HIGH	MEDIUM
SY Valda	Syngenta	2015	MEDIUM	M EARLY	MR	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-Glenville	21st c gen.	2018	M SHORT	M EARLY	MR	NA	R	NA	M	NA	NA	NA
TCG-Heartland	21st c gen.	2019	M SHORT	M Early	MR	NA	R	NA	M	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
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

[1]Refers to developer: CANADA represents developer from that country; 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 = Not adequately tested; R = Resistant; S = susceptible; VS = Very susceptible.

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

Hard Red Spring Wheat Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Days to heading (DAP)	Plant height (in)	Protein† (%)	Test weight (lb/bu)	Yield 2021 (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
AAC BRANDON	54.7	18.4	18.5	59.1	20.5	27.5	41.4
TCG-SPITFIRE	57.3	17.6	17.5	57.9	18.8	26.0	40.3
Elgin-ND	55.7	19.9	18.6	57.7	18.2	24.2	39.9
LCS TRIGGER	61.0	15.9	17.8	57.1	16.9	25.6	39.8
FALLER	56.7	17.2	17.8	57.8	17.7	27.1	39.6
LCS REBEL	53.3	17.7	19.0	59.3	16.1	25.1	39.5
SY LONGMIRE	55.0	17.6	19.5	58.5	17.5	25.2	38.7
SY Rockford	55.3	17.6	18.9	57.4	14.4	22.9	38.5
SY VALDA	54.3	17.5	18.7	58.1	14.4	22.7	38.2
LANNING	54.7	17.2	17.7	57.4	21.6	26.1	38.1
DYNA-GRO COMMANDER	55.0	17.8	18.1	59.1	16.7	23.1	37.9
TCG-HEARTLAND	53.7	17.7	18.8	59.2	16.9	25.7	37.6
DYNA-GRO AMBUSH	54.0	17.5	18.7	59.5	16.6	22.7	37.5
CP3915	54.7	18.9	18.7	59.2	17.7	24.1	37.4
SY MCCLOUD	53.0	18.4	18.2	60.0	17.8	22.1	37.3
LANG-MN	54.7	19.8	18.7	58.4	19.3	24.5	37.3
GLENN	53.0	18.4	17.6	61.1	20.2	24.7	36.4
MS BARRACUDA	52.7	16.7	18.3	58.6	19.7	23.8	36.3
SYINGMAR	54.7	17.2	18.4	59.3	19.0	24.5	36.3
SY SOREN	53.0	17.1	18.3	59.3	19.2	23.9	36.3
CP3530	58.0	19.0	19.2	58.3	15.8	23.5	35.9
ND VITPRO	53.7	17.8	18.7	59.4	17.3	22.7	35.3
LCS CANNON	52.0	16.5	17.4	60.2	17.1	21.9	34.9
MN-WASHBURN	55.3	17.5	18.1	58.8	16.0	22.5	34.4
BOLLES	58.3	18.4	20.7	57.3	13.3	20.7	34.3
DAGMAR	52.0	17.3	17.8	58.5	21.5	25.0	-
TCG-WILDCAT	55.0	17.2	18.2	59.0	16.4	24.6	-
MN15005-4	57.0	16.8	17.7	59.5	18.7	24.3	-
DYNA-GRO BALLISTIC	56.3	17.7	18.1	58.4	16.7	24.2	-
MN-TORGY	54.0	18.0	18.7	59.2	16.3	24.2	-
DRIVER	56.0	19.3	17.1	60.0	19.0	23.9	-
MS RANCHERO	55.0	18.0	17.5	57.8	16.0	23.8	-
ND FROHBERG	55.0	16.4	18.7	59.2	16.4	22.6	-
AAC CONCORD	56.3	19.4	18.4	57.5	17.1	22.1	-
AP MURDOCK	53.7	15.7	18.8	58.3	14.3	21.1	-
CAG-RECKLESS	55.0	18.0	18.5	59.3	20.7	-	-
CP3119A	60.7	16.9	16.0	53.1	20.4	-	-
CP3099A	58.3	18.0	16.3	55.8	19.8	-	-
AAC STARBUCK VB	54.7	18.1	18.8	59.2	19.3	-	-
CP3188	55.3	17.8	16.9	58.4	18.5	-	-
WB9590	53.3	16.5	18.8	59.2	18.1	-	-
AAC GOODWIN	54.7	19.9	18.6	59.0	17.9	-	-
SD4873	57.0	17.3	18.9	58.2	17.3	-	-
AAC WHEATLAND VB	54.0	17.7	18.6	59.5	16.4	-	-
WB9479	53.0	15.5	19.2	59.9	16.4	-	-
AP GUNSMOKE CL2	54.3	16.9	20.0	58.3	16.2	-	-
LCS BUSTER	59.0	16.5	17.8	57.1	15.7	-	-
SK RUSH	54.0	17.3	19.3	58.4	15.7	-	-
SY611CL2	53.3	16.8	18.2	59.1	15.6	-	-
PFS-BUNS	61.0	15.2	18.9	54.8	15.2	-	-
CAG-JUSTIFY	55.7	17.8	19.7	56.9	14.9	-	-
AP SMITH	55.3	14.4	18.7	59.0	14.4	-	-
MS COBRA	54.0	16.5	18.9	59.5	14.0	-	-
Mean	55.2	17.5	18.4	58.5	17.4	-	-
CV (%)	1.4	5.9	1.9	0.7	17.9	-	-
LSD (5%)	1.3	1.7	0.6	0.7	5.0	-	-
LSD (10%)	1.1	1.4	0.5	0.5	4.2	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft
Previous crop: Chickpea
Planted: 5-03-2021
Harvested: 08-06-2021
Soil test (0-6"): P=39 ppm; K=380 ppm; pH=5.8; OM=2.1%
Soil type: Williams-Bowbells loam
(0-24"): NO3-N=13 lb/a
Applied fertilizers in lb/a: N=86; P_2O_5=20; K_2O=0
†Protein adjusted to 12% moisture
Herbicide Applied: 06-09-2020: Bromac @ 1.5pts/a

Dryland Spring Wheat Advance Yield Trial- MSU EARC, Sidney, MT 2021

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
AGRIPR_141	25.1	169	60.1	14.8	49.9
AGRIPR_161	25.6	171	57.6	15.1	50.5
BZ_92413R	23.3	168	60.2	14.7	42.7
BZ_996434	23.9	167	59.6	15.2	43.5
BZ917-252	24.0	170	55.2	15.4	47.3
BZ917-277	26.5	170	60.5	14.5	53.5
CI_10003	34.5	174	56.9	16.4	37.1
CP3099A	29.1	176	56.2	13.8	53.3
CP3119A	26.0	174	54.2	15.1	46.1
CP3188	27.7	169	58.8	13.8	52.4
CP3530	27.7	170	58.3	15.9	43.2
CP3915	25.9	169	60.7	15.0	48.2
LIMAGR_201	26.4	173	55.9	14.2	45.0
LIMAGR_211	25.7	166	63.0	13.5	54.1
LIMAGR_212	25.9	167	59.3	14.6	47.6
MS_201	24.9	165	60.5	13.6	47.8
MS_211	27.5	169	59.3	15.6	42.6
MS_212	24.0	168	60.6	14.9	49.7
MT_1716	26.1	169	58.7	14.9	51.5
MT_1809	26.0	168	58.7	15.0	52.7
MT_1855	29.7	170	56.3	15.5	49.5
MT_1904	25.5	171	61.2	15.3	46.4
MT_1927	27.1	171	55.8	16.1	47.2
MT_1931	24.7	166	59.8	14.2	56.8
MT_1934	26.1	167	59.7	13.6	58.3
MT_1938	25.3	167	60.1	14.2	56.5
MT_1939	25.3	167	59.4	13.8	55.5
MT_1951	27.2	168	55.2	16.0	49.4
MT_2005	26.1	166	61.2	14.1	52.6
MT_2007	23.2	166	59.7	13.8	51.9
MT_2011	25.9	169	61.9	14.3	48.6
MT_2013	25.9	167	61.0	14.8	51.3
MT_2018	26.1	166	61.7	14.3	50.4
MT_2019	24.7	168	59.5	14.5	52.6
MT_2020	25.2	167	60.0	14.0	50.5
MT_2021	27.2	167	59.2	14.0	53.9
MT_2022	25.1	166	61.6	14.0	50.9
MT_2030	23.9	167	58.9	14.2	51.6
MT_2034	26.4	168	57.7	14.0	51.9
MT_2038	23.6	167	61.1	14.2	54.9
MT_2043	25.7	170	60.2	14.8	51.3
MT_2045	25.2	167	59.0	15.1	49.6
MT_2047	24.0	167	61.6	14.6	51.8
MT_2049	25.2	168	58.5	14.2	56.1
MT_2050	26.1	168	60.2	13.3	51.5
MT_2054	26.0	168	60.7	13.6	52.8
MT_2063	24.7	169	59.5	14.2	52.9
MT_2065	25.3	166	61.4	14.2	52.8
MT_2072	26.4	170	57.6	16.5	44.5
MT_2075	23.7	167	57.9	14.9	42.0
ND___695	24.7	169	59.5	15.1	50.0
PI_574642	28.0	171	57.2	15.8	41.6
PI_633974	25.7	170	59.2	15.2	44.9
PI_642366	25.9	169	59.5	13.9	53.3
PI_660981	24.8	167	57.9	15.2	41.1

(Continued on next page)

PI_671855	27.5	171	57.0	16.4	45.1
PI_676978	23.1	166	58.6	14.7	49.4
PI_679964	28.8	171	58.1	14.0	57.1
PI_690450	25.9	166	61.8	14.5	57.6
SYN_181	23.7	168	61.1	14.9	48.5
SYN_182	23.3	169	59.9	14.9	43.7
SYN_183	24.4	169	59.9	14.7	50.7
SYN_211	22.5	170	59.3	15.2	48.8
SYN_212	24.1	168	59.2	15.2	47.7
SYN_213	22.5	167	60.6	14.1	50.5
WB_171	22.7	167	61.5	14.3	54.6
WB_173	24.5	170	61.9	14.6	50.0
WB_211	26.3	171	62.0	14.1	49.8
WB_9879_CLP	25.9	169	60.2	15.1	47.1
Mean	25.6	169	59.4	14.7	49.8
P-Value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
CV (%)	6.4	0.6	1.4	5.1	10.1
LSD (0.05)	2.6	1.7	1.3	1.2	8.1

Planted: 4/8/21
Harvested: 8/5/21
(Julian*) is a continuous count of days since January 1
† Test weight and grain yield adjusted to 12.0% moisture
Soil Test N Avail (lb/ac): 62.5
N added (lb/ac): 80
Herbicide Application: Open Sky @ 16 oz/ac on 6/1/21

Previous crop: fallow
Soil Type: Williams Clay Loam
Plot Width: 5 ft
Crop Year Precipitation: 7.45 inch
Soil Test P2O5 (ppm): 21.7
P2O5 added (lb/ac): 26

Spring Wheat Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Plant Height (in)	Days to Head (DAP+)	Lodging (0 - 9*)	Protein† 2021 (%)	Protein† 2-Yr Avg (%)	Protein† 3-Yr Avg (%)	Test Weight (lb/bu)	Yield 2021‡ (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
Dyna-Gro Ambush	27	56	1	15.2	16.1	15.8	61.7	85.1	73.9	83.3
SY Ingmar	26	57	0	15.1	16.1	15.8	61.7	75.4	68.9	81.0
LCS Trigger	28	63	0	12.4	13.2	13.3	60.1	84.6	73.6	79.8
TCG Heartland	24	55	0	16.1	16.7	16.3	61.8	73.4	68.3	78.6
SY Longmire	26	56	0	15.7	16.6	16.2	61.3	75.1	68.7	77.0
SY McCloud	25	53	1	16.3	16.8	16.3	61.9	61.7	62.0	76.7
LCS Rebel	27	54	1	16.2	16.6	16.1	61.9	69.1	66.2	76.6
TCG Spitfire	27	59	0	14.1	15.1	14.9	60.9	70.7	66.2	76.3
CP3530	28	59	1	15.1	15.6	15.4	59.4	80.7	71.1	76.1
Faller	28	58	0	14.7	15.7	15.1	59.4	75.0	68.0	75.6
Glenn	28	55	1	15.7	16.5	16.3	62.8	72.6	68.2	74.9
Mott	30	57	0	15.4	15.9	15.7	61.4	74.5	68.0	74.3
Dyna-Gro Commander	23	55	0	15.1	15.8	15.5	60.3	53.7	58.0	74.3
Lanning	27	56	1	15.5	16.4	16.2	59.9	71.0	66.1	73.7
Bolles	27	58	0	16.9	17.9	17.5	59.4	62.7	61.6	72.3
Elgin-ND	30	59	1	15.6	16.3	16.1	59.9	69.8	65.7	72.2
ND-VitPro	26	54	0	16.3	17.0	16.5	62.3	63.7	63.5	70.5
MS Barracuda	22	52	0	16.6	17.2	16.7	60.3	43.9	52.7	69.3
TCG Stalwart	25	56	1	15.9	16.5	16.9	58.7	70.7	65.8	68.6
SY Valda	22	57	0	15.2	14.7	-	60.8	57.7	75.8	-
MS Ranchero	30	57	1	13.9	15.1	-	58.6	83.4	72.6	-
Driver	29	59	1	14.4	15.6	-	60.4	75.8	69.3	-
MN-Torgy	23	57	0	15.2	16.2	-	60.8	73.5	67.8	-
CP3915	25	58	0	15.2	16.1	-	61.0	72.4	67.6	-
MN-Washburn	25	59	0	14.4	15.4	-	60.5	72.6	67.0	-
Dagmar	25	53	1	15.9	16.6	-	60.7	71.5	66.9	-
CP3910	27	53	0	15.5	16.4	-	60.4	70.6	66.8	-
TCG Wildcat	27	57	0	15.0	16.4	-	61.0	69.8	66.1	-
ND-Frohberg	27	57	0	15.6	16.2	-	61.0	64.9	63.6	-
PFS-Buns	27	64	0	14.0	-	-	57.1	90.8	-	-
LCS Buster	30	61	0	12.4	-	-	57.8	87.9	-	-
AAC BRANDON	26	57	2	15.3	-	-	60.6	82.6	-	-
MS Cobra	24	57	1	14.9	-	-	60.9	74.1	-	-
AAC WHEATLAND VB	26	56	1	15.5	-	-	59.4	73.9	-	-
CP3099A	27	61	1	13.1	-	-	56.3	71.8	-	-
CAG-Justify	25	60	1	14.1	-	-	57.2	71.7	-	-
AAC STARBUCK VB	27	55	1	16.5	-	-	60.8	71.7	-	-
Dyna-Gro Ballistic	28	58	0	14.5	-	-	59.0	70.9	-	-
AAC GOODWIN	26	59	0	15.5	-	-	60.6	70.8	-	-
CAG-Reckless	27	58	1	14.8	-	-	61.5	69.5	-	-
Lang-MN	26	58	0	15.7	-	-	59.1	68.9	-	-
WB9590	22	55	0	16.2	-	-	59.5	67.4	-	-
WB9479	23	55	0	16.8	-	-	60.5	66.9	-	-
SK RUSH	25	55	0	16.6	-	-	58.6	64.1	-	-
AP Smith	25	57	0	15.4	-	-	60.1	63.0	-	-
AP Gunsmoke CL2	25	55	2	15.6	-	-	59.8	62.4	-	-
SY611CL2	22	55	1	15.5	-	-	61.9	61.2	-	-
AAC Concord	27	58	2	15.2	-	-	58.8	54.6	-	-
MEAN	26.1	56.8	-	15.24	16.09	15.92	60.20	70.62	66.9	75.32
C.V. (%)	-	-	-	2.72	-	-	1.05	15.63	-	-
LSD (5%)	-	-	-	0.67	-	-	1.02	15.44	-	-
LSD (10%)	-	-	-	0.56	-	-	0.86	12.93	-	-

+ Days After Planting * 0: no lodging - 9: plants lying flat on the ground † Protein content adjusted to 12% moisture ‡ Hail storm on July 22, 2021

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W
Elevation: 1902 ft
Soil test (0-6 in.): P=18 ppm; K=170 ppm; pH=7.7; OM=2.1 %
Previous crop: Sugarbeet
(0-24 in.): NO3-N=12 lb/a
Planted: 4/30/2021
Yield goal: 120 bu/a
Harvested: 8/18/2021
Planting population: 1.5 million seeds/a
Soil type: Lihen Loamy Fine Sand
Applied fertilizer: 350 lb/a Urea (46-0-0) - [4/26] and 100 lb/a Urea (46-0-0) - [6/22]
Plot size: 90 ft^2
Herbicides applied: Huskie FX (13.5oz/a), Luxxur A (0.21oz/a), and Luxxur B (6.85oz/a) [6/16]
Rainfall: 6.73 (4/30 - 8/18)
Fungicides applied: Prosaro 421 (8.2oz/a) [7/1]
Irrigation: 14.6 inches (4/30 - 8/18)

Irrigated Advanced Spring Wheat Trial - MSU EARC, Sidney, MT 2021

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
AGRIPR_141	29.3	175.7	63.0	14.8	63.1
AGRIPR_161	29.6	177.7	61.8	14.3	65.2
BZ_92413R	26.0	174.3	63.9	13.8	65.1
BZ_996434	27.5	173.3	63.5	14.9	58.0
BZ917-252	25.1	178.0	59.0	15.4	63.0
BZ917-277	29.7	179.0	63.7	14.1	71.5
CI_10003	36.4	181.3	62.2	15.0	55.9
CP3099A	31.2	181.7	61.4	12.2	73.3
CP3119A	27.3	179.0	59.5	13.2	68.9
CP3188	29.2	173.0	61.5	13.5	72.0
CP3530	33.6	177.0	61.0	15.7	59.8
CP3915	31.5	174.7	62.8	14.8	65.1
LIMAGR_201	25.2	179.3	59.6	13.6	55.8
LIMAGR_211	29.6	172.0	64.0	13.5	70.0
LIMAGR_212	29.9	173.7	63.2	13.7	63.2
MS_201	28.3	173.0	62.0	14.2	61.3
MS_211	31.6	176.3	62.6	15.8	55.8
MS_212	30.1	173.0	63.1	14.7	60.2
MT_1716	32.1	176.0	63.4	13.5	69.6
MT_1809	29.2	174.0	62.9	14.2	67.1
MT_1855	30.7	178.0	62.8	13.6	75.1
MT_1904	30.7	176.3	64.9	13.0	64.3
MT_1927	31.7	178.7	60.5	15.2	65.5
MT_1931	28.9	172.7	61.4	14.9	71.0
MT_1934	29.6	172.0	62.2	14.1	72.6
MT_1938	30.4	172.0	62.5	15.0	64.4
MT_1939	29.1	174.0	61.7	14.0	67.6
MT_1951	31.9	174.3	58.6	16.8	58.0
MT_2005	29.7	171.3	63.7	13.5	68.2
MT_2007	30.1	172.0	63.1	14.1	72.5
MT_2011	30.0	174.0	63.3	14.5	60.1
MT_2013	31.1	171.7	63.7	14.4	60.9
MT_2018	27.2	171.7	64.0	14.5	60.4
MT_2019	29.3	173.0	61.4	15.1	63.6
MT_2020	28.7	172.3	61.7	15.1	62.8
MT_2021	30.0	172.3	61.4	14.6	63.9
MT_2022	27.2	171.0	63.5	14.5	66.9
MT_2030	28.5	172.3	61.9	14.8	69.6
MT_2034	29.1	175.3	60.5	14.5	64.8
MT_2038	30.1	173.3	60.7	15.5	60.2
MT_2043	28.4	176.0	62.1	16.0	56.1
MT_2045	29.6	172.7	62.9	14.5	62.1
MT_2047	27.6	173.3	63.9	14.5	65.0
MT_2049	27.7	173.7	62.4	14.1	75.7
MT_2050	29.9	174.0	62.7	15.1	65.7
MT_2054	31.6	173.0	62.0	14.9	57.8
MT_2063	30.1	174.7	63.3	12.9	69.9
MT_2065	30.5	171.7	63.7	14.7	58.6
MT_2072	30.0	176.0	62.6	15.3	58.3
MT_2075	29.1	174.0	61.1	14.0	63.7
ND___695	30.5	174.3	62.6	14.8	72.0
PI_574642	30.8	177.7	61.0	15.6	61.3
PI_633974	28.7	175.3	62.3	14.4	63.6
PI_642366	29.5	175.3	63.6	13.1	77.2
PI_660981	29.9	172.3	61.2	14.4	63.6

Continued on next page

PI_671855	29.3	177.7	59.9	16.9	59.3
PI_676978	28.0	172.3	60.2	15.3	61.3
PI_679964	31.5	179.0	63.5	13.1	77.5
PI_690450	32.3	172.7	63.1	14.8	74.2
SYN_181	28.5	173.7	64.6	15.0	66.8
SYN_182	28.3	174.3	63.0	14.1	69.5
SYN_183	26.3	172.3	62.9	14.2	65.9
SYN_211	27.7	177.7	62.6	14.7	67.9
SYN_212	28.1	173.7	62.0	14.4	62.5
SYN_213	28.7	172.3	63.0	13.1	73.7
WB_171	24.4	173.0	62.3	14.6	65.0
WB_173	26.5	177.0	65.3	14.1	69.3
WB_211	28.7	174.3	65.3	13.7	73.3
WB_9879_CLP	28.9	175.0	62.6	15.1	63.8
Mean	29.4	174.6	62.4	14.5	65.5
P-Value	<0.0001	0.22	<0.0001	<0.0001	0.1093
CV (%)	6.1	0.6	1.3	5.4	13.0
LSD (0.05)	2.9	1.6	1.3	1.3	13.7

Planted: 4/28/21
Harvested: 8/11/2021
(Julian*) is a continuous count of days since January 1
† Test weight and grain yield adjusted to 12.0% moisture
Soil Test N Avail (lb/ac): 26
N added (lb/ac): 80
Herbicide Application: Open Sky @ 16 oz/ac on 5/26/21
Huskei FX @ 18 oz/ac on 6/13/21

Previous crop: sugarbeet
Soil Type: Savage Silty Clay
Plot Width: 5 ft
Crop Year Precipitation: 6.47 inch
Irrigation (Sprinkler): 2.68 inch
Soil Test P2O5 (ppm): 13
P2O5 added (lb/ac): 26

EARC Staff planting beets: Staci Hurley, Thomas Gross, Ron Brown and Shawn **Bennett**

Roosevelt County Dryland Spring Wheat - MSU Poplar, MT 2021

Variety	Plant Height (inch)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
AGRIPR_10	24.0	58.2	18.3	26.3
AGRIPR_14	25.1	55.8	18.8	21.5
AGRIPR141	24.8	56.4	18.8	23.4
CP3099A	23.3	54.1	17.1	20.5
CP3119A	20.3	52.8	17.1	18.6
CP3188	24.8	55.5	18.1	21.0
CP3530	28.1	55.1	19.1	20.9
CP3915	26.0	56.9	18.3	22.6
MT_1716	26.7	58.2	17.1	21.4
MT_1809	24.0	56.8	18.9	19.9
MT_1931	26.5	55.6	17.9	27.7
MT_1934	26.8	56.4	17.2	24.2
MT_1938	25.2	56.9	17.4	26.8
MT_1951	26.1	52.8	19.6	19.9
ND___695	26.9	57.5	18.1	23.7
PI_633974	23.7	57.6	17.5	17.6
PI_642366	24.7	57.4	17.5	21.6
PI_660981	25.7	55.3	18.6	17.7
PI_671855	25.6	54.8	19.9	22.2
PI_676978	26.0	54.6	18.0	26.0
PI_679964	24.8	56.0	17.3	19.8
PI_690450	26.1	58.4	18.0	26.0
Mean	25.2	56.0	18.1	22.3
P-Value	0.0016	<0.0001	<0.0001	0.0063
CV (%)	6.6	1.4	2.8	14.7
LSD (0.05)	2.7	1.3	0.8	5.4

Planted: 4/21/2021
Harvested: 8/3/2021
(Julian*) is a continuous count of days since January 1
† Test weight and grain yield adjusted to 12.0% moisture
Herbicide Application: Huskie Complete @3.7 oz/ac on 6/1/21

Previous crop: pea
Plot Width: 5 ft
Crop Year Precipitation: 6.69
Fall Fertilizer: 200 lbs/ac 39-0-6-2.5 S
Spring Fertilizer: 80 lbs/ac MESZ 10-40-0-10S-1Zn

FARMING ISN'T JUST A JOB. IT'S A WAY OF LIFE.

Sheridan County Dryland Spring Wheat - MSU Dagmar, MT 2021

Variety	Plant Height (inch)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
AGRIPR_10	17.2	64.9	17.2	17.1
AGRIPR_14	17.7	64.6	17.1	23.4
AGRIPR141	18.7	65.3	16.4	27.4
CP3099A	17.9	61.5	14.9	24.9
CP3119A	17.5	59.5	14.5	27.8
CP3188	18.7	63.9	14.7	28.3
CP3530	18.8	63.4	17.5	22.1
CP3915	17.5	65.7	16.9	23.2
MT_1716	18.4	64.3	16.1	25.9
MT_1809	18.0	64.1	15.2	33.0
MT_1931	18.4	63.8	15.6	30.8
MT_1934	19.2	63.6	15.7	29.2
MT_1938	15.9	62.9	16.3	27.6
MT_1951	18.0	60.3	17.8	24.0
ND___695	17.6	64.3	15.9	28.6
PI_633974	18.1	63.5	17.0	21.3
PI_642366	20.1	64.2	15.1	29.6
PI_660981	18.8	62.3	16.4	22.3
PI_671855	18.0	61.9	18.7	22.4
PI_676978	18.1	63.1	16.7	23.3
PI_679964	21.1	63.7	15.7	25.9
PI_690450	17.6	63.7	16.4	26.4
Mean	18.2	63.4	16.3	25.7
P-Value	0.389	<0.0001	<0.0001	<0.0001
CV (%)	9.5	0.8	3.8	12.6
LSD (0.05)	2.8	0.8	1.0	5.3

Planted: 5/3/2021
Harvested: 8/17/2021
(Julian*) is a continuous count of days since January 1
† Test weight and grain yield adjusted to 12.0% moisture
Herbicide Application: Deadbolt @ 16 oz/ac
Discover @ 16 oz/ac

Previous crop: lentil
Plot Width: 5 ft
Crop Year Precipitation: 7.90 inch
N added (lb/ac): 70
P2O5 added (lb/ac): 26

If it was easy...
everybody would do it.

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
AAC CABRI* **	CANADA	2016	M TALL	M LATE	M	R	M	NA	MS	MEDIUM	M LARGE	HIGH	EXCELLENT
AAC GRAINLAND* **	CANADA	2020	M TALL	M LATE	M	R	M	NA	MS	MEDIUM	M LARGE	M HIGH	GOOD
ALKABO	NDSU	2005	MEDIUM	MEDIUM	R	R	MR	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
CDC DEFY*	CANADA	2020	M TALL	MEDIUM	MR	R	M	NA	MS	MEDIUM	LARGE	HIHG	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
AAC SPITFIRE*	CANADA	2016	M SHORT	MEDIUM	R	R	M	NA	S	MEDIUM	M LARGE	HIGH	GOOD
AAC STRONGHOLD***	CANADA	2018	M SHORT	MEDIUM	R	R	M	NA	MS	MEDIUM	M LARGE	HIGH	GOOD
AC STRONGFIELD*	CANADA	2004	M TALL	M LATE	M	R	M	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
TCG-BRIGHT	TCG	2019	MEDIUM	M EARLY	M	R	M	NA	S	HIGH	MEDIUM	MEDIUM	EXCELLENT
TCG-WEBSTER	TCG	2021	SHORT	EARLY	R	R	MS	M	S	MEDIUM	MEDIUM	MEDIUM	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; TCG = 21st Century Genetics; WB = WestBred.

[2]MR = Moderately resistant; M = Intermediate; MS = Moderately susceptible; NA = Not adequately tested; 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 low cadmium accumulating variety. **Indicates Solid Stem sawfly tolerance

Durum Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Days to heading	Plant height	Protein†	Test weight	Yield			
					2021	2020	2-Yr Avg	3-Yr Avg*
	(DAP)	(in)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)	(bu/a)
Grenora	69	17	18.9	60.9	17.7	30.7	24.2	38.7
TCG- Bright	61	16	18.9	60.5	14.9	31.4	23.1	38.0
ND RIVELAND	61	19	19.1	60.1	15.5	29.4	22.4	37.8
CDC Verona	63	18	20.4	60.2	15.1	31.2	23.1	37.2
AC COMMANDER	61	17	19.8	61.4	18.8	29.5	24.1	37.2
MOUNTRAIL	62	15	19.4	60.2	15.9	25.9	20.9	36.5
DIVIDE	71	19	19.7	59.9	13.4	31.6	22.5	36.2
CARPIO	63	18	18.5	60.0	18.5	29.3	23.9	35.9
VT Peak	72	17	19.5	61.7	16.1	27.2	21.7	35.9
ALKABO	61	16	19.0	61.2	15.5	28.2	21.8	35.6
TIOGA	61	19	18.7	61.3	15.9	24.2	20.1	35.4
ND GRANO	62	15	19.8	60.0	15.3	26.5	20.9	35.2
RUGBY	61	18	20.0	60.3	13.1	27.5	20.3	35.0
JOPPA	62	17	18.8	61.2	15.7	27.4	21.5	34.8
STRONGFIELD	62	19	20.4	60.5	15.4	25.5	20.4	34.8
BEN	60	17	20.0	60.9	14.0	26.9	20.5	34.6
MAIER	62	17	20.1	61.0	13.6	23.2	18.4	34.1
LEBSOCK	62	16	19.2	61.0	13.8	25.5	19.7	34.0
PIERCE	62	17	19.1	60.6	13.0	26.1	19.6	33.6
NORMANNO	59	17	18.2	61.2	14.7	24.6	19.6	32.1
ALZADA	69	16	18.6	61.4	16.0	25.1	20.6	31.8
AAC STRONGHOLD	63	16	20.2	60.5	12.1	27.0	19.5	-
AAC SPITFIRE	63	16	20.4	60.0	16.2	-	-	-
CDC DEFY	61	17	19.2	61.6	15.0	-	-	-
AAC GRAINLAND	61	18	21.5	60.0	14.6	-	-	-
ND STANLEY	62	17	19.4	61.3	13.6	-	-	-
Mean	63	17	19.4	60.7	15.2	-	-	-
CV (%)	9.5	8	1.9	0.8	19.7	-	-	-
LSD (5%)	9.7	2	0.6	0.7	4.8	-	-	-
LSD (10%)	8.1	2	0.5	0.6	4.1	-	-	-

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

Planted: 04-30-2021 Harvested: 08-12-2021

Soil test (0-6"): P=39 ppm; K=380 ppm; pH=5.8; OM=2.1% Soil type: Williams-Bowbells loam

(0-24"): NO3-N=13 lb/a

Applied fertilizers in lb/a: N=65; P_2O_5=20; K_2O=0

Herbicide Application: 06-22-2021: Bromac @ 1.5pts/a

Dryland Statewide Durum - MSU EARC, Sidney, MT 2021

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Carpio	27.2	173	59.2	16.3	36.6
CDC-Vivid	24.3	172	59.3	16.3	38.2
Divide	26.9	172	59.8	15.2	38.9
Grenora	26.1	171	58.8	14.9	40.5
Joppa	26.8	172	59.7	15.7	37.1
Lustre	25.6	172	58.0	16.4	36.6
Mountrail	25.3	171	57.9	15.5	41.4
MTD16001	27.3	172	58.8	15.0	40.0
MTD16002	28.5	174	59.8	14.7	42.9
MTD18067	26.4	173	59.0	15.5	37.7
MTD18091	26.3	174	58.8	17.1	35.7
MTD18148	22.7	171	59.8	15.1	44.5
MTD18155	25.2	172	59.5	15.6	42.2
MTD18172	27.3	173	61.1	15.7	42.7
MTD18179	25.3	172	56.2	17.4	35.0
MTD18181	27.2	174	59.5	16.4	34.9
MTD18213	27.6	174	57.8	16.9	35.6
MTD18217	27.9	175	59.1	16.6	37.6
MTD18256	27.9	174	59.0	15.7	40.3
MTD18266	27.3	174	60.3	16.7	38.1
MTD18313	20.5	167	62.1	14.9	43.3
MTD18348	28.4	172	60.0	15.0	43.5
MTD18381	26.7	170	59.2	14.9	37.5
MTD18413	27.3	171	60.2	15.1	44.0
MTD18430	30.7	176	57.0	16.4	34.2
MTD18486	27.9	178	60.6	15.8	34.8
ND-Grano	27.1	173	59.7	16.1	37.9
ND-Riveland	28.7	172	59.6	15.5	42.5
Tioga	28.0	172	60.1	16.0	37.6
Mean	26.7	173	59.3	15.8	39.0
P-Value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
CV (%)	5.4	0.4	1.0	4.4	7.6
LSD (0.05)	2.4	1.1	0.9	1.10	3.4

Planted: 4/8/21
Harvested: 8/5/21
(Julian*) is a continuous count of days since January 1
† Test weight and grain yield adjusted to 12.0% moisture
Soil Test N Avail (lb/ac): 62.5
N added (lb/ac): 80
Herbicide Application: Open Sky @ 16 oz/ac on 6/1/21

Previous crop: fallow
Soil Type: Williams Clay Loam
Plot Width: 5 ft
Crop Year Precipitation: 7.45 inch
Soil Test P2O5 (ppm): 21.7
P2O5 added (lb/ac): 26

Durum Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Plant Height (in)	Days to Head (DAP+)	Lodging (0 - 9*)	Protein† 2021 (%)	Protein† 2-Yr Avg (%)	Protein† 3-Yr Avg (%)	Test Weight (lb/bu)	Yield 2021‡ (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
Grenora	27	60	0	16.3	16.7	15.9	55.9	57.4	77.0	75.6
ND Riveland	31	61	0	16.7	17.1	16.3	56.7	62.8	75.0	74.2
Joppa	28	60	1	16.3	16.9	15.8	58.1	60.8	70.7	73.5
ND Grano	29	61	1	16.8	17.2	16.3	57.6	70.5	72.3	73.4
AC Commander	26	60	0	16.6	17.2	16.2	54.4	52.9	68.0	72.1
Alkabo	25	59	0	16.1	16.8	16.1	57.0	62.0	66.9	69.0
Tioga	31	60	1	17.4	17.6	16.6	56.0	59.2	65.5	68.9
Carpio	28	61	2	15.8	17.2	16.3	58.4	63.5	67.7	68.5
Divide	29	61	0	17.3	17.9	16.8	56.0	51.8	61.4	66.5
Strongfield	26	59	2	17.6	18.5	17.2	56.5	56.9	62.5	66.2
Alzada	24	58	1	17.3	17.3	16.4	55.8	44.1	63.4	64.5
Pierce	28	61	2	15.4	16.8	16.1	56.2	50.9	59.2	63.4
Mountrail	27	60	1	16.2	17.4	16.4	55.6	42.8	56.7	63.2
CDC Verona	28	61	0	18.0	19.2	18.0	57.1	58.5	62.3	61.1
Rugby	28	60	1	18.0	18.4	17.3	56.9	42.8	56.4	60.9
Maier	27	60	0	17.7	18.8	17.7	58.3	46.4	55.5	60.4
ND Stanley	30	61	0	17.3	18.0	-	57.2	68.9	70.4	-
AAC STRONGHOLD	29	62	0	17.2	18.0	-	56.4	58.0	66.7	-
Normanno	22	58	1	17.0	16.7	-	53.2	50.9	58.3	-
CDC DEFY	32	60	0	16.3	-	-	57.9	69.2	-	-
AAC SPITFIRE	28	60	1	17.6	-	-	53.4	59.4	-	-
AAC GRAINLAND	32	63	0	18.3	-	-	53.3	59.4	-	-
TCG-Webster	22	56	1	16.2	-	-	56.6	49.8	-	-
MEAN	27.8	60.0	-	16.93	17.56	16.58	56.28	59.38	62.28	65.49
C.V. (%)	-	-	-	3.13	-	-	2.11	14.83	-	-
LSD (5%)	-	-	-	0.87	-	-	1.96	13.79	-	-
LSD (10%)	-	-	-	0.73	-	-	1.63	11.49	-	-

+ Days After Planting * 0: no lodging - 9: plants lying flat on the ground † Protein content adjusted to 12% moisture ‡ Hail storm on July 22, 2021

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W
Elevation: 1902 ft
Soil test (0-6 in.): P=18 ppm; K=170 ppm; pH=7.7; OM=2.1 %
Previous crop: Sugarbeet
(0-24 in.): NO3-N=12 lb/a
Planted: 4/30/2021
Yield goal: 120 bu/a
Harvested: 8/18/2021
Planting population: 1.5 million seeds/a
Soil type: Lihen Loamy Fine Sand
Applied fertilizer: 350 lb/a Urea (46-0-0) - [4/26] and 100 lb/a Urea (46-0-0) - [6/22]
Plot size: 90 ft^2
Herbicides applied: Huskie FX (13.5oz/a), Luxxur A (0.21oz/a), and Luxxur B (6.85oz/a) [6/16]
Rainfall: 6.7 (4/30 - 8/18)
Fungicides applied: Prosaro 421 (8.2oz/a) [7/1]
Irrigation: 14.6 inches (4/30 - 8/18)

Irrigated Statewide Durum - MSU EARC, Sidney, MT 2021

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Carpio	31.2	181	14.7	14.7	44.7
CDC-Vivid	30.5	180	15.0	15.0	49.1
Divide	31.9	181	13.7	13.7	50.3
Grenora	31.2	179	12.8	12.8	59.4
Joppa	33.5	179	13.1	13.1	60.3
Lustre	32.5	180	14.0	14.0	51.3
Mountrail	31.9	180	14.9	14.9	47.8
MTD16001	31.5	180	13.3	13.3	49.6
MTD16002	34.1	181	13.2	13.2	57.0
MTD18067	31.6	180	12.0	12.0	71.6
MTD18091	30.0	182	14.0	14.0	48.6
MTD18148	22.5	177	14.6	14.6	55.5
MTD18155	31.2	179	14.2	14.2	57.6
MTD18172	34.0	181	13.9	13.9	58.1
MTD18179	30.4	181	14.7	14.7	56.3
MTD18181	31.6	185	14.6	14.6	48.2
MTD18213	30.7	182	13.1	13.1	52.1
MTD18217	33.5	185	14.3	14.3	45.8
MTD18256	34.0	182	13.6	13.6	60.6
MTD18266	30.8	184	15.2	15.2	49.0
MTD18313	25.9	177	15.0	15.0	51.4
MTD18348	33.1	182	14.1	14.1	47.3
MTD18381	33.7	179	14.4	14.4	48.9
MTD18413	31.7	180	14.9	14.9	54.5
MTD18430	33.9	185	13.3	13.3	56.1
MTD18486	33.5	185	13.7	13.7	56.1
ND-Grano	29.6	181	14.2	14.2	53.8
ND-Riveland	33.7	179	14.5	14.5	60.3
Tioga	32.3	180	14.1	14.1	50.5
Mean	31.6	181.0	14.0	14.0	53.5
P-Value	<0.0001	0.22	<0.0001	<0.0001	<0.0001
CV (%)	6.2	0.4	4.3	4.3	9.8
LSD (0.05)	3.2	1.3	0.7	0.7	8.6

Planted: 4/28/21
Harvested: 8/10/21
(Julian*) is a continuous count of days since January 1
† Test weight and grain yield adjusted to 12.0% moisture
Soil Test N Avail (lb/ac): 26
N added (lb/ac): 80
Herbicide Application: Open Sky @ 16 oz/ac on 5/26/21

Previous crop: sugarbeet
Soil Type: Savage Silty Clay
Plot Width: 5 ft
Crop Year Precipitation: 6.47 inch
Irrigation (sprinkler): 2.68 inch
Soil Test P2O5 (ppm): 13
P2O5 added (lb/ac): 26

Sheridan County Dryland Durum - MSU Dagmar, MT 2021

Variety	Plant Height (inch)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Carpio	19.6	63.1	16.5	16.8
CDC-Vivid	22.4	63.9	18.2	17.3
Divide	21.3	63.6	16.6	18.4
Grenora	19.1	63.2	16.5	18.1
Joppa	20.7	64.0	16.5	17.4
Lustre	17.5	62.4	17.9	15.1
Mountrail	20.1	63.1	17.3	15.1
MTD-16001	19.7	63.2	16.2	17.5
MTD16002	21.2	62.9	16.0	19.3
MTD18313	17.6	64.9	17.2	15.1
MTD18346	22.9	63.5	16.0	23.3
ND-Grano	20.1	63.8	17.4	15.3
ND-Riveland	22.5	63.8	16.4	20.8
Tioga	22.8	63.6	17.2	17.9
Mean	20.5	63.5	16.9	17.7
P-Value	0.0221	0.0302	0.0095	0.5626
CV (%)	9.9	1.0	4.1	23.6
LSD (0.05)	3.4	1.1	1.4	6.9

Planted: 5/3/2021
Harvested: 8/17/2021
(Julian*) is a continuous count of days since January 1 †
Test weight and grain yield adjusted to 12.0% moisture
Herbicide Application: Deadbolt @ 16 0z/ac
Discover @ 16 oz/ac

Previous crop: lentil
Plot Width: 5 ft
Crop Year Precipitation: 7.90 inch
N added (lb/ac): 70
P2O5 added (lb/ac): 26

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
AAC GOLDRUSH	CANADA	2017	MEDIUM	MEDIUM	**GOOD**	NA	MR	R	M	NA	NA
AAC WILDFIRE	CANADA	2015	MEDIUM	MEDIUM	**GOOD**	NA	M	MS	NA	NA	NA
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
BROADVIEW	CANADA	2009	MEDIUM	MEDIUM	**GOOD**	R	R	R	NA	MEDIUM	MEDIUM
CDC CHASE	CANADA	2013	MEDIUM	MEDIUM	**GOOD**	M	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
KELDIN	WB	2011	SHORT	MEDIUM	**GOOD**	NA	MR	MR	MR	NA	NA
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
RAY**	MT	2019	M TALL	M LATE	GOOD	MR	R	NA	NA	MEDIUM	MEDIUM
REDFIELD	SD	2013	SHORT	MEDIUM	FAIR	R	S	MS	NA	M HIGH	MEDIUM
SY MONUMENT	AGRIPRO	2015	M SHORT	MEDIUM	FAIR	NA	MR	MR	NA	M LOW	MEDIUM
SY SUNRISE	AGRIPRO	2015	SHORT	MEDIUM	**GOOD**	NA	NA	NA	NA	NA	NA
SY WOLF	AGRIPRO	2010	M SHORT	MEDIUM	POOR	R	R	MR	MR	HIGH	M LOW
TCG BOOMLOCK	TCG	2019	MEDIUM	MEDIUM	FAIR	NA	NA	NA	NA	MEDIUM	M HIGH
THOMPSON	SD	2017	MEDIUM	M EARLY	NA	R	MR	MR	NA	NA	NA
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; TCG = 21ST CENTURY GENETICS; 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. **DUAL PURPOSE-GRAIN/FORAGE

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.

Dryland Intrastate Winter Wheat Evaluation - MSU EARC, Sidney, MT 2020-2021

Variety	Winter Survival	Plant Height	Days to Heading	Test Weight†	Protein	Grain Yield†
	%	(inch)	(Julian*)	(lb/bu)	(%)	(bu/ac)
AAC_Wildfire	98.3	24.9	163	59.0	11.7	53.4
AP_18_AX	28.3	21.6	158	62.0	12.0	34.6
Balance	5.0	21.6	161	58.0	14.7	18.8
Battle_AX	21.7	18.9	159	62.4	12.1	29.7
Bobcat	73.3	22.3	161	62.1	12.3	46.5
Brawl_CL_Plus	20.0	21.1	155	63.5	13.1	21.6
Byrd_CL_Plus	35.0	23.1	159	61.4	11.3	29.2
CP7017AX	26.7	22.4	159	61.3	11.7	28.2
CP7050AX	46.7	22.4	155	64.2	12.8	34.8
CP7869	88.3	19.7	156	63.0	11.7	46.4
CP7909	40.0	21.2	154	63.3	11.4	23.9
Flathead	65.0	21.7	157	62.8	12.3	44.5
Fortify_SF	40.0	20.7	158	63.7	11.9	39.1
FourOsix	56.7	22.0	159	60.8	12.4	42.2
Judee	16.3	20.9	160	60.7	14.3	18.9
Keldin	43.3	21.5	160	61.9	11.8	40.5
LCS_18-7071_AX	35.0	23.3	162	61.4	10.4	47.6
LCS_Helix_AX	43.3	21.6	157	63.7	11.3	39.6
LCS_Julep	13.3	22.0	157	65.3	12.9	21.1
Loma	86.7	22.5	160	61.5	12.0	49.3
Milestone	6.7	23.1	164	58.6	12.3	25.2
MT1745	90.0	23.6	160	60.7	11.6	52.7
MT1872	68.3	20.9	160	61.0	12.0	39.7
MT19175	66.7	21.9	161	60.5	11.7	51.4
MTCL1737	68.3	20.8	160	60.1	13.0	48.7
MTCL19149	15.0	19.7	161	60.8	12.1	35.2
MTCL19151	73.3	20.9	159	61.2	13.1	47.5
MTFH19132	36.7	22.9	159	60.5	12.0	40.1
MTS18116	60.0	21.5	163	61.0	12.3	42.4
MTS18149	78.3	18.9	163	61.1	12.0	54.6
MTS1831	51.7	21.5	163	60.9	12.5	42.3
MTS1855	55.0	19.7	160	60.3	13.5	45.7
MTS1903	36.7	21.2	163	61.0	12.1	38.9
MTS1908	58.3	23.6	165	60.8	11.4	42.0
MTS1915	56.7	20.8	161	60.7	12.0	45.5
NAS-7653	45.0	20.8	160	61.9	11.7	39.0
Northern	63.3	21.5	159	61.2	12.3	44.9
NP13005004#49	1.7	20.0	159	64.4	13.2	9.0
StandClear_CLP	70.0	25.5	160	62.6	12.4	45.6
SY_517_CL2	10.0	18.4	157	63.6	14.0	15.6
SY_Clearstone_2CL	65.0	22.9	161	59.9	12.0	40.2
SY_Wolverine	31.7	19.7	157	62.8	12.4	24.5
Warhorse	75.0	22.4	160	60.5	12.8	41.5
WB4401	23.3	18.3	157	61.3	11.5	25.2
WB4418	25.0	19.3	158	62.9	12.3	34.0
WB4505	50.0	20.7	157	63.2	11.4	39.0
WB4792	23.3	22.8	159	64.6	10.8	37.4
Whistler	66.7	22.7	159	61.7	11.7	48.8
Yellowstone	75.0	23.3	160	60.5	12.4	48.9
Mean	47.5	21.5	160	61.7	12.2	37.9
P-Value	<0.0001	0.0142	<0.0001	<0.0001	<0.0001	<0.0001
CV (%)	49.7	9.6	0.9	1.2	5.6	17.3
LSD (0.05)	38.3	3.4	2.3	0.8	0.8	7.5

Planted: 9/11/2020
Harvested: 7/28/2021
Available N (lb/ac): 51
N added (lb/ac): 74.5 lb/ac
(Julian*) is a continuous count of days since January 1
† Grain yield were adjusted to 12.0% moisture
Herbicide Application: Gold Sky @ 1 pt/ac on 5/14/21

Previous crop: fallow
Soil Type: William Clay Loam
Plot Width: 5 ft
P2O5 available (ppm): 23
P2O5 applied (lb/ac): 26
Crop Year Precipitation: 7.45 inch

Barley Variety Descriptions

Variety	Origin[1]	Use[2]	Year released	Height	Maturity	Resistance to[3]					Quality Factors	
						Lodging	Stem Rust	Loose Smut	Net Blotch	Spot Blotch	Test Weight	Grain Protein
Two-Row												
AAC Synergy	SY	M/F	2015	M SHORT	M LATE	MR	MR	NA	MR	MR	MEDIUM	M LOW
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	S	NA	NA
AC Metcalfe	Canada	M	1997	MEDIUM	LATE	M	S	MR	MS	MS	MEDIUM	MEDIUM
CDC Bow	Canada	M	2019	Medium	Late	MR	R	MS	MS	MR	High	Medium
CDC Copeland	Canada	M	1999	TALL	M LATE	MS	MR	S	MS	VS	LOW	MEDIUM
CDC churchill	canada	M/F	2016	MEDIUM	LATE	MR	MR	MS	MR	M	MEDIUM	M LOW
Celebration	BARI	M/F	2008	M SHORT	MEDIUM	MR	S	NA	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
esma	canada	M	2020	MEDIUM	LATE	MR	NA	NA	NA	NA	M LOW	
Explorer	Secobra	M	NA	M SHORT	M LATE	MR	NA	NA	MR	S	NA	NA
Haxby	MT	F	2003	MEDIUM	MEDIUM	MS	S	S	S	MS	V HIGH	MEDIUM
Hockett	MT	F/F	2008	MEDIUM	MEDIUM	MS	S	S	NA	NA	MEDIUM	M HIGH
LCS Genie	Lime	M	NA	SHORT	MEDIUM	MR	NA	NA	MS	S	NA	NA
LCS Odyssey	Lime	M/F	NA	SHORT	MEDIUM	M	NA	NA	NA	NA	NA	NA
ND Genesis	NDSU	F/F	2015	MEDIUM	M LATE	MR	S	NA	MR	MR	HIGH	LOW
Pinnacle	NDSU	F/F	2006	MEDIUM	M LATE	MR	S	S	MS	MR	HIGH	LOW
Sirish	SYNGENTA	M	NA	SHORT	M LATE	MR	S	S	MS	MS	MEDIUM	MEDIUM
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												
AB Advantage	canada	F/H	2020	TALL	M LATE	M	NA	NA	NA	NA	M HIGH	NA
CDC Austenson	canada	F/H	2006	MEDIUM	LATE	MR	NA	NA	NA	NA	M HIGH	NA
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; SY = Syngenta; WB = WestBred.
[2]F = Feed; M = Malt; H = Hay

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

NORTH DAKOTA STATE UNIVERSITY

Williston Research Extension Center

Barley Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Days to heading	Plant height	Plumps	Thins	Protein†	Test weight	Yield		
							2021	2-Yr Avg	3-Yr Avg*
	(DAP)	(in)	(%)	9%)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
Two-Row									
Pinnacle	68	17	86.0	2.1	12.5	49.3	20.0	30.1	56.5
ND Genesis	70	20	83.0	1.8	13.2	47.3	18.8	29.8	56.4
Explorer	72	16	87.5	1.5	16.4	50.5	25.7	31.7	56.4
AAC Synergy	73	18	88.0	1.8	16.0	47.4	15.8	26.1	52.5
Conlon	67	18	94.7	0.8	15.0	50.6	22.8	29.2	50.3
CDC Bow	75	18	93.0	0.9	15.4	46.8	14.5	25.3	49.5
AAC Connect	69	18	89.7	1.0	16.0	48.3	13.7	25.9	49.0
ESMA	71	17	84.2	1.8	13.9	50.5	37.0	-	-
Brewski	72	17	80.4	2.4	13.4	49.0	29.4	-	-
ABI Cardinal	75	17	90.6	1.2	15.4	49.0	22.4	-	-
CDC CHURCHILL	75	17	88.7	1.0	15.3	49.2	20.2	-	-
CDC AUSTENSON	72	18	77.8	2.7	14.8	49.4	19.0	-	-
CDC Fraser	76	17	90.5	1.1	14.8	46.4	16.4	-	-
Six-Row									
Tradition	67	16	67.6	2.0	14.1	49.8	25.7	26.8	42.3
AB ADVANTAGE	69	20	91.8	1.1	14.4	43.6	18.2	-	-
Mean	71	17	85.9	1.6	14.0	48.7	23.9	-	-
CV (%)	1.6	5.3	3.5	24.0	5.6	1.7	25.8	-	-
LSD (5%)	1.8	1.5	4.9	0.6	1.3	1.4	10.1	-	-
LSD (10%)	1.5	1.3	4.1	0.5	1.1	1.2	8.4	-	-

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

Planted: 04/29/2021 — Harvested: 08/11/2021

Soil test (0-6"): P=2039 ppm; K=285380 ppm; pH=5.8; OM=2.1% — Soil type: Williams-Bowbells loam

(0-24"): NO3-N=13 lb/a

Applied fertilizers in lb/a: N=30; P_2O_5=20; K_2O=0

Herbicides applied: 06-22-2021: Bromac @ 1.5 pts/A

WREC Staff - 2021 Field Day

Dryland Intrastate Barley Evaluation - MSU EARC, Sidney, MT 2021

Variety	Plant Height (inch)	Days to Heading (Julian*)	Plump >6/64 (%)	Regular>5/64 (%)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Hockett	20.8	170	62.0	32.9	50.2	13.8	62.9
Merit57	21.1	172	28.5	54.2	44.3	15.9	52.8
MT16M00707	23.3	168	80.5	16.4	50.6	12.7	67.1
MT16M00709	21.9	169	68.7	25.2	48.4	12.8	59.0
MT16M01801	21.2	172	61.6	30.9	47.8	13.6	61.2
MT16M01902	20.0	165	83.9	13.7	49.4	13.9	65.3
MT16M02201	21.6	165	77.9	19.4	48.0	13.6	61.1
MT16M05403	20.7	173	50.4	42.8	50.3	13.7	65.6
MT16M05610	20.4	174	74.5	22.8	48.1	14.4	58.4
MT16M09602	18.3	166	88.1	10.5	52.7	13.0	52.7
MT17M00302	23.2	172	46.2	47.1	49.3	14.4	60.5
MT17M01711	21.3	166	61.9	31.6	47.2	13.7	64.2
MT17M01906	20.7	166	82.7	14.4	49.7	13.1	63.7
MT17M01908	22.7	167	87.0	11.4	50.9	12.7	63.6
MT17M02507	19.9	167	62.9	32.3	48.9	13.5	70.4
MT17M04801	23.7	168	67.3	29.0	50.3	14.1	61.6
MT17M05416	19.7	168	55.9	38.6	47.9	14.2	56.6
MT17M05502	23.5	172	56.3	38.6	48.5	14.2	59.3
MT17M05508	22.4	169	50.2	43.0	48.2	13.7	57.1
MT17M05808	19.7	169	65.5	31.0	48.0	14.1	54.8
MT17M06305	23.7	173	60.7	33.4	46.9	13.9	53.6
MT18M06008	18.9	165	88.0	10.0	53.4	13.1	48.5
MT18M06009	21.1	165	88.6	9.6	50.4	13.1	60.2
MT18M06011	20.5	164	86.6	10.6	53.1	13.4	62.5
MT18M06012	19.1	166	87.0	11.8	50.4	12.1	61.7
MT18M09205	19.2	171	64.0	30.2	46.3	13.3	52.3
MT18M09301	22.0	174	63.5	32.6	45.4	14.5	56.9
MT18M09403	22.9	169	81.4	16.3	50.4	14.6	57.3
MT18M09602	21.5	169	71.3	24.6	50.0	12.8	59.2
MT18M09802	21.3	177	43.6	46.1	46.8	15.3	57.8
MT18M09804	22.1	171	53.7	39.8	48.1	14.9	57.2
MT18M09901	20.7	177	42.3	50.0	44.0	16.0	55.8
MT18M09902	22.1	173	49.8	42.8	48.1	14.6	58.3
MT18M09904	20.0	175	44.6	47.6	47.3	15.2	60.1
MT18M10106	22.4	172	70.8	25.4	50.5	13.1	72.8
MT18M10107	21.1	174	56.4	38.5	49.7	14.9	55.3
MT18M10204	19.6	166	77.3	19.4	51.2	13.6	62.5
MT18M10205	20.7	166	86.5	12.2	52.4	14.0	49.4
MT18M10207	21.7	166	81.1	15.8	49.8	14.4	60.2
MT18M10208	22.5	168	64.1	30.9	50.6	14.3	60.8
MT18M10401	22.0	173	39.2	51.1	46.5	15.2	51.3
MT18M11002	20.9	169	51.7	42.5	50.0	13.6	66.2
MT18M11004	20.8	171	30.5	61.5	49.3	13.2	64.3
MT18M11006	21.2	168	43.9	47.9	48.5	14.7	61.7
MT18M11101	19.5	169	36.5	54.8	47.4	14.5	55.3
MT18M11103	21.1	176	42.8	47.1	44.6	14.4	58.8
MT18M11105	18.5	177	44.9	46.1	47.9	14.8	54.5
MT18M11106	22.7	166	74.8	21.6	51.2	13.8	68.4
Odyssey	19.5	178	61.1	34.5	46.7	14.8	62.0
Mean	21.1	170	63.2	31.4	48.9	14.0	59.6
P-Value	0.0007	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0003
CV (%)	7.7	1.1	12.0	19.8	1.7	5.8	10.0
LSD (0.05)	2.6	3.0	12.3	10.1	1.3	1.3	9.7

Planted: 4/6/2021 Previous crop: fallow

Harvested: 7/23/2021 Soil Type: William Clay Loam

(Julian*) is a continuous count of days since January 1 Plot Width: 5 ft

† Test weight and grain yield were adjusted to 12.0% moisture Soil Test N Crop Year Precipitation: 7.45 inch

Avail (lb/ac): 62.5 lb/ac Soil Test P2O5 (ppm): 21.7 ppm

N added (lb/ac): 60 lb/ac P2O5 added (lb/ac): 26 lb/ac

Herbicide applied: Defy LV-6 @ 20 oz/ac & Axial @ 15 oz/ac on 6/1/21

Dryland Hulless Barley Evaluation - MSU EARC, Sidney, MT 2021

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Havener	21.2	177	59.8	16.1	54.6
MT16H09302	22.9	170	58.8	14.6	52.3
MT16H09308	23.9	171	61.1	13.7	45.2
MT18H01901	24.8	172	60.1	15.7	25.8
MT18H02702	21.6	173	58.5	15.9	52.8
MT18H02801	24.0	178	59.0	16.5	54.9
MT18H02901	23.9	172	60.5	15.8	46.3
MT18H03003	24.0	169	57.2	15.5	45.5
MT18H03101	20.1	171	61.4	15.4	42.6
MT19_H08_15	17.7	175	58.8	15.5	39.2
MT19_H11_04	22.8	176	58.1	17.1	53.9
MT19_H11_05	23.3	177	57.0	17.1	53.7
MT19_H11_07	21.2	174	56.5	16.9	49.7
MT19_H11_13	23.9	177	57.4	16.7	49.3
MT19_H14_05	22.3	176	58.5	18.1	55.9
MT19_H14_10	22.9	174	60.7	17.3	45.8
Mean	22.5	174	59.0	16.1	48.0
P-Value	0.0072	0.0002	<0.0001	<0.0001	0.0006
CV (%)	8.3	1.4	1.2	3.1	14.1
LSD (0.05)	3.1	4.0	1.2	0.8	11.2

Planted: 4/6/21
Harvested: 8/2/21
(Julian*) is a continuous count of days since January 1 † Test weight and grain yield adjusted to 12.0% moisture Soil Test N Avail (lb/ac): 62.5 lb/ac
N added (lb/ac): 60 lb/ac
Herbicide applied: Defy LV-6 @ 20 oz/ac & Axial @ 15 oz/ac on 6/1/21

Previous crop: fallow
Soil Type: William Clay Loam
Plot Width: 5 ft
Crop Year Precipitation: 7.45 inch
Soil Test P2O5 (ppm): 21.7 ppm
P2O5 added (lb/ac): 26 lb/ac

"Be happy with what you have while working for what you want."
HELEN KELLER

Forage Barley - MSU EARC, Sidney, MT 2021

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Haymaker	31.1	178	45.0	14.7	44.9
Hays	28.5	181	44.2	13.6	54.3
Lavina	30.1	176	45.0	14.0	75.3
MT16F01601	32.4	174	46.3	13.5	66.7
MT16F02408	29.5	175	47.5	14.7	62.0
MT16F02410	29.1	177	44.7	14.2	64.1
MT16F02902	32.1	177	44.8	14.1	63.7
MT17F01611	30.9	177	45.1	13.8	63.2
MT17F02406	31.2	176	44.7	13.6	51.6
MT18F00403	31.7	180	43.0	14.8	51.8
MT18F00503	29.5	179	42.8	14.5	54.0
MT18F00507	30.7	180	42.4	14.7	55.8
MT18F00607	32.9	183	44.4	14.6	52.1
MT18F00803	28.1	179	41.2	14.0	53.7
MT18F01010	28.1	179	42.2	13.7	41.3
MT18F01104	33.5	175	44.0	14.1	47.9
MT19_F03_05	28.0	178	45.0	14.1	65.2
MT19_F04_02	30.7	177	43.4	14.0	61.7
MT19_F04_03	28.9	175	46.5	13.4	67.1
MT19_F05_03	27.5	172	44.1	13.7	66.7
MT19_F05_04	30.1	176	42.3	12.3	69.2
MT19_F06_02	27.9	175	43.7	14.0	69.8
MT19_F06_04	26.8	177	40.8	15.0	45.8
MT19_F07_02	30.1	175	47.8	15.1	33.3
MT19_F07_04	29.5	172	45.0	12.8	70.3
Mean	30.0	177	44.2	14.0	58.1
P-Value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
CV (%)	5.4	0.6	1.7	4.4	16.0
LSD (0.05)	2.64	1.8	1.2	1.0	15.3

Planted: 4/28/21
Harvested: 8/6/21
(Julian*) is a continuous count of days since January 1 † Test weight and grain yield adjusted to 12.0% moisture Soil Test N Avail (lb/ac): 26 lb/ac
N added (lb/ac): 60 lb/ac
Herbicide applied: Defy LV-6 @ 20 oz/ac & Axial @ 15 oz/ac on 5/26/21
Huskie FX @ 18 oz/ac on 6/13/21

Previous crop: sugar beet
Soil Type: Savage Silty Clay
Plot Width: 5 ft
Crop Year Precipitation: 6.47 inch
Irrigation (sprinkler): 2.68 inch
Soil Test P2O5 (ppm): 13 ppm
P2O5 added (lb/ac): 26 lb/ac

Barley Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Plant Height (in)	Days to Head (DAP+)	Lodging (0 - 9*)	Protein† 2021 (%)	Protein† 2-Yr Avg (%)	Protein† 3-Yr Avg (%)	Test Weight (lb/bu)	Plump % (>6/64)	Yield 2021‡ (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
Celebration	24	56	1	14.4	13.7	14.4	51.1	89	76.1	114.9	122.3
Tradition	25	56	0	14.1	13.6	14.0	51.1	88	70.1	104.8	117.7
Innovation	21	55	0	14.1	13.1	13.6	50.6	82	78.1	111.9	117.1
ND Genesis	24	62	0	13.0	12.3	12.6	52.2	90	76.0	107.5	115.8
AAC Synergy	26	62	0	13.2	12.9	13.7	51.6	90	83.9	106.3	111.4
AAC Connect	21	63	1	13.4	13.1	13.5	50.7	80	61.9	96.1	111.1
Explorer	21	61	0	14.4	13.2	13.6	50.2	87	72.0	97.0	110.8
Pinnacle	22	61	0	13.8	12.4	12.8	51.9	91	63.5	94.4	109.5
Hockett	19	61	0	13.2	13.1	13.7	52.8	85	65.2	90.5	101.5
Conlon	23	54	0	13.9	13.5	13.8	52.0	92	43.8	79.0	89.9
CDC Bow	24	64	0	13.5	13.1	-	51.1	91	80.1	109.0	-
CDC Austenson	24	62	0	13.7	-	-	53.3	87	95.1	-	-
BC Lexy	21	61	0	14.6	-	-	49.0	87	87.5	-	-
BC Ellinor	21	62	0	12.8	-	-	47.8	85	84.8	-	-
Brewski	23	61	0	13.2	-	-	51.4	90	82.5	-	-
CDC Churchill	21	61	1	14.3	-	-	51.6	83	79.0	-	-
CDC Fraser	23	63	0	13.9	-	-	50.1	88	78.0	-	-
BC Leandra	17	65	0	13.1	-	-	47.9	77	74.2	-	-
AB Advantage	25	62	0	13.8	-	-	48.7	85	71.7	-	-
ABI Cardinal	21	63	0	13.2	-	-	51.5	88	69.6	-	-
MEAN	22.3	60.6	-	13.69	13.11	13.56	50.83	65.0	74.65	101.04	110.70
C.V. (%)	-	-	-	8.08	-	-	7.89	9.78	17.60	-	-
LSD (5%)	-	-	-	NS	-	-	6.69	4.44	18.61	-	-
LSD (10%)	-	-	-	1.52	-	-	0.75	3.70	15.54	-	-

+ Days after planting * 0: no lodging - 9: plants lying flat on the ground † Protein content adjusted to 0% moisture ‡ Hail storm on July 22, 2021

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W — Elevation: 1902 ft
Soil test (0-6 in.): P=18 ppm; K=170 ppm; pH=7.7; OM=2.1 % — Previous crop: Sugarbeet
(0-24 in.): NO3-N=12 lb/a — Planted: 5/4/2021
Yield goal: 120 bu/a — Harvested: 8/13/2021
Planting population: 1.25 million seeds/a — Soil type: Lihen Loamy Fine Sand
Applied fertilizer: 170 lb/a of Urea (46-0-0) [4/22] — Plot size: 92 ft^2
Herbicides applied: Starane Flex (13.5oz/a), Bison (1.5pt/a), and Axial Bold (15oz/a) [6/17] — Rainfall: 6.7 inches (5/4 - 8/13)
Fungicides applied: Prosaro 421 (8.2oz/a) [7/1] — Irrigation: 14.6 inches (5/4 - 8/13)

Irrigated Intrastate Barley Evaluation - MSU EARC, Sidney, MT 2021

Variety	Plant Height (inch)	Days to Heading (Julian*)	Plump >6/64 (%)	Regular 5/64 (%)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Hockett	25.7	181	72.4	21.5	46.9	13.9	55.6
Merit57	27.1	179	72.6	22.1	47.2	13.2	61.1
MT16M00707	27.6	178	74.2	20.3	47.7	12.3	60.9
MT16M00709	28.5	177	74.8	18.6	46.8	11.3	64.2
MT16M01801	29.5	180	72.3	19.1	46.7	11.8	67.9
MT16M01902	26.0	175	79.0	16.0	46.6	12.3	76.8
MT16M02201	23.7	174	79.7	15.5	43.9	11.9	60.3
MT16M05403	27.2	180	72.0	22.1	47.1	13.2	51.9
MT16M05610	25.6	180	75.7	19.4	46.8	13.1	53.2
MT16M09602	24.4	176	84.7	11.6	49.3	11.7	61.7
MT17M00302	25.9	181	71.2	21.7	48.0	11.9	61.5
MT17M01711	24.3	174	69.0	24.6	45.3	12.8	66.4
MT17M01906	26.0	173	70.7	20.9	45.8	12.7	61.8
MT17M01908	27.6	174	81.9	13.9	47.4	11.6	65.5
MT17M02507	27.5	178	75.5	18.8	48.2	11.4	70.2
MT17M04801	26.9	178	70.8	22.2	46.9	12.5	62.5
MT17M05416	24.9	181	64.0	28.1	45.2	13.2	50.4
MT17M05502	27.6	181	74.3	20.6	47.8	14.6	42.6
MT17M05508	28.8	181	68.1	24.3	46.1	13.3	55.1
MT17M05808	26.3	178	68.5	35.4	45.1	14.0	52.5
MT17M06305	30.1	181	80.0	15.7	46.6	14.3	29.0
MT18M06008	26.1	172	83.9	12.1	48.1	11.6	67.1
MT18M06009	22.8	173	79.7	16.2	45.5	12.0	57.0
MT18M06011	23.9	172	84.2	11.0	48.6	12.0	69.2
MT18M06012	24.5	174	77.9	18.3	46.1	11.9	54.2
MT18M09205	28.9	181	73.9	20.5	44.9	12.0	50.1
MT18M09301	28.0	181	80.0	15.9	46.5	13.2	51.7
MT18M09403	26.9	180	82.7	13.8	47.0	14.4	50.3
MT18M09602	25.2	179	75.3	19.1	46.8	11.9	57.1
MT18M09802	24.9	182	60.4	27.1	45.1	14.4	36.3
MT18M09804	25.5	181	69.6	22.4	46.9	13.0	56.3
MT18M09901	26.5	183	75.0	19.5	45.3	13.2	51.2
MT18M09902	29.2	181	68.1	41.6	45.3	12.7	53.0
MT18M09904	25.9	181	71.0	22.5	46.2	13.6	59.4
MT18M10106	27.1	180	71.2	20.9	47.9	12.1	58.0
MT18M10107	25.6	181	68.1	24.9	46.6	14.6	39.1
MT18M10204	22.8	174	75.6	18.8	46.7	13.0	64.8
MT18M10205	25.6	173	83.2	13.1	49.5	13.2	58.3
MT18M10207	25.1	175	82.0	13.7	48.9	13.0	67.2
MT18M10208	26.3	176	80.6	14.7	49.6	11.9	69.3
MT18M10401	24.9	181	65.3	27.2	47.2	13.3	53.1
MT18M11002	25.5	180	64.1	27.2	47.7	12.7	69.4
MT18M11004	25.7	180	60.1	32.3	47.7	12.4	66.9
MT18M11006	25.2	178	64.3	25.5	47.4	12.2	64.9
MT18M11101	23.3	178	69.0	22.5	47.9	12.5	70.8
MT18M11103	25.7	181	68.6	24.0	44.7	12.8	63.6
MT18M11105	24.7	181	74.4	19.7	47.9	12.7	67.5
MT18M11106	25.9	179	75.2	19.1	48.6	12.8	68.6
Odyssey	23.5	181	82.2	13.5	45.9	12.8	59.3
Mean	26.0	178	73.8	20.6	46.9	12.7	58.9
P-Value	0.0001	<0.0001	<0.0001	0.0076	<0.0001	<0.0001	<0.0001
CV (%)	7.3	0.8	9.0	37.9	2.2	6.5	15.8
LSD (0.05)	3.1	2.4	10.7	12.7	1.7	1.4	15.1

Planted: 4/28/21
Harvested: 8/6/21
(Julian*) is a continuous count of days since January 1 † Test weight and grain yield adjusted to 12.0% moisture Soil Test N Avail (lb/ac): 26 lb/ac
N added (lb/ac): 60 lb/ac
Herbicide applied: Defy LV-6 @ 20 oz/ac & Axial @ 15 oz/ac on 5/26/21
Huskie FX @ 18 oz/ac on 6/13/21

Previous crop: sugar beet
Soil Type: Savage Silty Clay
Plot Width: 5 ft
Crop Year Precipitation: 6.47 inch
Irrigation (sprinkler): 2.68 inch
Soil Test P2O5 (ppm): 13 ppm
P2O5 added (lb/ac): 26 lb/ac

Irrigated Hulless Barley Evaluation - MSU EARC, Sidney, MT 2021

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight† (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Havener	26.5	180	56.4	14.2	57.7
MT16H09302	26.4	176	53.4	15.6	37.4
MT16H09308	24.1	177	55.2	14.7	22.5
MT18H01901	25.7	173	54.2	16.2	14.5
MT18H02702	27.9	180	54.9	14.9	50.9
MT18H02801	26.5	185	56.3	15.0	39.6
MT18H02901	26.5	177	55.9	16.5	33.0
MT18H03003	25.6	172	51.2	15.7	34.4
MT18H03101	26.3	180	58.1	15.8	40.1
MT19_H08_15	25.3	183	54.3	15.2	23.3
MT19_H11_04	29.7	182	53.7	15.8	52.4
MT19_H11_05	26.3	181	53.1	17.0	41.8
MT19_H11_07	24.1	182	54.0	16.7	36.8
MT19_H11_13	24.7	183	56.6	16.9	32.9
MT19_H14_05	27.1	179	52.7	17.2	45.7
MT19_H14_10	27.9	181	56.1	17.7	32.1
Mean	26.3	179	54.8	15.9	37.2
P-Value	0.2718	<0.0001	<0.0001	<0.0001	<0.0001
CV (%)	8.4	1.1	2.6	3.7	15.6
LSD (0.05)	3.7	3.4	2.3	1.0	9.7

Planted: 4/28/21
Harvested: 8/6/21
(Julian*) is a continuous count of days since January 1 † Test weight and grain yield adjusted to 12.0% moisture Soil Test N Avail (lb/ac): 26lb/ac
N added (lb/ac): 60 lb/ac
Herbicide applied: Defy LV-6 @ 20 oz/ac & Axial @ 15 oz/ac on 5/26/21
Huskie FX @ 18 oz/ac on 6/13/21

Previous crop: sugarbeet
Soil Type: Savage Silty Clay
Plot Width: 5 ft
Crop Year Precipitation: 6.47 inch
Irrigation (sprinkler): 2.68 inch
Soil Test P2O5 (ppm): 13 ppm
P2O5 added (lb/ac): 26 lb/ac

"Agriculture is our wisest pursuit, because it will in the end contribute most to real wealth, good morals, and happiness."

- Thomas Jefferson

OAT VARIETY DESCRIPTIONS

VARIETY	ORIGIN[1]	YEAR RELEASED	GRAIN COLOR	HEIGHT	MATURITY	RESISTANCE TO[2]				QUALITY FACTORS	
						LODGING	STEM RUST	CROWN RUST	BARLEY YELLOW DWARF	TEST WEIGHT	GRAIN PROTEIN
AC PINNACLE	CANADA	1999	WHITE	TALL	LATE	MS	R	R	S	MEDIUM	LOW
BEACH	NDSU	2004	WHITE	TALL	M LATE	MR	S	MR/MS	MS	MEDIUM	M HIGH
CDC DANCER	CANADA	2000	WHITE	TALL	LATE	MR	S	MS	S	HIGH	MEDIUM
CDC MINSTREL	CANADA	2006	WHITE	TALL	LATE	MR	S	S	S	M HIGH	MEDIUM
CS CAMDEN	CANTERRA	2016	WHITE	MEDIUM	MED	R	S	MS	NA	NA	NA
DEON	MN	2013	YELLOW	TALL	LATE	R	S	R	T	V HIGH	NA
HAYDEN	SDSU	2014	WHITE	MEDIUM	MED	M	S	MR/MS	MR	M HIGH	MEDIUM
HIFI	NDSU	2001	WHITE	TALL	LATE	MR	MR	R	T	M HIGH	MEDIUM
HYTEST	SDSU	1986	WHITE	TALL	EARLY	MS	S	MS	S	V HIGH	HIGH
JURY	NDSU	2012	WHITE	TALL	LATE	MS	R	R	MR	M HIGH	MEDIUM
KILLDEER	NDSU	2000	WHITE	MED	MED	MR	S	MS	MR	M HIGH	MEDIUM
LEGGETT	CANADA	2005	WHITE	TALL	LATE	MR	MR	R	S	MEDIUM	MEDIUM
NEWBURG	NDSU	2011	WHITE	TALL	LATE	MS	R	R	MR	MEDIUM	MEDIUM
OTANA	MT	1977	WHITE	TALL	LATE	S	S	S	S	HIGH	MEDIUM
ORE3541M	CANADA	2018	WHITE	MEDIUM	LATE	R	S	R	MS	HIGH	M HIGH
ORE3542M	CANADA	2019	WHITE	MEDIUM	LATE	R	S	R	S	M HIGH	MEDIUM
PAUL	NDSU	1994	HULLESS	V TALL	LATE	MS	R	MR	T	V HIGH	HIGH
ROCKFORD	NDSU	2008	WHITE	TALL	LATE	R	S	R	MR	M HIGH	MEDIUM
SOURIS	NDSU	2006	WHITE	MED	MED	R	MS	R	MS	HIGH	MEDIUM
STALLION	SDSU	2006	WHITE	TALL	LATE	M	S	MR	NA	HIGH	MEDIUM

[1]Refers to developer: CANADA represents developers from that country; MN = Minnesota; MT = Montana State University; NDSU = North Dakota State University; SDSU = South Dakota State University.

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

Oats Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Days to heading (DAP)	Plant height (in)	Test weight (lb/bu)	2021 (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
CS Camden	64	21	41.7	34.2	53.0	100.3
Killdeer	63	22	41.8	24.4	49.6	98.0
Rockford	65	21	42.0	32.9	50.7	95.3
Jury	65	19	39.7	21.2	45.0	91.1
Leggett	64	25	40.6	16.5	40.2	90.4
Deon	65	20	43.2	31.7	45.9	89.5
Otana	65	21	38.1	31.6	48.7	89.5
Warrior	66	18	41.8	29.2	45.6	85.7
Minstrel CDC	62	21	39.2	18.8	41.9	85.6
Newburg	65	21	41.6	27.1	48.5	81.6
ORE3541M	65	22	39.7	25.8	46.4	79.9
HiFi	63	22	36.9	13.2	37.2	79.5
ND Heart	65	21	41.9	28.9	43.7	76.4
ORE 3541M	66	20	36.6	14.8	40.9	76.2
Beach	63	20	39.9	21.0	41.7	73.8
Hytest	64	21	36.2	14.0	35.0	65.7
Paul	65	22	-	4.8	22.9	55.3
AAC DOUGLAS	62	20	41.0	29.8		
Mean	64.4	20.5	38.9	20.5	-	-
CV (%)	1.7	8.7	3.9	14.8	-	-
LSD (5%)	1.8	2.9	2.5	5.0	-	-
LSD (10%)	1.5	2.4	2.1	4.1	-	-

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

Planted: 04-27-2021 Harvested:08-13-2021 Previous crop: Soybeans

Soil test (0-6"): P=39 ppm; K=400 ppm; pH=6.3; OM=2.1%

(0-24"): NO3-N=32 lb/a Soil type: Williams-Bowbells loam

Applied fertilizers in lb/a: N=46; P_2O_5=20; K_2O=0

Herbicide Application: Bromac @ 1.5pts/a 6/22/2021

Oat Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Plant Height (in)	Days to Head (DAP +)	Lodging (0 - 9*)	Test Weight (lb/bu)	Yield 2021† (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
CS Camden	33	59	2	40.1	137.7	178.0	181.3
Deon	35	61	1	42.1	128.8	163.5	167.4
ND Heart	34	57	1	40.9	129.2	162.1	-
Warrior	32	58	1	42.3	115.2	157.6	-
Rockford	33	60	0	43.2	123.8	144.8	-
Jury	38	59	1	41.3	121.1	135.7	-
AAC Douglas	30	56	0	40.7	132.6	132.6	-
Paul	31	61	2	49.7	107.8	110.0	-
MEAN	33.9	59.2	1.3	42.7	123.31	151.16	174.36
C.V. (%)	-	-	-	1.07	11.22	-	-
LSD (5%)	-	-	-	0.79	20.55	-	-
LSD (10%)	-	-	-	0.65	17.00	-	-

+ Days After Planting * 0: no lodging - 9: plants lying flat on the ground † Hail storm on July 22, 2021

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W
Elevation: 1902 ft
Soil test (0-6 in.): P=18 ppm; K=170 ppm; pH=7.7; OM=2.1 %
Previous crop: Sugarbeet
(0-24 in.): NO3-N=12 lb/a
Planted: 5/4/2021
Yield goal: 200 bu/a
Harvested: 8/17/2021
Planting population: 1.25 million seeds/a
Soil type: Lihen Loamy Fine Sand
Applied fertilizer: 460 lb/a of Urea (46-0-0) [4/26]
Plot size: 92 ft^2
Herbicides applied: Starane Flex (13.5oz/a) and Bison (1.5pt/a) [6/17]
Rainfall: 6.7 (5/4 - 8/17)
Fungicides applied: none applied
Irrigation: 14.6 inches (5/4 - 8/17)

Wheat Variety Comparisons, Williston, ND 2021

Gautam Pradhan, Jerald Bergman, Kyle Dragseth

The gross return per acre was based on three-year average yield and protein (2019, 2020, 2021) from dryland varietal trials, and the market price obtained in the second week of December 2021 from grain elevators in and around Williston.

Spring Wheat

Variety	3 Yr Avg. Yield	3 Yr Avg. Protein	Gross Return	+ or - ND VitPro
	bu/a	%	$/a	$/a
AAC Brandon	41.4	17.2	402.40	59.11
TCG-Spitfire	40.3	16.7	391.39	48.11
Elgin-ND	39.9	16.9	387.66	44.37
LCS Trigger	39.8	15.6	386.54	43.26
Faller	39.6	17.0	384.50	41.22
LCS Rebel	39.5	16.6	383.69	40.40
SY Longmire	38.7	17.4	376.18	32.89
SY Rockford	38.5	17.0	374.12	30.84
SY Valda	38.2	16.7	371.77	28.48
Lanning	38.1	17.5	370.62	27.34
Commander	37.9	17.1	368.50	25.21
TCG-Heartland	37.6	17.7	365.23	21.95
Ambush	37.5	17.9	364.53	21.24
CP3915	37.4	17.5	363.28	20.00
Lang-MN	37.3	17.3	362.52	19.23
SY McCloud	37.3	17.7	362.47	19.19
Glenn	36.4	16.9	353.58	10.29
MS Barracuda	36.4	16.9	353.34	10.06
SY Ingmar	36.3	16.8	352.84	9.56
SY Soren	36.3	17.5	352.62	9.34
CP3530	35.9	16.4	349.11	5.83
ND Frohberg	35.8	17.5	348.04	4.76
ND VitPro	35.3	16.6	343.28	**0.00**
LCS Cannon	34.9	15.9	339.23	-4.05
MN-Washburn	34.4	16.7	334.55	-8.74
Bolles	34.3	18.5	333.22	-10.07

Durum

Variety	3 Yr Avg. Yield	3 Yr Avg. Protein	Gross Return	+ or - ND Riveland
	bu/a	%	$/a	$/a
Grenora	38.7	17.2	618.95	14.01
TCG-Bright	38.0	16.6	607.29	2.35
ND Riveland	37.8	17.8	604.95	**0.00**
CDC Verona	37.2	18.7	595.87	-9.08
AC Commander	37.2	18.3	595.80	-9.15
Mountrail	36.5	17.7	583.63	-21.31
Divide	36.2	17.9	579.47	-25.48
VT Peak	36.1	18.0	577.03	-27.92
Carpio	35.9	17.1	573.77	-31.18
Alkabo	35.5	17.2	568.48	-36.46
Tioga	35.4	17.0	566.24	-38.70
ND Grano	35.1	18.0	562.40	-42.55
Rugby	35.0	18.1	559.99	-44.95
Joppa	34.8	17.1	557.38	-47.56
Strongfield	34.7	19.0	555.72	-49.22
Ben	34.6	18.1	553.85	-51.10
Maier	34.1	18.5	545.40	-59.54
Lebsock	34.0	17.4	544.63	-60.31
Pierce	33.6	17.3	537.12	-67.83
Normanno	32.1	16.7	513.49	-91.45
Alzada	31.8	17.5	508.46	-96.49

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	FAIR	GOOD	V HIGH	LOW	MED	S	NA
Cardinal	MT/NDSU	YES	N	HIGH LINO	V GOOD	V GOOD	HIGH	FAIR	MED	T	MT
Chickadee	STI	YES	N	HIGH LINO	V GOOD	V GOOD	HIGH	GOOD	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 446	STI	YES	N	HIGH OLEIC	V GOOD	V GOOD	V HIGH	FAIR	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	MS	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.

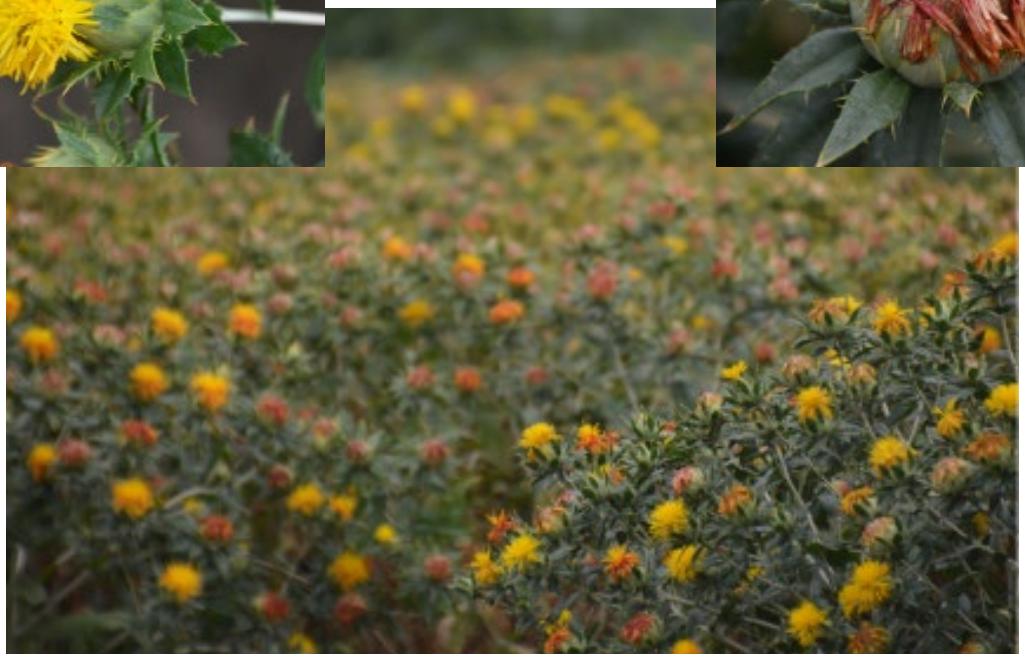
[2]PVP = Plant Variety Protection. "YES" indicates that the variety is protected, and the seed may be sold for planting purposes only as a class of certified seed (Title V option) and/or exclusive licensed variety.

[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



Safflower Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Stand	Days to Flowering	Plant height	Oil	Test weight	2021	Yield	
							2-Yr Avg	3-Yr Avg*
	(%)	(DAP)	(in)	(%)	(lb/bu)		(lb/a)	(lb/a)
Chickadee	73	66	14.0	39.1	42	906	1088	1347
Cardinal	62	66	15.0	37.0	42.9	819	1049	1227
Montola 2000	48	66	12.9	39.6	39.0	946	1071	1198
Hybrid 446	38	67	15.0	30.7	43.3	879	1050	1158
Montola 2003	73	67	13.4	38.8	41.1	818	1065	1115
Hybrid 200	45	66	14.0	32.5	41.9	745	1008	1085
MonDak	45	67	14.8	36.1	41.6	730	945	1084
Finch	75	65	14.7	37.5	43.5	934	1074	1028
NutraSaff	55	68	16.3	49.4	36.7	760	902	930
STI 1201	63	66	11.8	43.6	37.8	749	974	962
Rubis Red	50	67	16.9	29.1	44.5	668	698	846
STI 1401	43	69	15.1	46.9	34.9	598	737	-
Montola 2003	73	67	13.4	38.8	41.1	818	-	-
Mean	55.9	66	14.4	39.9	39.8	725	-	-
CV (%)	15.7	1.8	8.3	2.0	1.0	12.5	-	-
LSD (5%)	14.5	2.0	2.0	1.3	0.7	149.6	-	-
LSD (10%)	12.1	1.7	1.7	1.1	0.5	124.6	-	-

Location: WREC; Latitude 48° 8' N; Longitude 103° 44' W; Elevation 2105 ft Previous Crop: Wheat
Planted: 05/10/2021 Harvested: 09/07/2021
Soil test to 6" in ppm: P= 24 K= 264 pH=6.1 Soil type: Williams-Bowbells loam
Soil test to 24" in lb/a: N= 20
Applied fertilizers in lb/a: N=30; P_2O_5=18; K_2O=0
Applied fungicides: 07/15/2021 - Azoxystar @ 8 oz/A
Applied herbicides: Valor @ 3 oz/a applied October 20th 2020; Roundup @ 32 oz/a (5/08/21)

Safflower Irrigated Variety Trial

MSU-EARC Sidney MT 2021

Variety	Days to Flower	Height	Oil	Test Weight	2021	Yield	
						2-Yr Avg	3-Yr Avg
	(DAP)	(in)	(%)	(lb/bu)	(lb/a)	(bu/a)	(bu/a)
MonDak	65	23.1	41.1	39.8	3651	3462	3312
Montola 2003	65	23.2	41.5	39.2	3335	3179	3184
Hybrid 200	62	21.8	36.3	42.3	3058	3413	3116
Chickadee	65	23.9	42.1	40.8	3366	3296	3082
Hybrid 446	62	24.7	35.6	43.7	3253	3393	3049
STI 1201	64	21.9	47.2	37.5	2814	2928	2686
STI 1401	65	21.5	51.6	34.1	2885	2906	2666
Rubis Red	64	24.0	39.4	45.0	3196	2726	2631
Montola 2000	64	21.5	42.8	38.4	2857	2702	2502
NutraSaff	64	24.4	55.0	36.2	2858	2764	2443
Cardinal	66	27.8	43.7	41.2	3297	2692	2364
Montola 2001	65	24.4	40.5	34.9	2761	2256	2073
Mean	64	23.4	44.2	38.6	2850.0	-	-
CV (%)	1.1	4.9	1.8	2.3	11.9	-	-
LSD (5%)	1.1	1.9	1.3	1.5	558.9	-	-
LSD (10%)	1.0	1.6	1.1	1.2	465.5	-	-

Location: Sidney, MT
Previous Crop: Wheat

Planted: 05/10/2021
Harvested: 09/07/2021

Fertilizer Soil Test: N = 21.2; P = 17.3
Soil type: Williams Clay Loan

Applied fertilizers: N = 80 lbs/a; P = 26 lbs/a

Applied fungicides: none

Applied herbicides: Sonalan HFP @ 7.5 lbs/a on 10/19/20; Sonalan HFP @ 48oz/a on 4/2/21; Assure II @ 12 oz/a on 6/1/21

Irrigation: 2.68" along with 6.44" of rain

Safflower Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Stand (%)	Days to Flower (DAP*)	Days to Maturity (DAP*)	Plant Height (in)	Oil† 2021 (%)	Oil† 2-Yr Avg (%)	Oil† 3-Yr Avg (%)	Test Weight (lb/bu)	Yield 2021‡ (lb/a)	Yield 2-Yr Avg (lb/a)	Yield 3-Yr Avg (lb/a)
Hybrid 446	67	73	118	21	29.1	31.2	33.6	41.9	2332	2172	1989
MonDak	78	75	116	19	33.2	35.2	37.2	39.3	2704	2213	1963
Hybrid 200	55	73	116	20	31.1	32.1	34.3	40.0	2506	2105	1912
Cardinal	88	75	115	22	34.1	38.0	39.0	40.9	2738	2046	1795
Chickadee	76	74	118	20	36.9	37.6	39.2	41.0	2502	1924	1733
Montola 2003	72	76	117	19	35.9	37.8	39.2	40.8	2601	1911	1670
Montola 2000	62	73	117	18	36.1	37.7	39.3	37.7	2229	1747	1630
Rubis Red	54	73	117	21	29.3	32.8	34.4	43.8	1829	1773	1559
Finch	87	72	116	20	35.1	38.2	38.9	39.7	2278	1811	1536
STI1201	44	75	116	19	40.6	41.8	42.5	36.6	1697	1543	1423
Montola 2001	53	75	120	20	36.4	37.3	36.5	33.4	1741	1437	1293
Nutrasaff	61	74	118	21	47.1	48.7	47.5	38.0	1916	1537	1282
STI1401	51	77	120	20	45.5	46.2	46.3	36.0	1719	1408	1220
MEAN	65.3	74.4	117.2	20.0	36.18	38.05	39.07	39.16	2214.9	1817.5	1615.8
C.V. (%)	22.2	2.6	1.3	7.2	3.21	-	-	2.04	16.6	-	-
LSD (5%)	22.6	3.2	2.6	2.3	2.01	-	-	1.30	535.7	-	-
LSD (10%)	18.8	2.6	2.2	2.0	1.68	-	-	1.09	446.2	-	-

+ Days after planting * 0: no lodging - 9: plants lying flat on the ground † Oil content reported on oven dried basis ‡ Hail storm on July 22, 2021

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W — Elevation: 1902 ft
Soil test (0-6 in.): P=30 ppm; K=130 ppm; pH=7.5; OM=1.9 % — Previous crop: Barley
(0-24 in.): NO3-N=47 lb/a — Planted: 5/7/2021
Yield goal: 2,000 lb/a — Harvested: 9/23/2021
Planting population: 278,000 seeds/a — Soil type: Lihen Loamy Fine Sand
Applied fertilizer: 99 lb/a of Urea (46-0-0) [4/29] — Plot size: 55 ft^2
Herbicides applied: Prowl H2O (2pt/a) [5/10] and Section 3 (5.33oz/a) and Superb (1pt/100gal) [6/17] — Rainfall: 7.9 inches (5/7 - 9/23)
Fungicides applied: Priaxor D (8oz/a) [7/28] — Irrigation: 12.9 inches (5/7 - 7/25)

Sunflowers-Express Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Origin	Hybrid Type	Oil Type	Days to Flowering	Plant height	Oil	Test weight	2021	Yield	
									2-Yr Avg	3-Yr Avg
				(DAP)	(in)	(%)	(lb/bu)	(lb/a)	(bu/a)	(bu/a)
CP455E	Croplan	Express	High Oleic	61	27.8	36.5	30.9	1408.3	1710.0	1469.7
E-91 E	Proseed	Express	Nusun	66	47.2	37.2	32.7	1576.6	1596.6	1351.8
N4H302 E	NuSeed	Express	High Oleic	62	39.5	38.1	31.7	1420.5	1366.4	1290.2
Falcon	NuSeed	Express	Nusun	65	41.3	38.8	33.8	1265.9	1209.6	1135.4
H45HO10EX	Dyna-Gro	Express	High Oleic	60	39.0	37.8	31.5	1226.8	1326.5	1113.0
E-93 E	Proseed	Express	Nusun	66	50.4	38.7	31.7	1433.7	1625.0	-
CP432E	Croplan	Express	Nusun	59	48.0	37.0	32.0	1256.0	-	-
H47HO11EX	Dyna-Gro	Express	High Oleic	64	47.9	38.1	32.0	1077.8	-	-
Mean				63	42.4	37.8	32.1	1341.1	-	-
CV (%)				1.5	20.6	5.7	3.2	10.6	-	-
LSD (5%)				1.6	15.1	3.7	1.8	246.3	-	-
LSD (10%)				1.3	12.4	3.1	1.5	202.9	-	-

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

Planted: 06/01/2021 Harvested: 10/08/2021

Soil test to 6" in ppm: P = 24; K = 265; OM =2.0%, pH = 6.1 Soil type: Williams-Bowbells loam.

Soil test to 24" in lb N=20 lb/a DAP = Days after planting.

Applied fertilizers ir N=45; P=20; K=0; S=5

Herbicide Application: Valor @ 3 oz/a (10/21/20); PowerMax @ 32 oz/a (6/2/21); Intensity @ 16 oz/a (7/7/2021)

Sunflowers-Clearfield Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Origin	Hybrid Type	Oil Type	Days to Flowering (DAP)	Plant height (in)	Oil (%)	Test weight (lb/bu)	2021 (lb/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
H45NS16CL	Dyna-Gro	CL	Nusun	63	40.8	39.0	32.7	1623.0	1409	1405
H44HO12CL	Dyna-Gro	CL	High Oleic	60	39.0	40.2	33.3	1205.8	1298	1312
N4H470 CLP	NuSeed	CP	High Oleic	66	38.7	41.7	33.2	1147.8	1086	1200
H42H018CL	Dyna-Gro	CL	High Oleic	63	34.6	37.4	32.3	1064.8	1195	1066
N4H422 CL	NuSeed	CL	High Oleic	64	42.3	38.9	31.7	1635.9	1411	-
E-50016CL	Proseed	CL	High Oleic	64	43.0	36.4	31.2	1398.5	1326	-
N4HM354	NuSeed	CL	Nusun	64	37.8	38.5	32.9	1506.1	-	-
4425CL	Sunopta	CL	MO	66	46.5	32.8	31.2	1457.6	-	-
E-31CL	Proseed	CL	High Oleic	66	48.2	32.3	29.3	1339.0	-	-
12G25CL	Proseed	CL	High Oleic	63	45.5	40.1	33.1	1334.8	-	-
4415HODMCLP	Sunopta	CP	High Oleic	65	47.0	36.7	31.0	1121.9	-	-
Mean				64	42.5	37.5	31.9	1362.4	-	-
CV (%)				1.7	5.7	5.0	2.5	14.3	-	-
LSD (5%)				1.8	4.1	3.2	1.4	330.7	-	-
LSD (10%)				1.5	3.4	2.6	1.1	273.8	-	-

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

Planted: 06/01/2021 Harvested: 10/08/2021

Soil test to 6" in ppm: P = 24; K = 265; OM =2.0%, pH = 6.1 Soil type: Williams-Bowbells loam.

Soil test to 24" in lb N=20 lb/a DAP = Days after planting.

Applied fertilizers ir N=45; P=20; K=0; S=5

Herbicide Application: Valor @ 3 oz/a (10/21/20); PowerMax @ 32 oz/a (6/2/21); Intensity @ 16 oz/a (7/7/2021)

Sunflower Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Brand / Company	Oil Type¥	Hybrid Type	Days to Flower (DAP)	Harvested Population	Bird Damage (%£)	Disease Damage (%£)	Total Head Damage (%£)	Oil† 2021 (%)	Oil† 2-Yr Avg‡ (%)	Oil† 3-Yr Avg¥ (%)	Test Weight (lb/bu)	Yield 2021‡ (lb/a)	Yield 2-Yr Avg‡ (lb/a)	Yield 3-Yr Avg¥ (lb/a)
Falcon	NuSeed	NS	Express	65	26052	3	20	23	35.2	36.8	38.0	31.8	2626	2473	2675
N4H302 E	NuSeed	HO	Express	62	18771	3	47	50	36.9	37.1	37.5	28.7	2174	2625	2587
H45HO10EX	Dyna-Gro	HO	Express	64	19204	6	44	50	38.4	38.4	38.8	29.0	2367	2610	2487
E-91 E	Proseed	HO	Express	65	20315	1	16	17	34.8	36.1	35.9	29.4	2600	2645	2461
H42HO18CL	Dyna-Gro	HO	Clearfield	63	21521	2	31	33	35.4	36.6	37.3	31.5	2265	2497	2428
H44HO12CL	Dyna-Gro	HO	Clearfield	62	19998	29	26	56	38.6	39.4	39.6	32.2	1959	2441	2330
E-31 CL	Proseed	HO	Clearfield	64	20982	4	8	12	33.1	31.7	-	30.3	2901	2901	-
N4HM354	NuSeed	NS	Clearfield	63	22406	7	16	23	37.7	37.0	-	32.8	2598	2598	-
12G25 CL	Proseed	HO	Clearfield	64	17774	4	37	41	38.3	38.4	-	31.3	2206	2296	-
H45NS16CL	Dyna-Gro	NS	Clearfield	63	24872	8	40	48	38.1	36.4	-	33.0	2712	2712	-
E-93 E	Proseed	HO	Express	65	15800	9	16	24	31.6	33.3	-	28.6	2182	2397	-
4425CL	Sunopta	MO	Clearfield	64	20630	6	9	15	33.4	-	-	30.9	3180	-	-
N4H470 CLP	NuSeed	HO	Clearfield Plus	66	24826	6	24	30	38.8	-	-	29.8	3135	-	-
E-50016 CL	Proseed	HO	Clearfield	64	24183	3	23	25	36.3	-	-	31.7	3013	-	-
4415HODMCLP	Sunopta	HO	Clearfield Plus	64	25545	4	49	53	36.0	-	-	32.4	2590	-	-
N4H422 CL	NuSeed	HO	Clearfield	63	17671	10	30	40	35.6	-	-	30.3	2535	-	-
H47HO11EX	Dyna-Gro	HO	Express	65	18487	4	11	15	33.3	-	-	32.4	2467	-	-
MEAN				63.8	19155.1	7.0	29.1	36.1	32.36	36.49	37.86	30.94	2559.5	2615.0	2585.9
C.V. (%)				-	15.0	82.2	59.2		3.62	-	-	2.75	17.2	-	-
LSD (5%)				-	4498.4	7.5	22.2		1.67	-	-	1.21	700.5	-	-
LSD (10%)				-	3752.5	6.3	18.5		1.39	-	-	1.01	584.4	-	-

+ Days after planting † Oil content adjusted to 10% moisture ¥ HO=high oleic, NS=NuSun, MO=mid oleic £ Damage determined if 25% or more of the individual head showed damage ‡ Hail storm on July 22, 2021

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W
Elevation: 1902 ft
Soil test (0-6 in.): P=26 ppm; K=145 ppm; pH=7.3; OM=1.9 %
Previous crop: Barley
(0-24 in.): NO3-N=75 lb/a
Planted: 6/1/2021
Yield goal: 2,500 lb/a
Harvested: 11/4/2021
Planting population: 26,000 seeds/a
Soil type: Lihen Loamy Fine Sand
Applied fertilizer: 176 lb/a of Urea (46-0-0) [5/12] and 135 lb/a Urea (46-0-0) [7/1]
Plot size: 50 ft^2
Herbicides applied: Prowl H2O (3pt/a) [6/7], Section 3 (5.33/oz/a) and Superb (2qt/100gal) [6/21]
Rainfall: 7.9 inches (6/1 - 11/4)
Fungicides applied: none applied
Irrigation: 25.2 inches (6/1 - 11/4)

NORTH DAKOTA STATE UNIVERSITY

Williston Research Extension Center

Canola Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Company	Technology	Duration of Flowering	Days to Maturity (DAP)	Height (in.)	Oil (%)	Test Weight (lb/bu)	Yield 2021 (lb/ac)	Yield 2-YR Avg (lb/ac)	Yield 3-YR Avg (lb/ac)
CP9978TF	Croplan	True Flex - RR	24.0	83.5	28.7	35.7	51.0	589	828	998
Starflex	Star	True Flex - RR	23.5	82.8	28.7	38.1	52.2	607	804	906
CS2600 CR-T	Canterra Seeds	True Flex - RR	22.0	83.8	25.4	38.4	50.6	650	796	825
DKTF91SC	Dekalb	True Flex - RR	23.5	82.5	27.0	37.0	50.9	606	673	-
BY 6211TF	BrettYoung	True Flex - RR	23.0	82.5	28.2	35.4	51.6	589	-	-
Integra 7361RC	Integra	True Flex - RR	22.5	84.0	28.0	36.3	50.5	528	-	-
NC401 TF	Nuseed	True Flex - RR	20.3	84.5	28.1	35.6	52.4	432	-	-
L340PC	BASF-invigor	Liberty Link	18.5	85.8	33.0	35.7	53.1	777	-	-
L345PC	BASF-invigor	Liberty Link	19.3	86.0	35.4	35.1	52.2	755	-	-
CS4000 LL	Canterra Seeds	Liberty Link	21.0	86.0	33.7	35.3	52.7	713	-	-
LR344PC	BASF-invigor	True Flex/Liberty Link	16.8	84.5	32.7	37.4	52.0	688	-	-
L2333P	BASF-invigor	Liberty Link	18.5	83.8	32.4	36.1	53.2	658	-	-
CS2500 CL	Canterra Seeds	Clearfield	20.3	82.8	32.9	38.5	52.3	746	916	1085
CS2700 CL	Canterra Seeds	Clearfield	21.8	85.5	34.0	39.3	51.6	577	773	-
Mean			20.9	84.0	29.9	36.5	51.9	628.6	-	-
CV %			8.0	1.7	9.6	2.4	0.5	20.3	-	-
LSD 0.05			2.4	2.0	4.1	1.2	0.4	180.6	-	-
LSD 0.10			2.0	1.7	3.4	1.0	0.3	150.8	-	-

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

Planted: 05/11/2021 Harvested: 08/13/2021

Soil test to 6" in ppm: P=39 ppm OM=2.1 Soil type: Williams-Bowbells loam.

Soil test to 24" in lb/a: N=32 lb/a pH=6.3

Applied fertilizers in lb/a: N=75; P=20; K=0; S=48

1DAP = Days after planting.

Herbicides applied: 5/18/21 Roundup @ 32 oz/a on all plots (burn down); 6/21/21 Liberty 280 @ 26 oz/a with Intensity @ 4 oz/a on Liberty plots; 6/22/21 Roundup at 22 oz/a on RR plots only

Canola Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Company	Days to Flower (DAP+)	Flower Duration (DAP+)	Days to Maturity (DAP+)	Lodging (0 - 9*)	Oil† 2021 (%)	Oil† 2-Yr Avg (%)	Oil† 3-Yr Avg (%)	Test Weight (lb/bu)	Yield 2021‡ (lb/a)	Yield 2-Yr Avg (lb/a)	Yield 3-Yr Avg (lb/a)
Roundup Ready												
CP9978TF	Croplan	49	16	95	2	39.1	39.5	40.3	51.9	3130	2871	2579
StarFlex	Star	50	16	96	2	39.7	40.0	40.9	52.2	2338	2323	2166
NC401 TF	Nuseed	50	17	98	2	37.3	38.7	-	52.6	2376	2419	-
BY6211TF	BrettYoung	48	17	95	2	38.3	-	-	52.3	3255	-	-
Integra 7361RC	Integra	50	18	95	2	39.1	-	-	51.8	2831	-	-
Liberty Link												
L345PC	BASF-invigor	53	15	97	2	41.7	-	-	51.6	2975	-	-
L340PC	BASF-invigor	52	15	96	2	40.4	-	-	51.2	2955	-	-
L233P	BASF-invigor	50	16	96	2	41.2	-	-	51.6	2679	-	-
LR344PC	BASF-invigor	53	14	96	2	41.5	-	-	51.8	2573	-	-
MEAN		50.4	15.8	96.0	1.9	39.82	39.42	40.56	51.89	2790.0	2537.5	2372.3
C.V. (%)		-	-	-	-	2.66	-	-	0.42	14.9	-	-
LSD (5%)		-	-	-	-	1.54	-	-	0.31	605.2	-	-
LSD (10%)		-	-	-	-	1.28	-	-	0.26	501.7	-	-

+ Days after planting * 0: no lodging - 9: plants lying flat on the ground † Oil content adjusted to 8.5% moisture ‡ Hail storm on July 22, 2021

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

Soil test (0-6 in.): P=24 ppm; K=250 ppm; pH=7.4; OM=3.1 % — Previous crop: Spring Wheat

(0-24 in.): NO3-N=73 lb/a — Planted: 5/13/2021

Yield goal: 2,500 lb/a — Harvested: 8/30/2021

Planting population: 520,000 seeds/a — Soil type: Lihen Loamy Fine Sand

Applied fertilizer: 200 lb/a of Urea (46-0-0)[5/12] and 125 lb/a of AMS (21-0-0-24S)[5/12] — Plot size: 53 ft^2

Herbicides applied: **(Roundup Ready)** Cornerstone Plus (24oz/a) and Class Act (1qt/100 gal) [6/21] — Rainfall: 7.8 inches (5/13 - 8/30)

(Liberty Link) Liberty 280 (29oz/a), Section 3 (5.33oz/a), and Class Act (1qt/100gal) [6/21] — Irrigation: 15.5 inches (5/13 - 8/30)

Insecticide applied: Mustang Maxx (4oz/a) and Mpede (2pt/a) [6/18]

Fungicides applied: none applied

Statewide Canola Variety Trial EARC, Sidney, MT 2021

Variety	Plant Stand (%)	Plant Height (cm)	Days to Flowering (Julian*)	Test Weight† (lb/bu)	Oil (%)	Grain Yield† (bu/ac)
BY_5125CL	85.0	82.3	172	53.3	42.5	389.7
BY_6211TF	85.0	86.3	169	54.0	40.9	609.0
CP7130LL	91.3	87.5	173	55.7	38.5	594.5
CP7144LL	91.3	94.8	173	54.6	38.0	527.7
CP930RR	77.5	79.8	169	51.7	44.3	318.4
CP9919RR	76.3	79.3	169	52.7	38.8	539.5
CP9978TF	82.5	80.3	169	53.6	40.6	511.9
DG_200CL	91.3	90.5	173	52.9	38.4	425.8
DG_760TM	85.0	76.5	171	54.0	42.7	538.0
DG_761TM	90.0	84.0	172	54.4	41.0	546.7
DKTF91SC	88.8	79.3	170	53.5	43.4	587.7
DKTFLL21SC	71.3	76.5	170	53.5	42.2	315.5
InVigor_L233P	77.5	83.3	172	53.6	39.3	488.9
InVigor_L234PC	85.0	85.0	171	54.9	41.0	537.4
InVigor_L340PC	86.3	78.3	172	54.5	31.7	562.9
InVigor_L345PC	80.0	88.8	171	54.3	38.8	535.9
InVigor_LR344PC	90.0	92.5	172	52.8	42.0	696.8
NC155_TF	87.5	84.0	169	55.2	38.3	650.2
NC401_TF	80.0	88.8	172	53.6	38.2	345.0
NC471_TF	93.8	91.5	171	54.3	42.7	619.4
NCC101S	88.8	72.8	168	53.8	35.5	523.0
StarFlex	83.8	79.5	169	54.2	43.5	476.5
X19D94214	93.8	81.8	169	54.0	42.1	608.2
Mean	85.3	83.6	171	53.9	40.2	519.5
P-Value	0.0974	<0.0001	<0.0001	<0.0001	<0.0001	0.1358
CV (%)	12.3	7.6	0.8	1.7	7.9	33.9
LSD (0.05)	14.7	8.9	2.0	1.3	4.5	245.5

Planted: 4/29/21
Harvested: 7/28/21
(Julian*) is a continuous count of days since January 1 † Test weight and grain yield adjusted to 12.0% moisture Soil Test N Avail (lb/ac): 21.2
N added (lb/ac): 80
Herbicide: Sonalan HFP @ 7.5 lbs/ac on 10/19/2020
Mustang Maxx @ 4 oz/ac on 5/26/2021 & 6/1/2021
Assure II @ 12 oz/ac on 6/1/2021

Previous crop: cereal
Soil Type: Savage Silty Clay
Plot Width: 5 ft
Crop Year Precipitation: 6.47 inch
Irrigation (sprinkler): 2.68 inch
Soil Test P2O5 (ppm): 17.3
P2O5 added (lb/ac): 26

Regional Canola Variety Trial EARC, Sidney, MT 2021

Variety	Plant Stand (%)	Plant Height (cm)	Days to Flowering (Julian*)	Test Weight† (lb/bu)	Oil (%)	Grain Yield† (bu/ac)
16.SC.182.10	83.8	72.8	170	53.8	40.6	451.6
16.SC.182.7	76.3	77.0	173	52.0	41.0	267.0
16.SC.2.10	75.0	70.0	172	50.5	36.6	133.7
Empire	91.3	60.0	169	53.3	41.1	288.8
SCD.23.4.2	85.0	72.0	170	51.7	40.3	244.9
SCD.23.4B.Seed	87.5	73.3	171	50.6	43.3	212.8
Mean	83.1	70.8	171	52.0	40.5	266.5
P-Value	0.1009	0.0391	0.0104	0.0031	<0.0001	0.0054
CV (%)	10.3	9.4	0.7	2.2	2.3	35.9
LSD (0.05)	12.8	9.9	1.9	1.7	1.4	142.2

Planted: 4/29/21
Harvested: 7/28/21
(Julian*) is a continuous count of days since January 1 † Test weight and grain yield adjusted to 12.0% moisture Soil Test N Avail (lb/ac): 21.2
N added (lb/ac): 80
Herbicide: Sonalan HFP @ 7.5 lbs/ac on 10/19/2020
Mustang Maxx @ 4 oz/ac on 5/26/2021 & 6/1/2021
Assure II @ 12 oz/ac on 6/1/2021

Previous crop: cereal
Soil Type: Savage Silty Clay
Plot Width: 5 ft
Crop Year Precipitation: 6.47 inch
Irrigation (sprinkler): 2.68 inch
Soil Test P2O5 (ppm): 17.3
P2O5 added (lb/ac): 26

No irrigation since 6/8/21 due to irrigation system being damaged

NORTH DAKOTA STATE UNIVERSITY

Williston Research Extension Center

Soybean Roundup Ready Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Company/Brand	Relative Maturity	Height (in.)	Oil (%)	Protein (%)	Test Weight (lb/bu)	Yield 2021 (bu/a)	2-YR Avg (bu/a)	3-YR Avg (bu/a)
LGS0111RX	LG Seeds	0.1	44.0	21.3	40.3	56.4	14.7	13.1	22.8
S03XT29	Dyna-Gro Seeds	0.3	37.8	19.7	40.1	55.7	13.1	11.2	21.9
ND17009GT	NDSU	00.9	47.3	20.8	41.3	58.7	15.4	12.3	21.0
ND21008GT20	NDSU	00.8	39.0	21.3	38.5	57.5	13.1	11.5	20.9
S009XT68	Dyna-Gro Seeds	00.9	38.0	20.0	39.6	55.7	12.8	11.1	20.7
ND18008GT	NDSU	00.8	49.8	20.5	41.4	58.4	15.0	11.4	20.0
RX0411	REA Hybrids	0.4	40.5	19.5	39.4	56.4	16.1	11.6	-
ND2108GT73	NDSU	0.8	34.5	20.7	38.5	57.1	13.5	10.4	-
RX0112XF	REA Hybrids	0.1	45.0	21.0	38.4	55.8	17.5	-	-
LGS00838XF	LG Seeds	00.8	37.0	20.8	40.1	55.7	13.4	-	-
ND17-19726 (exp)	NDSU	0.0	31.5	20.9	40.8	56.9	12.4	-	-
RX00912	REA Hybrids	00.9	39.3	21.4	38.1	56.1	12.0	-	-
Mean			40.3	20.6	39.7	56.7	14.1	-	-
CV (%)			11.8	1.8	2.1	1.1	14.9	-	-
LSD (5%)			6.9	0.5	1.2	0.9	3.0	-	-
LSD (10%)			5.7	0.4	1.0	0.7	2.5	-	-

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

Planted: 5/27/21 Harvested: 9/30/2021

Soil test to 6" in ppm: P=22 ppm K=264 OM=1.9 pH=5.6 Soil type: Williams-Bowbells loam.

Soil test to 24" in lb/a: N=10 lb/a

Applied fertilizers in lb/a: none

DAP = Days after planting.

Herbicide Application: Valor @ 3oz/a applied October 20th 2020; 6/22/21 Roundup @ 32 oz/a

RR Soybean Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Company/Brand	Relative Maturity	Plant Height	Lodging	Protein†			Oil†	Test Weight	Yield		
					2021	2-Yr Avg	3-Yr Avg			2021‡	2-Yr Avg	3-Yr Avg
			(in)	(0 - 9*)	(%)	(%)	(%)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
ND17009GT	NDSU	00.9	25	2	36.0	37.0	36.9	19.5	58.7	48.5	39.1	35.8
50309N	Integra	0.3	27	1	33.4	34.9	-	18.5	56.2	52.7	47.4	-
RX0411	REA Hybrids	0.4	31	0	31.7	33.3	-	19.0	57.5	56.9	46.6	-
ND2108GT73	NDSU	0.8	28	1	33.8	-	-	18.6	58.5	63.0	-	-
40300N	Integra	0.3	28	0	32.1	-	-	18.8	56.5	60.0	-	-
70212XF	Integra	0.2	31	1	33.5	-	-	19.1	57.7	57.0	-	-
R0112XF	REA Hybrids	0.1	30	2	33.9	-	-	19.0	57.3	54.9	-	-
ND21008GT20	NDSU	00.8	21	3	33.7	-	-	18.9	58.0	50.5	-	-
RX00912	REA Hybrids	00.9	26	1	31.6	-	-	19.4	56.9	50.0	-	-
MEAN			27.5	1.1	33.30	35.06	36.90	18.97	57.50	54.82	44.39	35.85
C.V. (%)			-	-	1.06	-	-	1.17	0.97	7.59	-	-
LSD (5%)			-	-	0.51	-	-	0.32	0.82	6.07	-	-
LSD (10%)			-	-	0.43	-	-	0.27	0.68	5.03	-	-

* 0: no lodging - 9: plants lying flat on the ground † Protein and Oil content adjusted to 13% moisture ‡ Hail storm on July 22

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W
Elevation: 1902 ft
Soil test (0-6 in.): P=26 ppm; K=145 ppm; pH=7.3; OM=1.9 %
Previous crop: Barley
(0-24 in.): NO3-N=75 lb/a
Planted: 5/19/2021
Yield goal: 50 bu/a
Harvested: 10/7/2021
Planting population: 200,000 seeds/a
Soil type: Lihen Loamy Fine Sand
Applied fertilizer: none applied, seed inoculated
Plot size: 48 ft^2
Herbicides applied: Prowl H2O (3pt/a) [5/27], Cornerstone Plus (24oz/a) and Class Act (1qt/100gal) [6/9] [6/21]
Rainfall: 8.0 inches (5/19 - 10/7)
Fungicides applied: Priaxor D (8oz/a) [7/28]
Irrigation: 25.2 inches (5/19 - 10/7)

Conventional Soybean Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Company/Brand	Relative Maturity	Plant Height	Lodging	Protein†			Oil†	Test Weight	Yield		
					2021	2-Yr Avg¥	3-Yr Avg£			2021‡	2-Yr Avg¥	3-Yr Avg£
			(in)	(0 - 9*)	(%)	(%)	(%)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
ND Stutsman	NDSU	0.7	28	0	32.3	34.5	33.8	18.7	57.9	64.4	56.1	64.6
ND Benson	NDSU	0.4	28	0	36.2	35.8	36.0	18.7	57.4	54.6	51.9	58.7
ND Rolette	NDSU	00.9	25	1	34.7	35.4	-	19.5	57.4	52.2	48.5	-
ND Dickey	NDSU	0.7	26	0	34.5	-	-	17.5	57.3	56.5	-	-
Liska	Prograin	00.3	25	1	38.2	-	-	17.7	56.8	45.8	-	-
Maya	Prograin	00.6	27	0	38.6	-	-	16.7	58.6	46.5	-	-
Hana	Prograin	00.9	25	1	37.1	-	-	18.6	57.3	39.3	-	-
MEAN			26.3	0.4	35.95	35.23	34.91	18.21	57.54	51.31	52.20	61.65
C.V. (%)			-	-	1.20	-	-	1.21	0.63	8.03	-	-
LSD (5%)			-	-	0.64	-	-	0.33	0.54	6.12	-	-
LSD (10%)			-	-	0.53	-	-	0.27	0.45	5.05	-	-

* 0: no lodging - 9: plants lying flat on the ground † Protein and Oil content adjusted to 13% moisture ‡ Hail storm on July 22
¥ 2-Yr Avg from 2019 and 2021 data £ 3-Yr Avg from 2018, 2019, and 2021 data

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W — Elevation: 1902 ft
Soil test (0-6 in.): P=26 ppm; K=145 ppm; pH=7.3; OM=1.9 % — Previous crop: Barley
(0-24 in.): NO3-N=75 lb/a — Planted: 5/19/2021
Yield goal: 50 bu/a — Harvested: 10/7/2021
Planting population: 200,000 seeds/a — Soil type: Lihen Loamy Fine Sand
Applied fertilizer: none applied, seed inoculated — Plot size: 48 ft^2
Herbicides applied: Prowl H2O (3pt/a) [5/27], Section 3 (5.33oz/a) and Superb (1qt/100gal) [6/17], Basagran (1.5pt/a), Raptor (2oz/a), Assure II(12oz/a), and Superb (1qt/100 gal) [6/21] — Rainfall: 8.0 inches (5/19 - 10/7)
Fungicides applied: Priaxor D (8oz/a) [7/28] — Irrigation: 25.2 inches (5/19 - 10/7)

RR Soybean Irrigated Variety Trial - NDSU **WREC, Off-station, Trenton, ND 2021**

Variety	Company/Brand	Relative Maturity	Oil† (%)	Protein† (%)	Test Weight (lb/bu)	Yield (bu/a)
50309N	Integra	0.3	17.4	34.2	57.0	62.0
40300N	Integra	0.3	18.0	34.4	56.0	57.7
R0112XF	REA Hybrids	0.1	18.0	35.0	56.9	56.5
ND2108GT73	NDSU	0.8	17.7	33.9	57.0	55.7
70212XF	Integra	0.2	18.1	35.0	56.9	53.8
RX00912	REA Hybrids	00.9	18.6	33.1	57.0	49.3
RX0411	REA Hybrids	0.4	18.0	32.9	56.8	52.3
ND21008GT20	NDSU	00.8	18.3	34.4	57.2	50.5
ND17009GT	NDSU	00.9	18.4	37.5	57.8	48.2
MEAN			18.0	34.5	56.9	54.0
C.V. (%)			1.53	1.57	0.91	11.21
LSD (5%)			0.40	0.79	0.76	8.83
LSD (10%)			0.33	0.65	0.63	7.32

† Protein and Oil content adjusted to 13% moisture

Location: Latitude 47 58'N; Longitude 103 54'W — Elevation: 1900 ft
Soil Test (0-6 in.): P=24 ppm; K=330 ppm; pH=7.8; OM=2.6% — Previous crop: Sugarbeet
(0-24 in.): NO3-N=109 lbs/a — Planted: 5/19/2021
Yield goal: 50 lb/a — Harvested: 10/6/2021
Planting population: 200,000 seeds/a — Soil type: Lohler Silty Clay
Applied fertilizer: none applied, seed inoculated — Plot Size: 75 ft^2
Herbicides applied: Cornerstone Plus (32 oz/a) and Class Act (0.25%) [6/28] — Rainfall: 6.5 in [5/19 - 10/6]
Fungicides applied: none applied

Corn Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Company/Brand	Relative Maturity	Ear Height (in)	Days to Silk (DAP+)	Lodging (0 - 9*)	Test Weight (lb/bu)	Harvest Moisture (%)	2021‡ (bu/a)	2-Yr Avg (bu/a)
2B851	REA Hybrids	85	42	68	0	58.1	15.2	183.9	182.9
1B821	REA Hybrids	82	41	66	0	58.3	16.3	177.0	177.8
1B771	REA Hybrids	77	41	63	0	58.0	15.2	193.3	-
3537	Integra	85	42	65	0	58.0	16.2	185.7	-
3431	Integra	84	44	69	0	59.1	16.2	185.0	-
3282	Integra	82	45	67	0	59.5	16.3	174.4	-
3009	Integra	80	39	65	0	59.4	15.8	167.2	-
MEAN			42.0	65.9	-	58.63	15.87	180.93	180.31
C.V. (%)			-	-	-	0.74	3.15	14.74	-
LSD (5%)			-	-	-	0.65	0.74	NS	-
LSD (10%)			-	-	-	0.53	0.61	NS	-

+ Days after planting * 0: no lodging - 9: plants lying flat on the ground † Yield adjusted to Harvest Moisture
‡ Hail storm on July 22, 2021

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W
Elevation: 1902 ft
Soil test (0-6 in.): P=26 ppm; K=145 ppm; pH=7.3; OM=1.9 %
Previous crop: Barley
(0-24 in.): NO3-N=75 lb/a
Planted: 5/17/2021
Yield goal: 190 bu/a
Harvested: 10/21/2021
Planting population: 36,000 seeds/a
Soil type: Lihen Loamy Fine Sand
Applied fertilizer: 393 lb/a of Urea (46-0-0) [5/12]
Plot size: 100 ft^2
Herbicides applied: Cornerstone Plus (32oz/a) and Class Act (2.5at/100gal) [6/7] and [7/2]
Rainfall: 9.2 inches (5/17 - 10/21)
Fungicides applied: none applied
Irrigation: 25.2 inches (5/17 - 10/21)

Corn Irrigated Variety Trial - NDSU **WREC, Trenton Off-Station, ND 2021**

Variety	Company/Brand	Relative Maturity	Test Weight (lb/bu)	Harvest Moisture (%)	Yield † (bu/a)
2B851	REA Hybrids	85	57.7	17.4	161.5
1B821	REA Hybrids	82	57.9	17.5	159.7
3431	Integra	84	58.0	18.3	144.1
1B771	REA Hybrids	77	57.4	16.0	143.8
3009	Integra	80	59.2	16.4	122.6
3282	Integra	82	58.9	19.6	122.3
MEAN			58.2	17.5	142.3
C.V. (%)			0.97	7.87	15.55
LSD (5%)			NS	2.53	NS
LSD (10%)			NS	2.06	36.03

† Yield adjusted to harvest moisture

Location: Latitude 47 58'N; Longitude 103 54'W — Elevation: 1900 ft
Soil Test (0-6 in.): P=24 ppm; K=330 ppm; pH=7.8; OM=2.6% — Previous crop: Sugarbeet
(0-24 in.): NO3-N=109 lb/a — Planted: 5/11/2021
Yield goal: 190 bu/a — Harvested: 10/19/2021
Planting population: 36,000 seeds/a — Soil type: Lohler Silty Clay
Applied fertilizer: 45 lbs/a High NRG-N (27-0-0-1S) [6/1] — Plot size: 100 ft^2
Herbicides applied: Cornerstone Plus 32 oz/a, Class Act .25% [6/28] — Rainfall: 7.1 in [5/11 - 10/19]
Fungicides applied: none applied

LENTIL VARIETY 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 Variety Evaluation - MSU **Richland, MT 2021**

Variety	Plant Height	Test Weight	1000 Seed Weight	Adjusted Grain Yield
	(in)	(lb/bu)	(g)	(lb/a)
Avondale	11.7	61.8	50.1	517
CDC Dazil CL	10.2	63.4	32.1	620
CDC Impala	10.2	64.2	30.5	610
CDC Impress	10.9	61.3	49.8	342
CDC Richlea	11.5	61.2	51.6	487
CDC Viceroy	10.9	63.8	32.6	509
LC08600005E	10.8	63.5	46.2	691
LC14600088R	11.3	61.4	55.1	477
NDL120600R	11.9	60.6	52.3	531
Sage	10.4	63.5	38.7	464
Mean	10.9	62.5	43.9	525
P-Value	0.2266	N/A*	<0.0001	0.3376
LSD (0.05)	NS	N/A*	2.2	NS
CV (%)	8.4	N/A*	3.4	27.7

Location: Richland, MT
Planted: 4-23-2021
Applied fertilizers in lb/a: None
Yield adjusted to 13% moisture content

Previous crop: Durum
Harvested: 8-12-2021
Soil type: Farnuf Loam

*N/A - many sample sizes were insufficient for analysis therefore no statistical analysis was performed

Yi Zhou, Charlie Lim, and Thomas Gross at beet harvest

Irrigated Lentil Variety Evaluation - MSU **Sidney, MT 2021**

Variety	Days to Flower	Plant Height	Test Weight	1000 Seed Weight	Adjusted Grain Yield
	(DAP)[1]	(in)	(lb/bu)	(g)	(lb/a)
Avondale	56.0	12.3	61.3	50.4	2278
CDC Impala	63.0	11.0	64.8	28.0	2104
CDC Impress	60.0	11.3	61.5	54.4	2352
CDC Richlea	59.0	11.7	60.3	51.5	2374
CDC Viceroy	61.0	13.3	64.4	32.3	2338
NDL120600R	53.7	12.6	59.7	56.7	2195
Sage	53.7	10.4	62.9	37.5	2275
Mean	58.0	11.8	62.1	44.4	2274
P-Value	<0.0001	0.0059	<0.0001	<0.0001	0.2693
LSD (0.05)	2.3	1.3	0.7	2.0	NS
CV (%)	2.2	6.5	0.7	2.6	6.3

Location: EARC; Sidney, MT
Previous crop: Sugarbeet
Planted: 5-3-2021
Harvested: 8-4-2021
Applied fertilizers in lb/a: None
Soil type: Savage Silty Clay Loam
Yield adjusted to 13% moisture content
DAP[1] = Days after planting
Herbicide: Outlook at 12 oz/a preemergence

Farm Girl Tip:
Frisk the laundry!
If not, you will always find interesting things in your dryer:

corn, soybeans, bolts, etc.

Flax Variety Descriptions

VARIETY[1]	ORIGIN[2]	YEAR RELEASED	RELATIVE MATURITY[3]	SEED COLOR	PLANT HEIGHT[3]	RESISTANCE TO WILT[4]
ACC Bright	Canada	2016	LATE	YELLOW	M TALL	MR
AAC Marvelous	Canada	2020	M LATE	BROWN	M TALL	MR
Bison	NDSU	1926	MEDIUM	BROWN	MEDIUM	MR
Carter	NDSU	2004	MEDIUM	YELLOW	MEDIUM	MR
CDC Bethume	Canada	1999	M LATE	BROWN	M TALL	MR
CDC Buryu	Canada	2010	M LATE	BROWN	M TALL	MR
CDC Durado	Canada	2013	MEDIUM	YELLOW	MEDIUM	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	MEDIUM	BROWN	MEDIUM	MR
CDC Rowland	Canada	2020	M LATE	BROWN	M TALL	MR
CDC Sorrel	Canada	2007	M LATE	BROWN	M TALL	MR
Gold ND	NDSU	2014	MEDIUM	YELLOW	M TALL	MR/R
ND Hammond	NDSU	2018	MEDIUM	BROWN	MEDIUM	MS
Nekoma	NDSU	2002	LATE	BROWN	MEDIUM	MR
Omega	NDSU	1989	MEDIUM	YELLOW	MEDIUM	MS
Pembina	NDSU	1998	MEDIUM	BROWN	MEDIUM	MR
Prairie Blue	Canada	2003	M LATE	BROWN	MEDIUM	NA
Prairie Sapphire	Canada	2012	MEDIUM	BROWN	MEDIUM	MR
Prairie Thunder	Canada	2006	MEDIUM	BROWN	SHORT	NA
Webster	SDSU	1998	LATE	BROWN	TALL	MR
York	NDSU	2002	LATE	BROWN	MEDIUM	R

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

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

NORTH DAKOTA STATE UNIVERSITY

Williston Research Extension Center

Flax Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Days to heading	Days to Flowering	Plant height	Oil	Test weight	Yield		
						2021	2-Yr Avg	3-Yr Avg
	(DAP)	(DAP)	(in)	(%)	(lb/bu)	(bu/a)	(bu/a)	(bu/a)
CDC PLAVA	48	79	18	42.0	50.5	6.9	13.4	18.5
CDC BURYU	48	78	20	41.4	50.2	6.4	11.8	16.8
CDC GLAS	50	77	20	43.5	49.4	7.0	11.6	14.9
OMEGA	48	79	18	40.7	49.7	6.6	10.8	14.5
AAC BRIGHT	48	77	19	43.0	48.9	6.2	10.6	14.2
YORK	47	41	17	42.0	49.9	5.9	11.4	13.0
ND HAMMOND	47	77	19	40.3	49.0	6.8	11.5	13.0
WEBSTER	50	81	21	42.9	49.1	6.5	12.6	12.8
CDC NEELA	49	78	19	41.3	48.4	5.7	10.1	12.2
GOLD ND	50	80	21	42.9	49.9	7.7	10.2	11.5
CARTER	49	81	18	41.8	49.2	5.6	9.9	11.2
CDC DURADO	46	76	17	41.4	49.1	6.4	-	-
AAC MARVELOUS	49	79	19	43.9	50.2	6.4	-	-
CDC ROWLAND	50	80	20	41.0	49.9	6.1	-	-
Mean	50	78	20	41.8	NA	6.3	-	-
CV (%)	4.7	15.8	6.3	2.6	NA	22.8	-	-
LSD (5%)	1.1	5.7	0.6	0.5	NA	0.7	-	-
LSD (10%)	0.9	4.8	0.5	0.4	NA	0.6	-	-

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

Planted: 5/10/2021 Harvested: 09/10/2021

Soil test to 6" in ppm: P= 20 ; K = 264, OM = 1.9%; pH = 5.6 Soil type: Williams-Bowbells loam

Soil test to 24" in lb/a: N = 21

Applied Fertilizer in lbs/a: N = 50; P = 20; K = 0; S = 5

Herbicide Application: Valor @ 3oz/a applied October 20th 2020

NA: Not available - test weight taken from bulk sample of all reps

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
AAC CHROME	LEGUME LOGIC	SL	NA	MEDIUM	MEDIUM	M LARGE	R
AAC PROFIT	BIRDSALL GRAIN	NA	NA	NA	M LATE	MEDIUM	R
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	BIRDSALL GRAIN	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
HAMPTON	NDCIA	NA	NA	M SHORT	MEDIUM	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
LG SUNRISE	PULSE USA	SL	NA	TALL	MEDIUM	S MEDIUM	R
LGPN4909	LIMAGRAIN	NA	NA	NA	NA	NA	NA
LGPN4913	LIMAGRAIN	NA	NA	NA	NA	NA	NA
LGPN4915 (LG STUNNER)	LIMAGRAIN	NA	NA	NA	NA	NA	NA
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
NDP121587	NDSU	NA	NA	M SHORT	MEDIUM	M SMALL	R
NETTE 2010	PULSE USA	SL	NA	SHORT	M EARLY	M SMALL	NA
PSTSP27	PHOTOSYNTECH	SL	SD	SHORT	EARLY	MEDIUM	MR
PSTSP34	PHOTOSYNTECH	NA	NA	NA	NA	NA	NA
PSTSPS32	PHOTOSYNTECH	SL	SD	MEDIUM	MEDIUM	MEDIUM	MR
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 SMALL	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.

NORTH DAKOTA STATE UNIVERSITY

Williston Research Extension Center

Dryland Field Pea Variety Trial - NDSU — WREC, Williston, ND 2021

Variety	Days to Flowering (DAP)	Days to Maturity (DAP)	Height (in.)	Protein (%)	1000 Kernel Weight (g)	Test Weight (lb/bu)	2021 Yield (bu/ac)	2-YR Avg (bu/ac)	3-YR Avg (bu/ac)
Yellow Cotyledon Type									
AAC Chrome	54	81	13	28.3	214.7	62.0	11.1	19.0	37.7
AAC Carver	53	80	16	28.1	198.0	62.2	13.6	21.0	36.5
CDC Spectrum	55	81	15	30.5	205.5	61.9	12.6	19.2	34.1
Agassiz	53	79	15	30.6	213.9	61.8	12.9	19.5	33.7
CDC Inca	54	82	16	29.7	199.6	62.6	8.5	17.6	33.7
Jetset	52	79	15	28.5	201.8	61.5	11.5	18.8	33.3
AAC Profit	54	79	14	29.2	209.7	61.3	10.5	16.7	33.2
CDC Amarillo	56	82	15	30.0	191.3	61.8	8.5	18.4	32.0
Salamanca	53	79	13	30.8	216.6	62.0	11.5	16.9	30.6
Peregrine	50	77	12	27.9	219.1	63.2	12.9	17.1	30.5
Durwood	54	82	16	29.5	200.6	61.8	7.4	14.8	30.4
DS Admiral	52	78	14	27.9	213.2	61.8	11.5	17.6	29.9
Kite	51	78	12	28.7	218.7	62.0	16.0	16.6	29.8
DL Apollo	53	83	15	30.9	194.4	N/A	6.0	14.2	29.5
ND Dawn	53	79	15	27.9	207.3	60.9	10.6	14.2	27.9
Orchestra	54	80	13	31.5	213.5	61.9	12.3	16.3	-
Cronos	51	81	15	31.0	227.8	61.8	7.7	10.5	-
PS17100183	56	79	16	30.2	191.0	62.4	14.0	-	-
LG Stunner	51	78	16	30.3	204.9	62.7	12.4	-	-
PS17100022	53	78	15	29.2	196.5	62.6	12.1	-	-
EP_6816	53	79	16	30.4	193.4	62.7	11.8	-	-
EP_8506	53	80	14	30.8	193.0	61.5	11.5	-	-
AAC Asher	54	80	12	28.4	215.8	61.9	11.5	-	-
PS17100239	52	78	15	29.0	216.4	61.9	11.4	-	-
MS-20YP4	56	81	14	30.5	201.9	61.5	11.3	-	-
EP_6381	53	79	16	30.4	207.4	61.8	11.2	-	-
Spider	53	80	14	29.9	209.2	62.2	10.8	-	-
SG-L 8963	52	82	12	30.9	208.6	63.1	10.4	-	-
PG Cash	53	79	14	30.3	194.6	62.5	10.2	-	-
EPX_6186	55	80	16	30.4	206.0	62.5	10.1	-	-
EP_6360	51	79	14	30.9	222.9	60.9	9.5	-	-
SG-L 9086	55	82	15	28.8	209.2	62.0	9.2	-	-
DL GrowPro	54	81	15	31.1	230.5	61.9	9.0	-	-
M 122	53	80	15	30.3	230.7	62.4	8.2	-	-
EP_8272	51	80	14	32.2	217.3	62.2	8.0	-	-
M 118	52	78	13	28.5	225.1	61.1	7.1	-	-
EP_8971	54	84	14	32.1	217.8	N/A	5.0	-	-
Green Cotyledon Type									
CDC Striker	52	77	13	27.5	187.7	62.7	13.1	18.0	33.4
Arcadia	52	77	12	27.0	184.4	63.0	12.2	18.7	32.9
CDC Greenwater	55	83	14	27.1	211.4	61.1	11.3	19.2	31.8
Shamrock	54	83	15	29.8	212.9	63.2	11.3	14.9	30.8
Empire	54	84	18	30.3	191.0	62.1	6.5	15.5	29.0
MS-20GP5	55	80	14	27.2	209.6	61.9	11.5	18.4	-
Aragorn	50	76	14	27.3	206.1	61.6	12.1	13.9	-
Greenwood	50	77	12	26.6	193.1	62.4	10.6	13.3	-
SG-L 8318Z	57	84	16	27.8	221.0	61.6	8.0	-	-
Mean	53.0	79.8	14.4	29.5	207.7	62.0	10.6	-	-
CV %	1.9	1.4	9.8	2.0	3.5	0.9	24.7	-	-
LSD 0.05	1.4	1.5	2.0	0.8	10.2	NA	3.7	-	-
LSD 0.10	1.2	1.3	1.7	0.7	8.5	NA	3.1	-	-

Location of the WREC: Latitude 48 8'; Longitude 103 44'W; Elevation 2105 ft — Previous Crop: wheat

Planting Date: 5/6/2021 — Harvest Date: 8/3/2021

Soil test to 6" in ppm: P = 20; K = 264; OM = 1.9%; pH = 5.6 — Soil type: Williams-Bowbells loam

Soil test to 24" in lb/a: N = 21

Applied fertilizers in lb/a: none

Herbicide Application: Valor @ 3 oz/a applied October 28th 2020

Dryland Green Dry Pea Variety Evaluation - MSU **Richland, MT 2021**

Variety	Plant Height	Test Weight	1000 Seed Weight	Protein	Adjusted Grain Yield
	(in)	(lb/bu)	(g)	(%)	(lb/a)
Aragorn	15.2	62.6	209.0	25.0	1280
CDC Greenwater	18.1	61.9	224.2	24.0	1583
Empire	22.2	64.3	208.8	26.2	1078
Ginny 2	15.4	63.6	218.2	24.5	909
Hampton	13.8	63.3	226.0	27.1	1207
MS-20GP5	19.1	63.1	222.8	24.9	1514
NDP100144G	18.9	62.9	193.0	25.3	1397
PS0877MT457	17.8	62.6	218.5	27.7	928
SG-L 8318Z	19.9	63.5	225.0	25.0	1417
Shamrock	16.2	65.0	235.1	24.9	1007
Mean	17.7	63.3	218.1	25.4	1232
P-Value	<0.0001	<0.0001	<0.0001	<0.0001	0.0170
LSD (0.05)	2.9	0.5	12.4	0.8	425
CV (%)	11.5	0.6	3.9	2.2	23.9

Dryland Yellow Dry Pea Variety Evaluation - MSU **Richland, MT 2021**

Variety	Plant Height	Test Weight	1000 Seed Weight	Protein	Adjusted Grain Yield
	(in)	(lb/bu)	(g)	(%)	(lb/a)
AAC Asher	14.4	62.6	252.6	24.3	1281
AAC Carver	17.4	63.7	238.1	23.5	1262
AAC Chrome	15.4	62.8	236.7	24.2	1661
AAC Julius	19.0	63.5	231.2	25.1	1550
AAC Profit	16.0	61.0	235.8	25.3	1308
CDC Inca	17.6	63.5	208.3	25.2	1170
CDC Saffron	14.8	62.6	241.9	25.1	1207
CDC Spectrum	16.6	62.0	228.3	25.8	1502
Cronos	18.0	62.5	253.6	27.8	624
DL Apollo	18.1	64.2	214.1	27.3	1204
DL Grow Pro	19.5	61.6	270.9	27.6	1137
DS-Admiral	20.1	61.9	230.1	23.7	1371
Flute	17.0	62.7	201.9	25.8	1419
Goldenwood	11.3	64.3	173.7	27.9	1541
Kite	13.8	62.7	246.3	24.6	896
Korando	16.8	63.8	259.8	26.7	1078
LG Stunner	17.6	62.5	215.3	26.4	1133
LG Sunrise	18.9	63.9	218.5	23.4	1495
M 122	20.3	63.0	261.6	27.0	921
MS-20YP4	18.9	61.8	228.3	25.1	1655
ND Dawn	17.5	62.7	241.7	24.1	1385
Orchestra	16.8	62.2	241.1	28.5	927
Peregrine	14.3	63.3	239.8	23.5	1259
Pizzaz	18.2	64.5	286.3	25.9	1290
Pro 143-6220	15.7	62.9	212.3	24.7	1285
Pro 143-6230	14.7	62.7	208.9	25.1	975
PS16100107	16.7	63.6	260.0	27.6	1361
PS16N20003	21.2	65.2	238.3	26.5	1590
PS17100008	13.6	62.6	231.4	24.2	933
PS17100022	21.9	64.5	241.0	26.0	1488
PS17100239	15.9	64.3	239.5	25.8	1418
PS17100240	15.7	62.9	225.6	27.6	1016
PS0877MT632	15.2	64.9	220.9	26.1	1344
Salamanca	16.5	62.5	235.2	26.5	1125
SG-L 8963	16.1	63.4	228.2	26.1	666
SG-L 9086	20.0	62.8	231.6	23.0	1255
Spider	17.0	63.2	242.1	26.0	1271
Mean	17.0	63.1	234.3	25.6	1243
P-Value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD (0.05)	3.0	0.5	12.5	0.8	396
CV (%)	12.5	0.5	3.8	2.3	22.7

Location: Richland, MT
Previous crop: Durum
Planted: 4-22-2021
Harvested: 8-11-2021
Applied fertilizers in lb/a: None
Soil type: Farnuf Loam
Yield adjusted to 13% moisture content

Irrigated Green Dry Pea Variety Evaluation - MSU **Sidney, MT 2021**

Variety	Days to Flower	Plant Height	Test Weight	1000 Seed Weight	Protein	Adjusted Grain Yield
	(DAP)[1]	(in)	(lb/bu)	(g)	(%)	(lb/a)
Aragorn	50.0	15.5	63.3	207.4	25.1	2240
Hampton	52.7	14.0	64.2	228.7	26.4	2798
NDP100144G	57.0	21.0	63.6	198.1	25.6	2809
PS0877MT457	49.0	17.5	64.2	236.0	27.1	2463
Mean	52.2	17.0	63.8	217.6	26.0	2577
P-Value	<0.0001	0.0007	0.0694	<0.0001	0.0115	0.1186
LSD (0.05)	2.0	2.4	NS	5.6	1.1	NS
CV (%)	2.0	7.4	0.8	1.4	2.2	13.1

Irrigated Yellow Dry Pea Variety Evaluation - MSU **Sidney, MT 2021**

Variety	Days to Flower	Plant Height	Test Weight	1000 Seed Weight	Protein	Adjusted Grain Yield
	(DAP)[1]	(in)	(lb/bu)	(g)	(%)	(lb/a)
DS-Admiral	52.0	16.9	63.7	240.2	24.2	2529
Kite	52.0	14.8	64.2	256.9	24.7	2631
Korando	49.0	17.1	65.2	265.7	25.9	2589
ND Dawn	52.0	16.1	64.3	240.1	23.9	2643
Orchestra	52.0	17.8	64.2	272.1	28.5	2922
Peregrine	49.0	13.1	64.3	235.4	23.8	2604
PS0877MT632	52.0	19.0	64.8	222.8	25.8	2882
Salamanca	52.0	17.1	64.8	243.8	26.0	2627
Mean	51.3	16.5	64.4	247.1	25.3	2678
P-Value	N/A	0.0042	0.4296	<0.0001	<0.0001	0.5744
LSD (0.05)	N/A	2.5	NS	12.0	0.6	NS
CV (%)	2.5	8.7	1.2	2.8	1.3	9.6

Location: EARC; Sidney, MT
Previous crop: Sugarbeet

Planted: 5-4-2021
Harvested: 8-4-21

Applied fertilizers in lb/a: None
Soil type: Savage Silty Clay Loam

Yield adjusted to 13% moisture content
DAP[1] = Days after planting

Herbicide: Outlook at 12 oz/a preemergence, Varisto at 21 oz/a (6-7-2021)

Field Pea Irrigated Variety Trial - NDSU **WREC, Nesson Valley, ND 2021**

Variety	Plant Height (in)	Days to Flower (DAP+)	Days to Maturity (DAP+)	Lodging (0 - 9*)	Protein† 2021 (%)	Protein† 2-Yr Avg (%)	Protein† 3-Yr Avg (%)	Test Weight (lb/bu)	Yield 2021‡ (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
Green Cotyledon											
Arcadia	11	51	84	8	26	25.9	25.6	63.8	37.0	52.3	50.8
Aragorn	9	51	83	7	26	26.6	-	63.0	24.8	43.1	43.1
CDC Striker	12	51	83	6	25	26.7	26.1	64.2	31.9	43.2	-
Greenwood	10	45	81	7	26	-	-	64.8	26.6	-	-
Yellow Cotyldeon											
DS Admiral	13	50	83	6	25	25.2	24.9	63.9	29.1	55.1	51.8
Agassiz	14	52	84	6	27	28.5	27.6	64.3	34.7	49.0	50.5
CDC Amarillo	15	53	85	5	28	27.5	-	64.5	41.1	54.4	-
ND Dawn	12	52	84	7	28	26.9	-	64.0	30.5	48.9	-
Durwood	15	52	87	5	26	-	-	64.6	36.1	-	-
Peregrine	9	51	85	8	27	-	-	64.3	26.1	-	-
Kite	8	52	87	8	27	-	-	64.3	25.8	-	-
MEAN	11.7	50.8	84.3	6.7	26.56	26.74	26.03	64.15	31.25	49.44	49.04
C.V. (%)	-	-	-	-	6.93	-	-	0.65	19.30	-	-
LSD (5%)	-	-	-	-	NS	-	-	0.60	8.71	-	-
LSD (10%)	-	-	-	-	2.20	-	-	0.50	7.24	-	-

+ Days after Planting * 0: no lodging - 9: plants lying flat on the ground † Protein content adjusted to 0% moisture ‡ Hail storm on July 22, 2021

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

Soil test (0-6 in.): P=26 ppm; K=145 ppm; pH=7.3; OM=1.9 % — Previous crop: Barley

(0-24 in.): NO3-N=75 lb/a — Planted: 5/7/2021

Yield goal: 50 bu/a — Harvested: 8/11/2021

Planting population: 370,000 seeds/a — Soil type: Lihen Loamy Fine Sand

Applied fertilizer: none applied — Plot size: 55 ft^2

Herbicides applied: Prowl H2O (2pt/a) [5/10], Section Three (5.33oz/a), SuperB (1pt/100gal) [6/17], Basagran (1.5pt/a), Raptor (2oz/a), Assure II (12oz/a), SuperB (1pt/100gal) [6/21] and Gramoxone SL 2.0 (32oz/a), R-11 (1qt/100gal) [8/3] — Rainfall: 6.7 inches (5/7 - 8/11)

Irrigation: 12.9 inches (5/7 - 7/25)

Fungicides applied: Proline 480 5.3 oz/a [7/1]

NORTH DAKOTA STATE UNIVERSITY

Williston Research Extension Center

Chickpeas Dryland Variety Trial - NDSU **WREC, Williston, ND 2021**

Variety	Height	Days to Flowering	Days to Maturity	Seed Size		1000 Seed Weight	Test Weight	Yield
				> 22/64	Pan			
	(in.)	(DAP)	(DAP)	(%)	(%)	(g)	(lb/bu)	lbs/a
CDC Leader	8.8	52.0	83.0	27.3	72.9	324.0	60.3	793.9
CDC Palmer	9.6	52.0	83.5	32.5	67.5	344.5	59.9	712.9
CDC Frontier	10.3	53.0	86.8	9.5	90.6	317.3	60.3	674.4
ND Crown	11.4	52.3	85.5	42.5	57.6	350.2	59.4	623.9
Sawyer	10.3	54.0	84.5	26.2	73.9	357.4	60.0	615.0
CDC Orion	9.1	52.0	85.3	39.9	60.2	350.6	58.6	576.3
New Hope	11.6	53.5	87.8	31.8	68.6	328.7	60.1	363.5
Sierra	8.4	55.0	88.0	55.5	44.7	395.9	58.0	275.5
Royal	12.2	55.3	89.0	53.8	46.3	413.8	59.1	268.9
Mean	10.2	53.2	85.9	35.4	64.7	353.6	59.5	544.9
CV (%)	17.2	1.5	0.8	16.0	8.7	2.7	1.2	25.3
LSD (5%)	2.6	1.2	1.0	8.3	8.3	14.2	1.0	201.1
LSD (10%)	2.1	1.0	0.9	6.9	6.8	11.8	0.8	166.7

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

Planted: 05/10/2021 Harvested: 08/16/2021

Soil test to 6" in ppm: P=20; K=264; OM=1.9%; pH=5.6 Soil type: Williams-Bowbells loam.

Soil test to 24" in lb/a: N=21

Applied fertilizers in lb/a: none

DAP = Days after planting.

Herbicide Application: Valor @ 3 oz/a applied October 28th 2020

Plant Pathology Staff: Evana Somlyay, Erin Rosebrock, Audrey Kalil, Marguerite Wheeler,Taheni Gargouri-Jbir, Katherine Troutman

Dryland Chickpea Variety Evaluation - MSU **Richland, MT 2021**

Variety	Plant Height	Seed sizes greater than 22/64 inches	Adjusted Grain Yield
	(in)	(%)	(lb/a)
2510-2	13.2	1.1	616
Anna	14.4	0.1	858
CDC Consul	14.1	7.1	744
CDC Cory	14.6	2.8	1033
CDC Frontier	13.5	22.9	874
CDC Leader	13.9	30.9	926
CDC Orion	12.7	44.8	1023
CDC Palmer	13.3	36.9	865
Kasin	16.5	1.6	626
Myles	12.5	0.1	1089
ND Crown	15.5	47.3	869
New Hope	16.3	35.2	290
Royal	15.3	N/A	100
Sawyer	14.2	41.8	549
Sierra	15.3	70.1	208
Mean	14.3	21.0	711
P-Value	<0.0001	<0.0001	<0.0001
LSD (0.05)	1.5	8.0	343
CV (%)	7.5	26.8	33.9

Location: Richland, MT
Previous crop: Durum
Planted: 4-23-2021
Harvested: 8-12-2021
Applied fertilizers in lb/a: None
Soil type: Farnuf-Reeder Loam
Yield adjusted to 13% moisture content

Note: Antelope damage was substantial in this trial, especially for the larger seeded Kabuli cultivars

Irrigated Chickpea Variety Evaluation - MSU **Sidney, MT 2021**

Variety	Days to Flower (DAP)[1]	Plant Height (in)	Seed sizes greater than 22/64 in (%)	Adjusted Grain Yield (lb/a)
2510-2	55	16.0	0.5	3629
Anna	52	12.7	0.0	3166
CDC Consul	53	15.0	0.1	3257
CDC Cory	54	14.3	0.3	3291
CDC Frontier	54	13.8	12.0	3338
CDC Leader	50	12.1	25.3	3059
CDC Orion	49	12.9	55.3	3631
Myles	49	12.7	0.0	2583
ND Crown	52	15.2	56.9	2921
Royal	56	15.9	74.9	3086
Sawyer	52	12.7	25.8	2878
Sierra	56	13.0	72.1	2987
Mean	52.6	13.9	27.0	3149
P-Value	<0.0001	0.0017	<0.0001	0.0007
LSD (0.05)	1.8	2.0	5.4	410
CV (%)	2.0	8.4	12.0	7.7

Location: EARC; Sidney, MT
Previous crop: Sugarbeet
Planted: 5-4-2021
Harvested: 8-16-21
Applied fertilizers in lb/a: None
Soil type: Savage Silty Clay Loam
Herbicide: Outlook at 12 oz/a preemergence, Tough at 20 oz/a (6-9-2021)
DAP[1] = Days after planting
Fungicide: Miravis Neo at 13.7 oz/a (6-25-2021), Miravis Top at 14 oz/a (7-7-2021)
Yield adjusted to 13% moisture content

Industrial Hemp Variety Trial EARC, Sidney, MT 2021

Variety	Plant Height (in)	Stem Diamerter (mm)	Seed Yield lb/ac	Biomass Yield lb/ac	TKW	Harvest Index
Altair	68.1	7.5	318.5	6349.8	11.2	0.05
Anka	74.6	9.8	520.7	7738.3	11.3	0.07
Bialobrzeskie	72.3	8.1	273.4	7140.4	8.4	0.03
CFX_1	49.5	6.9	649.4	4222.0	15.3	0.15
CFX_2	49.0	7.1	577.1	4425.4	13.3	0.13
Grandi	38.9	7.0	581.1	2921.9	13.9	0.19
H-51	76.8	9.6	215.6	7909.2	11.0	0.03
Henola	60.7	7.3	798.4	5711.6	11.9	0.14
Hlesia	74.6	9.8	382.5	6086.7	11.2	0.06
Hliana	78.7	11.6	424.6	6596.8	10.6	0.06
Jin_Ma	79.1	11.1	0.0	10944.2	0.0	0.00
Lara	78.6	9.9	254.3	8277.7	10.1	0.03
SS_Beta	76.8	8.4	0.0	12947.3	0.0	0.00
Vega	63.4	7.8	612.1	5978.8	13.7	0.10
X-59	49.7	8.6	811.1	4393.1	13.5	0.18
Mean	66.0	8.7	427.9	6776.2	10.4	0.08
P-Value	<0.0001	0.0006	<0.0001	<0.0001	0.0019	<0.0001
CV (%)	13.1	18.4	51.6	24.2	17.2	46.63
LSD (0.05)	12.3	2.3	314.6	2337.8	2.4	0.05

Planted: 5/12/2021

Harvested: 8/18/2021 & 8/26/2021 Soil Test N Avail (lb/ac): 21.2 lb/ac N added (lb/ac): 80 lb/ac

Soil Test P2O5 (ppm): 17.3 ppm P2O5 added (lb/ac): 26 lb/ac

Herbicide: Sonalan HFP @ 7.5 lbs/ac on 10/19/2020
Assure II @ 12 oz/ac on 6/1/2021

Previous crop: cereal

Soil Type: Savage Silty Clay

Plot Width: 5 ft

Crop Year Precipitation: 6.47 inch

Irrigation (sprinkler): 2.68 inch

Montana State University
Eastern Agricultural Research Center
Frankie Crutcher, Jason Cook, Staci Hurley, Samantha Hoesel

Resistance of Spring Wheat Varieties to Fusarium Head Blight – EARC Sidney, MT 2021

Variety	Severity (%)[a]	Incidence (%)[b]	Index[c]	FDK (%)[d]	Yield (Bu/Ac)
Dagmar (S)	13.7 B-E	55.6 AB	7.6 B-D	1.7 B	36.4
Lanning (S)	8.3 DE	46.7 AB	4.0 D	1.3 B	47.7
McNeal (VS)	30.0 A	75.6 A	22.9 A	11.7 A	35.3
Reeder (S)	15.5 A-E	53.3 AB	8.2 B-D	1.7 B	42.7
Ingmar (MR)	2.9 E	31.7 B	0.9 D	0.5 B	39.8
Vida (S)	12.9 C-E	46.7 AB	6.1 B-D	0.3 B	50.0
MT1716	11.8 C-E	45.6 AB	5.5 CD	3.3 AB	46.0
MT1809	4.8 E	26.7 B	2.2 D	0.5 B	37.1
MT1855	8.8 DE	47.8 AB	4.4 CD	2.0 B	57.6
MT1904	19.3	63.3	12.2	10.0	35.8
MT1927	24.5 A-C	67.8 AB	16.6 A-C	0.7 B	35.3
MT1931	16.7 A-E	52.2 AB	8.9 B-D	1.0 B	47.3
MT1934	13.3 C-E	52.2 AB	7.2 B-D	1.3 B	37.6
MT1938	18.3 A-E	48.3 AB	8.8 B-D	0.0 B	51.4
MT1939	18.6 A-E	56.7 AB	10.9 A-D	1.0 B	42.7
MT1951	13.1 C-E	46.7 AB	6.6 B-D	2.0 B	39.1
MT2005	15.1 A-E	48.9 AB	8.4 B-D	0.7 B	44.0
MT2007	10.6 C-E	47.8 AB	5.3 CD	7.3 AB	43.9
MT2011	16.1 A-E	61.1 AB	9.8 B-D	1.7 B	41.4
MT2013	9.8 C-E	36.7 AB	3.6 CD	1.0 B	26.7
MT2018	13.8 B-E	50.0 AB	6.7 B-D	1.0 B	41.7
MT2019	15.1 B-E	56.7 AB	8.8 B-D	0.3 B	42.4
MT2020	9.3 C-E	43.3 AB	4.3 CD	1.0 B	47.9
MT2021	10.3 C-E	47.8 AB	5.2 CD	3.3 AB	46.9
MT2022	6.2 E	40.0 AB	2.9 D	1.7 B	42.5
MT2030	11.8 B-E	46.7 AB	5.5 B-D	0.0 B	40.1
MT2034	19.3	66.7	12.9	10.0	36.7
MT2038	22.7 A-D	60.0 AB	13.9 A-D	1.7 B	52.2
MT2043	17.2 A-E	65.6 AB	11.5 A-D	5.0 AB	32.7
MT2045	16.8 A-E	54.4 AB	9.6 B-D	6.7 AB	30.2
MT2047	10.8 C-E	58.3 AB	6.5 B-D	0.0 B	35.0
MT2049	10.3 C-E	51.1 AB	5.2 CD	1.7 B	42.9
MT2050	28.2 AB	65.6 AB	18.4 AB	0.3 B	37.1
MT2054	12.8 C-E	52.2 AB	6.6 B-D	1.7 B	29.5
MT2063	15.7 A-E	58.9 AB	9.7 B-D	2.3 B	43.2
MT2065	11.5 C-E	52.2 AB	6.6 B-D	0.7 B	40.2
MT2072	13.4 A-E	53.3 AB	8.0 B-D	1.0 B	30.9
MT2075	19.6 A-E	66.7 AB	13.8 A-D	7.5 AB	36.8
Mean	14.4	52.5	8.3	2.2	41.2
p-value	<.0001	0.02	<.0001	0.002	0.07
CV (%)	47.2	25.0	66.1	154.1	23.9
HSD (5%)	14.9	37.6	12.4	9.2	N/A

MR = moderately resistant, S = susceptible, and VS = very susceptible

Letters in common did not differ significantly according to a Tukey's HSD test at a significance level of 5%

[a]Severity: Average percent area of head covered by disease. Thirty heads were evaluated for each plot.

[b]Incidence: Percent of thirty heads per plot that had visible FHB symptoms.

[c]Index: Severity X Incidence / 100

[d]FDK: Percent scabby kernels

Continued on next page

Continued from previous page

Irrigated
Planted: 5/6
Harvested: 8/21
Plot Size: 5’ x 10’
Seeding Rate: 60 lbs/A
Soil Type: Savage silty clay loam
Previous Crop: Wheat
Residual Soil N to 3 ft: 79 lbs/A
Residual Soil P to 6 in: 21 ppm
Applied Fertilizer: 100-30
Irrigated (sprinkler): 5/13, 6/4, 6/23, 6/30, 7/12
Chemical Applications: 2,4-D, Wolverine Advanced, Widematch, Discover, NG
Precipitation April – September: 5.39 in
Spawn Inoculum Applied: 6/2
Vigor: 5/24
Disease assessment(s): 7/23, 7/28

Performance of Durum Wheat Under Different Seeding Date and Rate

Gautam P. Pradhan, Rojee Chipalu Pradhan, and Lauren Holman
Partial Funding Agency: Montana Wheat and Barley Committee

Introduction

Seeding dates play a significant role in field crop production. MonDak region accounts for 76% of 1.58 million acres of durum wheat planted in the USA. Durum crop is vulnerable to high temperature stress at the reproductive stage; the high temperature stress decreases grain number per spike, grain weight, and yield. In the MonDak region, high temperature usually begins in the month of July. The risk associated with high temperature stress at the reproductive stage may be circumvented by optimizing the seeding date. There is insufficient information on an optimal durum seeding date for the MonDak region.

Cadmium (Cd) is heavy metal toxic to humans. Producers of the MonDak region are mainly growing durum varieties (Joppa, Tioga, Divide) with high Cd accumulation potential. Due to higher grain Cd, there is always a risk of rejection of MonDak durum in the international market. So, there is a need to find management practices to decrease Cd in the grains of these varieties. Perilli et al. experimented on two durum varieties in Manitoba and showed that seeding date and location influences grain Cd concentration. There is a lack of information on the effect of seeding date on Cd accumulation in the durum for the MonDak region.

The seeding rate is another crucial entity that affects field crop production. The optimum plant population of field crops depends upon the climate, soil type, geography, cultivars, seeding rate, and seeding time of a given region. Isidro-Sánchez et al. showed a significant effect of variety and seeding rates on durum yield under the Saskatchewan climate. An experiment conducted at Minot and Hettinger showed no significant effect of seeding rate on grain yield of modern durum varieties. There is insufficient information on the optimum seeding rate of durum for the MonDak region. Also, the effect of seeding rate and an interaction effect of seeding rate × seeding date × variety on growth, grain yield, protein, and grain Cd concentration in durum is lacking.

Objectives

The overarching goal of this project is to enhance the growth, yield, and quality of durum wheat in the MonDak region through improved management practices. The project envisages determining the effect of seeding date and rate on durum, growth, yield, and grain quality (test weight, protein, and grain Cd content).

Materials and Methods

This experiment was conducted at the Williston Research Extension Center (WREC), Williston, ND. (Lat. 48.13789°, Lon. -103.73572°; Elevation 2105 ft). The soil type of the research site is Williams-Bowbells Loam. The treatment comprised of six seeding dates: April 23rd, May 3rd, 13th, 24th, 25th, June 2nd, and June 13th of 2021 as main plots; two durum wheat varieties (Joppa, a prevalent variety in MonDak region with no genetic makeup for low Cd accumulation; and ND Riveland a low Cd accumulating variety) as subplots, and five seeding rates (0.85, 1, 1.15, 1.3, and 1.45 million pure live seeds per acre) as sub-sub plots. In total, there will be 180 plots. During seeding, a MicroEssentaials fertilizer (12-40-010S-12Zn) was applied along with the seeds @ 58.8 lb/ac, and urea was side dressed at 110.7 lb/ac. The experimental field was kept weed free by hand weeding.

Results

Durum wheat experienced extreme high temperature and drought stress this year. The maximum daily temperature exceeded 90°F for 14 days in July and six days in August. Durum seeded in different dates was in the reproductive stage in those months (Fig. 1). The annual precipitation from 10/1/2020 to 09/30/2021 was 9.5 inches, which was 4.5 inches below the long-term 65 years average (Fig. 2). The average monthly precipitation in 2020/21 was always lower than the 65-year average except in November 2020 and June 2021 (Fig. 3).

Figure 1. Daily maximum temperature at WREC.

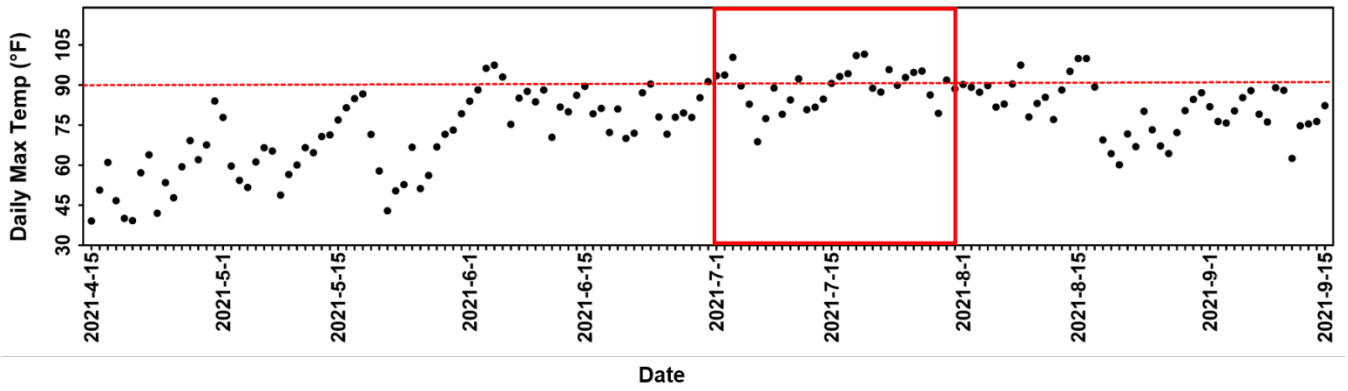


Figure 2. Annual precipitation at WREC.

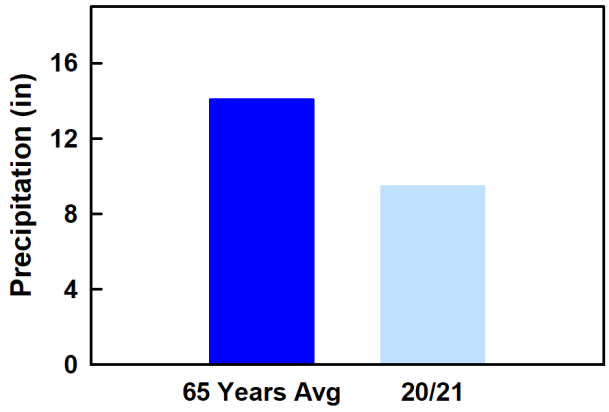
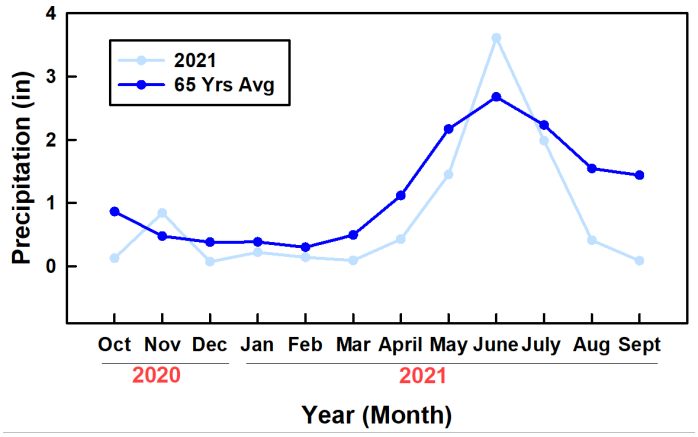


Figure 3. Monthly distribution of precipitation at WREC.



Durum grain yield ranged from 4 to 18 bu/ac. There was a significant interaction effect of seeding date and variety on durum yield. Irrespective of variety, durum seeded on April 23rd, 2021, produced a higher grain yield than other seeding dates. Seeding durum in May or June decreased grain yield by 58-80% in Joppa and by 41-66% in ND Riveland (Fig. 4).

Figure 4. Differential response of durum varieties to seeding date for grain yield. The number on top of the bar shows a percent decrease from April Planting.

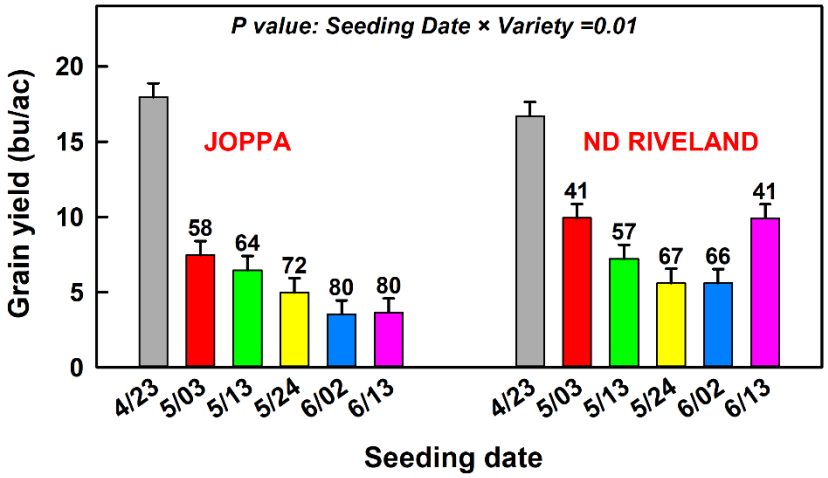
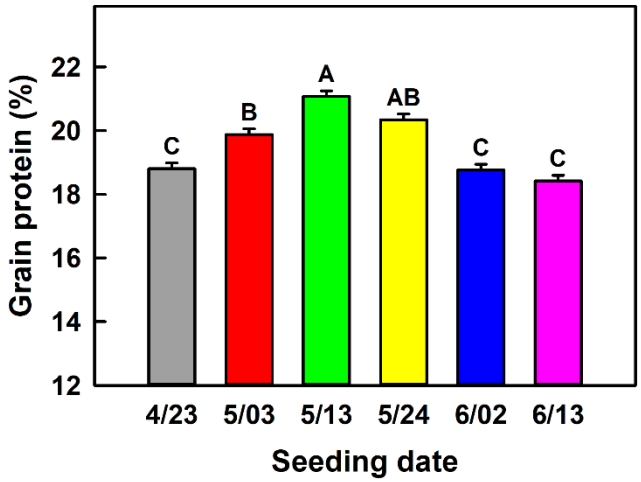


Figure 5. Effect of seeding date on durum grain protein.



Durum grain protein ranged from 18.4 to 21.1 percent. Durum seeded on May 13th and 24th had the highest grain protein, and those seeded in April or in June had the lowest grain protein (Fig. 5.). Due to a minimal yield, we could not quantify test weight for 114 plots (out of 180); so data was not analyzed and presented. We are still working on quantifying grain cadmium content.

Summary

The preliminary results from this trial showed that drought and high temperature stress affected durum yield tremendously. The maximum grain yield obtained at the seeding date of April 13th was 18 bu/ac only. Other seeding dates decreased the yield by 41 to 80 percent. We will be processing biomass and aerial imageries in the coming days.

Irrigated Canola Production: Population and Fertilizer, Year 2

Justin Jacobs, Andrina Turnquist, and Tyler Tjelde
NDSU – Williston Research Extension Center

Objective

Canola is becoming an important crop in northwestern North Dakota. The majority of canola acres are grown on dryland, however there has been an increased interest in growing canola under irrigation in North Dakota and the greater MonDak region. The Nesson Valley Irrigation Research and Development Project (NVIRDP) has been testing canola varieties in an annual variety trial since 2015 with an average yield of 2,800 pounds per acre. As a result of the ongoing variety trial testing, irrigated producers across North Dakota have contacted the NVIRDP regarding the best practices for growing canola under irrigation. Information regarding canola production in an irrigated system is not readily available and not pertinent to our region and environment. Canola planting populations and fertilizer rates have been well researched for dryland environments, but not for irrigated production in North Dakota.

Irrigation is not the dominant form of farm production in North Dakota, however northwestern North Dakota has the majority of the irrigated acres in the state. According to the 2021 FSA reports, North Dakota reported 310,900 acres of irrigated production, with 2,300 of those acres being canola production. With the increasing interest in canola production, several producers are seeking best management practices for irrigation. Williams county reported 1,600 acres of irrigated canola production in 2021. Will certain aspects of dryland canola production relate to irrigated production practices? What practices can be implemented in planting populations and fertilizer rates to increase yield?

Materials and Methods

Table 1. Planting populations in canola

Target Plant Pop	Pounds / Acre	Planted Pop
260,000	3	278,800
520,000	5	557,600
780,000	8	836,400
1,000,000	10	1,115,100

Four populations were observed; 260,000, 520,000, 780,000, and 1,000,000 seeds per acre. In order to account for percent emergence loss, higher populations were planted compared to the established stand (Table 1). The four planting rates were seeded into six different fertilizer treatments. Three rates of nitrogen (N) and two rates of sulfur (S) were investigated (Table 2). The N fertilizer rates were adjusted for the fall 2020 soil test of 73 pound per acre result of N.

Table 2. Fertilizer rates for nitrogen and sulfur in canola

Soil Residual = 73 lb N/a			
		Urea	AMS
N Fert	S Fert	Lb/a	Lb/a
75	15	0	63
	30	0	125
150	15	139	63
	30	110	125
225	15	302	63
	30	265	125

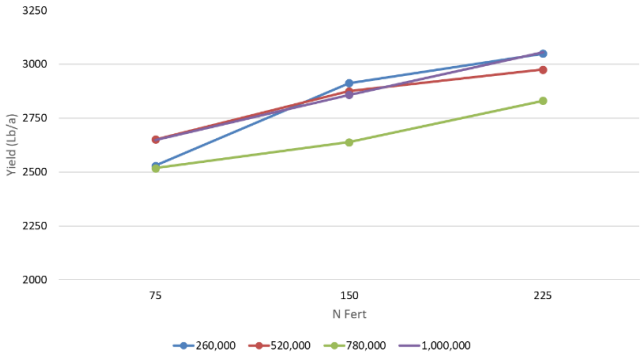
Ammonium Sulfate (AMS) was used as the source of sulfur. The amount of N received from the AMS application was also included in the total N for each N fertilizer rate. Previous research has shown that 150 pounds of nitrogen per acre is the recommended rate for dryland canola production in a cool, wet environment, with a recommended planting rate of 520,000 seeds per acre.

The trial was planted May 13, 2021 using a precision plot planter. Seven rows were planted with a row spacing of 7.5 inches. Seed was planted 0.5 inches deep. HyClass 930RR was the canola variety used. Sonolan HFP was applied as a preemergent herbicide and Cornerstone Plus was applied for post emergent weed control. In-season measurements were taken on lodging, flowering date, plant height, and maturity date. Harvest occurred August 31, 2021. After harvest, yield, oil content, and test weight were recorded on the harvested seed.

Results and Discussion

In 2020, the nitrogen rates and populations were easily identifiable from one another, due to differences in color of the plant or density of the plot. However, in 2021, these differences were not as identifiable. The populations appeared to have uniformity and made visual identification difficult. Similarly there was no noticeable difference in color of the plants across the fertilizer treatments. While the populations may not have been visually identifiable from one another, a closer inspection showed that the lower populations had more branching per plant, while the higher populations demonstrated visibly smaller stems. The branching can be attributed to canola's ability to compensate for lower stands (Kandel et al., 2019).

Figure 1. Canola yield response to N fertilizer



	Population			
	260,000	520,000	780,000	1,000,000
Fert (NxS)	Yield (Lb/a)			
75:15	2,474	2,801	2,408	2,595
75:30	2,586	2,501	2,147	2,700
150:15	2,708	2,837	2,474	2,760
150:30	3,117	2,912	2,396	2,954
225:15	3,155	3,051	2,610	3,123
225:30	2,945	2,902	2,684	2,988

For the second straight year, dry and hot conditions were observed during the growing season. Less than 8 inches of natural precipitation was recorded during the growing period. Irrigation began after planting and continued up until harvest. There were 14.5 inches of overhead irrigation applied. No diseases were identified in the trial, however an application of Priaxor D to control white mold was made during the flowering period. Flea beetle damage occurred early on in the growing season, and one application of Mustang Maxx and MPede were made.

In previous research with dryland canola production, yield did not increase when N fertilizer rates exceeded 150 pounds. However, irrigated research in Oregon has shown that yield can increase when more fertilizer is applied (Wysocki et al., 2007). In 2020, the treatment of 225 pounds of N decreased yield significantly compared to the 75-pound and 150-pound treatments. However, in 2021, the yield continued to increase past 150 pounds of applied N (Figure 1 and Table 3). In 2020, the yield was impacted by population, as the yield began to decrease once the population exceeded 780,000. In 2021, the yields were less affected by population, as the yield continued to increase past 780,000. There were no significant differences found between plant populations with the only significant differences being the interactions of fertilizer rates and plant populations.

Summary

The results of the study show that additional years of testing need to be conducted to create a plant population and fertility rate recommendation for irrigated canola production. A study out of Oregon State University in 2009 recommended 7 pounds of N for every 100 pounds of seed yield (Wysocki et al., 2007). The results in 2021 mirrored this previous research by showing that the top yield of 3,155 pounds per acre received 7 pounds of N for every 100 pounds of seed yield. However, a similar trial in Washington showed that optimum N rates are only 4 to 5 pounds of N for every 100 pounds of seed yield (Hang et al., 2009). Similarly, the 2020 results at Nesson Valley showed that the highest yield needed only 4 pounds of N for 100 pounds of seed yield. Further research is needed to establish the optimal fertilizer rate needed for irrigated production.

References

Hang, A.N., H.P. Collins, K.E. Sowers. 2009. *Irrigated Spring and Winter Canola Production in Washington*. Washington State University Extension Service, EM006E.

Kandel, H., L. Lubenow, C. Keene, and J.J. Knodel. 2019. Canola production field guide. A-2180. NDSU Extension, Fargo, ND.

Wysocki, D.J., M. Corp., D.A., Horneck, and L.K. Lutcher. 2007. *Irrigated and Dryland Canola*. Oregon State University Extension Service, EM3943-E.

Determining Soybean Planting Date and Soil Temperature for the No-till Semiarid Conditions of Western North Dakota

Gautam P. Pradhan, James Staricka and Jerald W. Bergman
NDSU – Williston Research Extension Center
Partial Funding Agency: North Dakota Soybean Council

Introduction

Planting date plays a crucial role in the performance and success of a field crop. Early or late planting may decrease grain yield and quality of a crop due to increased biotic (insect, disease, weed) and abiotic (frost, drought, and high temperature) stress. Kandel (2013) noted that soybean is susceptible to frost and prolonged exposure to near-freezing conditions in the spring and fall. He recommended that soybean be planted in North Dakota and Northwestern Minnesota when the soil temperature is >50°F. Western North Dakota has a cool semiarid climate with annual precipitation of <15 inches, at least 5 inches lower than the eastern part of the state. In this part of the state, the last spring freeze generally occurs in the last week of April and the first fall freeze in October. There is a lack of information on soybean planting dates and soil temperature suitable for the western part of North Dakota.

Objectives

- To find out the optimal soybean planting date for western ND.
- To determine an optimal soil temperature (at 4" depth) for planting soybean at western ND.

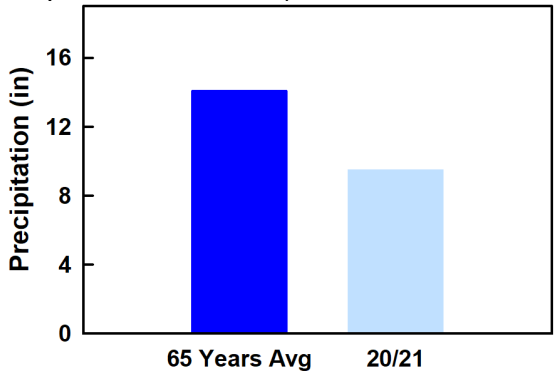
Materials and Methods

Two glyphosate-tolerant soybean varieties, 'ND17009GT' and 'ND18008GT', were seeded at Williston Research Extension Center, Williston, using a GPS based autosteered seven rows no-till plot seeder that maintained a row to row distance of 7". The treatments comprised of seven seeding dates: 3rd, 10th, 17th, 25th, and 31st of May, and 7th and 14th of June 2021 as main plots; two varieties: as subplots, and two seed treatments (treated with Obvious @ 4.6 oz/100 lb seed, and not treated) as sub-sub plots. The experimental field was kept weed free by spraying Valor @ 3 oz/ac on October 20th, 2020, and "RT 3 Powered by Roundup Technology Herbicide" @ 32 oz/ac on July 30th, 2021. During crop growth, drones equipped with multispectral, thermal, or RGB cameras were flown over the experimental field to estimate Canopy Temperature (CT), Normalized Difference Vegetation Index (NDVI), and Normalized Difference Red Edge (NDRE). At maturity, we measured plant height with a meter scale, collected biomass from nine square feet, and harvested crops using a plot combine.

Results

- 2021 is an extremely drought season. From October 1st, 2020 to September 30th, 2021, the annual precipitation was 9.5 inches, which was 4.5 inches lower than the 65-year average (Fig. 1).

Figure 1. Annual Precipitation at WREC (October 1st, 2020 – September 30th, 2021)



- There was no effect of seeding date, variety, and seed treatment on soybean plant height. The average plant height of the soybean was 23.8 inches.

- Averaged across other treatments, soybean planted on June 14th had the highest test weight (Fig. 2A) and grain yield (Fig. 2B), followed by soybean planted on May 17th.
- Averaged across other treatments, variety ND 17009GT had 1.9 lb/bu higher test weight (Fig. 3A) and 1.8 bu/ac more grain yield than ND 18008GT (Fig. 3B).

Figure 2. Soybean test weight and grain yield under different planting dates.

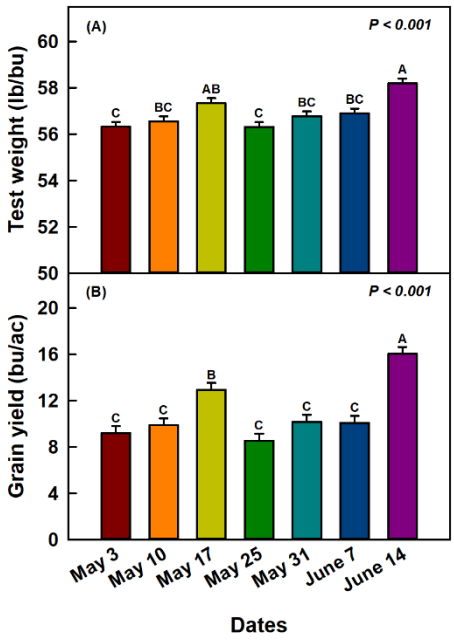
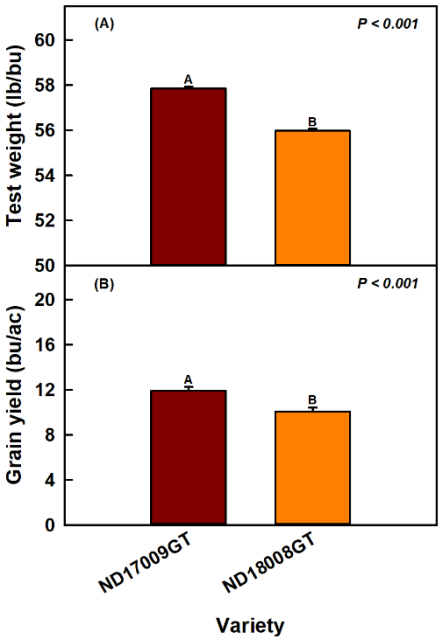


Figure 3. Soybean test weight and grain yield under different varieties



Summary

2021 is another severe drought year that adversely affected soybean growth and yield. This year, soybean seeded in the middle of June had the highest grain yield compared to all other seeding dates, and variety ND17009GT performed better than ND18008GT for both yield and test weight. We will be processing biomass and aerial imageries in the coming days.

Harvesting soybean with a plot combine.

Flax Seeding Date and Rate for No-Till Semiarid Western North Dakota

Gautam P. Pradhan, Jerald W. Bergman, James A. Staricka
Partial Funding Agency: AmeriFlax

Introduction

North Dakota (ND) is the largest flax-growing state in the USA, with 198,000 planted acres in 2020. In ND, approximately 48% of the flax acreage belonged to the state's northwestern region (Fig. 1). This region is characterized by a cold semiarid climate and no-till production practices. Seeding date and rate play a significant role in field crop production. Early or late seeding may decrease grain yield and quality of a crop due to increased biotic (insect, disease, weed, and bird incidence) and/or abiotic stress (frost, drought, and high temperature). A higher seeding rate may decrease crop yield and quality due to competition for resources (water, solar radiation, soil nutrients). And a lower seeding rate may adversely affect crop growth and yield due to insufficient plants per unit area, heavy weed infestation, and nonuniform maturity. There is a lack of information on suitable seeding dates and rates to enhance flax yield and quality under semiarid no-till conditions of western North Dakota.

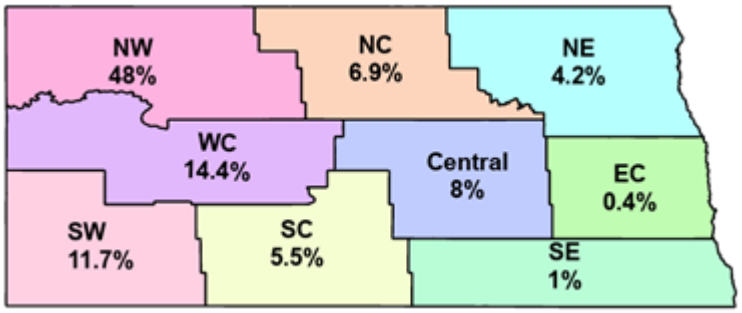


Figure 1. North Dakota district-wise percent flax acreage in 2020.

Objectives

- To determine suitable flax seeding date and rate for no-till semiarid western ND.
- To understand the responses of flax varieties to different seeding dates and rates.

Materials and Methods

This experiment was conducted at NDSU Williston Research Extension Center, Williston, ND (Lat. 48.1343°, Lon. -103.7398°; Elevation 2105 ft). The soil type of the research site is Williams-Bowbells Loam. The experiment was seeded using a GPS-based autosteered seven rows plot seeder that maintained a row to row distance of 7". The treatment comprised of six seeding dates: April 24th, May 3rd, 10th, 17th, 25th, and 31st as main plots; two Varieties: Gold ND and ND Hammond as subplots; and four seeding rates: 15, 25, 35, 45 lbs PLS/ac as sub-sub plots. The physiological data were recorded during plant growth using an unmanned aircraft system equipped with multispectral and thermal cameras. The soil moisture data were collected using a neutron probe from plots seeded with Gold ND at 25 lbs/ac seeding rate. At maturity, plant height was measured, biomass was collected from nine square feet, and the crop was harvested using a plot combine.

Results

2021 is an extremely drought year. The annual precipitation From 2020/10/01 to 2021/09/30 was 9.5 inches, which was 4.5 inches below the 65 years average (Fig. 2). The soil water profile of Gold ND with a seeding rate of 25 lbs PLS/ac showed that there was limited moisture on the first 30 inches of soil in May (Fig. 3), which was due to minimal precipitation from September 2020 to May 2021 (3.45 inches). Flax roots, irrespective of seeding date, never reached to and below 42 inches throughout the growing

period. There was an above-average rainfall in June 2021 (0.93 inches more than 65 yrs average) that drastically increased soil moisture to 18 inches depth; however, by July 29th, flax seeded on and before May 17th used all the moisture.

Figure 2. Annual precipitation at WREC (October 1st, 2020 – September 30th, 2021)

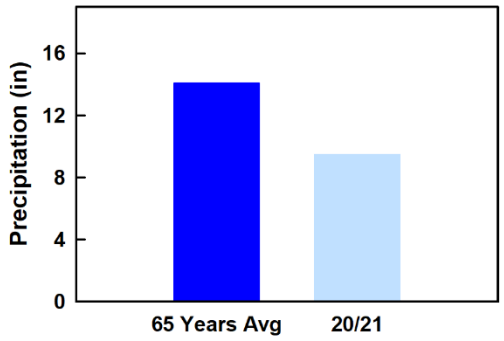
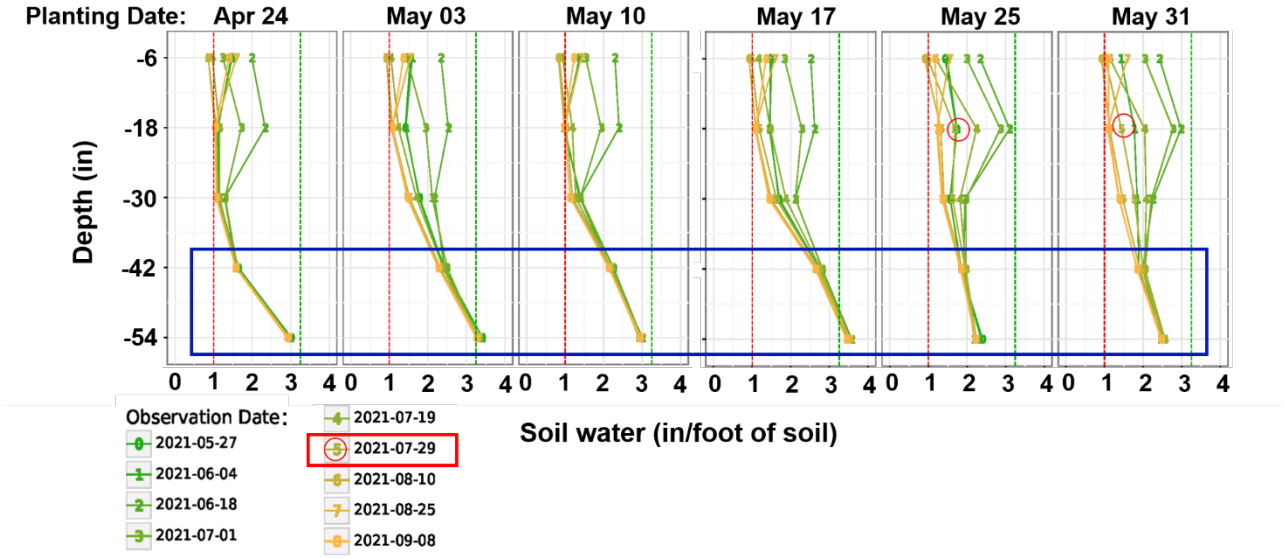


Figure 3. Soil water profile on different planting and observation dates.



Seeding date, variety, and the interaction effect of seeding date × variety on grain yield was significant. The average grain yield of Gold ND was 8.4 bu/ac, and that of ND Hammond was 6.6 (Fig. 4). This yield is 60.8% lower than the last year for Gold ND and 66.1% lower for ND Hammond. By comparing the same-colored bars, we can see that Gold ND yielded higher bushels of grain/ac than ND Hammond for seeding dates from April 24th to May 17th. Both varieties produced the highest yield when flax was seeded in the first week of May.

The effect of seeding rate on grain yield was highly significant. There was no evidence for the interaction effect of seeding rate and other treatments. A seeding rate of 15 lb/ac produced the lowest grain yield (Fig. 5). Increasing the seeding rate to 35 lb/ac boosted the grain yield significantly. A further increase in seeding rate to 45 lb/bu did not produce a higher grain yield.

Due to a minimal yield, the test weight could not be estimated for 54 plots; so, data was not analyzed and presented.

Summary

The preliminary results from this trial showed that the season-long drought stress affected flax yield tremendously. Gold ND had a higher yield potential than ND Hammond across all seeding dates. The

May 3rd seeding yielded the highest grain yield in both varieties. The seeding rate of 35 lb PLS/ac was the optimum seeding rate for grain yield in 2021. We will be processing biomass and aerial imageries in the coming days.

Figure 4. Grain yield under different seeding dates and varieties.

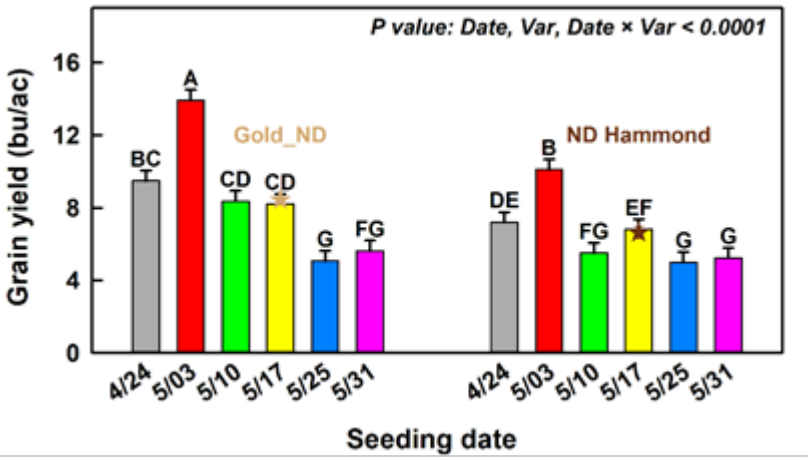
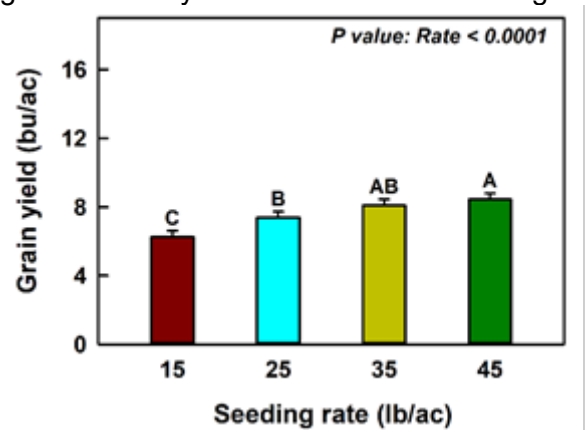
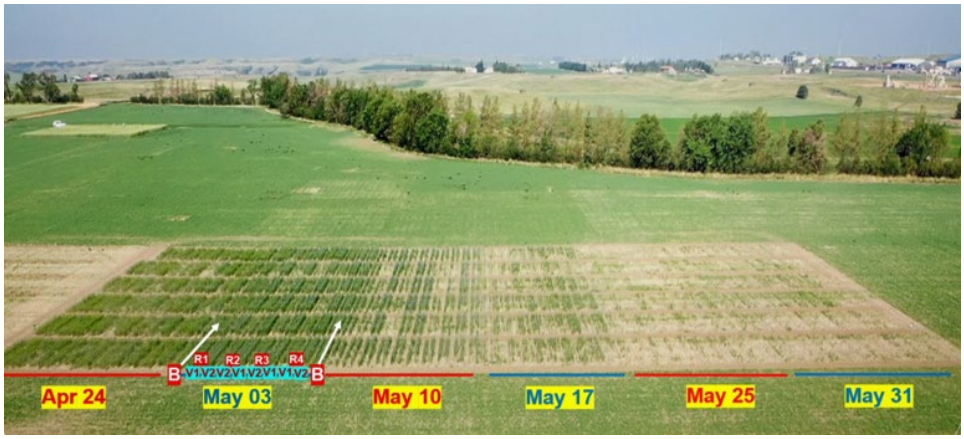


Figure 5. Grain yield under different seeding rates.





Picture 1. Aerial view of flax with experimental layout: Seeding dates, border (B), Varieties (V1=Gold ND, V2=ND Hammond), and Replications (Rn) are shown.

Evaluation of fungicides for control of Ascochyta blight of field pea

Audrey Kalil, Taheni Gargouri Jbir, Evana Somlyay,
Marguerite Wheeler, Katherine Troutman, Alyssa Wilkins and Erin Rosebrock

Introduction

Ascochyta blight, also known as Mycosphaerella blight, is a common foliar disease of field pea caused by three fungal pathogens: *Ascochyta pisi, Ascochyta (Mycosphaerella) pinodes* and *Phoma pinodella*. The disease affects leaves, stems, flowers and pods and can be confused with bacterial blight which causes similar looking symptoms. While field pea varieties differ in their susceptibility to Ascochyta blight, there are none available which are completely resistant. When this disease is present, Ascochyta blight management is therefore achieved through the application of foliar fungicides. The aim of this study was to compare commercially available fungicides in their ability to control Ascochyta blight of field pea.

Methods

The study was a randomized complete block design with 5 ft x 20 ft plots, 5 replicates per treatment. Border plots were planted in between treatment plots and on the outside of the trial. The trial was planted April 8th at the Williston REC dryland location in Williston, ND under no-till conditions (var: Aragorn). Overwintered, infested pea crop residue was sprinkled in the border plots as inoculum on June 10th. Fungicide treatments were 1 – non-treated, 2 – Miravis Top (13.7 fl oz/ac), 3 – Proline (5.7 fl oz/ac) and 4 – Provysol (3.75 fl oz/ac). Two fungicide applications were made for each fungicide treatment (A) June 14th (V8-R1 growth stage) and (B) June 28th (R1-R3 growth stage) using a four nozzle boom with Wilger ER110-02 nozzles (30 PSI, 15 gal/ac). NIS (Induce) was added to the fungicides at a rate of 0.25% v/v. The non-treated check did not receive fungicide or NIS. Ascochyta severity (SV, % symptomatic foliage) was evaluated on 10 plants per plot at four time points (6/10, 6/28, 7/5 and 7/14), means were calculated per plot. Incidence (INC) was calculated based on the percent of plants out of 10 exhibiting symptoms. The trial was harvested July 21st. Yield was adjusted to 13.5% moisture.

Results and conclusions

Table 2. Disease ratings and yield for fungicide treatments

	June 28		July 5		July 14		
Treatment Description	Asc INC	Asc SV	Asc INC	Asc SV	Asc INC	Asc SV	Yield (bu/ac)
Non-treated	9.4 a	10.0 a	90 a	13.2 a	70 a	4.2 a	6.62
Miravis Top	7.2 b	3.4 b	32 b	1.2 b	36 b	1.1 b	7.86
Proline	7 b	4.22 b	48 b	2.4 b	38 b	1.1 b	7.26
Provysol	5.6 b	3.22 b	40 b	2.6 b	40 b	0.8 b	7.16
p-value (ANOVA)	0.0009	0.0001	0.0001	0.0001	0.0018	0.0001	NS

Treatments sharing letters are not significantly different ($\alpha < 0.05$). NS = not statistically significant.
ASC = Ascochyta INC= incidence and SV = severity.

While levels of disease were low, significant differences in Ascochyta incidence and severity between the non-treated check and the fungicide treatments were detected after both fungicide applications. There was no differences among the fungicide treatments in levels of disease. Yield was not significantly different among all treatments. Severe drought was yield limiting, and this likely reduced the impact disease control had on this variable. This study suggests that fungicides are not needed to maintain yield of field pea under drought conditions where disease pressure is low. The relative efficacy of these products should be further evaluated under higher rainfall/yield potential conditions.

Funding Acknowledgement

This work was supported by Syngenta Crop Protection

Comparing Chickpea Varieties for Resistance to Ascochyta Blight

Audrey Kalil, Taheni Gargouri Jbir, Evana Somlyay, Marguerite Wheeler, Ariel Wertheim,
Katherine Troutman, Erin Rosebrock, Alyssa Wilkins,
Kate Pearson, Evan Herman, and Kaleb Jimison

Introduction

Ascochyta blight caused by the pathogen *Ascochyta rabiei* is a highly yield limiting disease of chickpea when not properly managed with both fungicides and genetic resistance. Chickpea varieties differ in their genetic resistance to this disease, and therefore variety selection is critical. This study was initiated to compare commercial varieties of large seeded Kabuli types grown in the US for resistance to Ascochyta blight and maintenance of yield under disease pressure.

Study Description

The studies were planted as a randomized complete block design with 5 x 19 ft plots and 4 replicates per treatment. The trials were planted May 5th, 2020 and April 26, 2021. The seeding rate was 5 plants per square foot adjusted based on seed germination. The trial was not inoculated so disease pressure was from the enviornment. No fungicides were applied. Ascochyta disease assessments were made July 17th, 2020 and July 16th, 2021. Disease was determined based on the percent of the crop canopy with disease symptoms. Examples of Ascochyta blight symptoms are below:



The trials were harvested August 24th, 2020 and August 11th, 2021.

Study Treatments

The varieties evaluated in this study are listed below. The seed source and breeding program which produced these varieties is described.

Variety	Breeding Program	Study Seed Source
CDC Palmer	Crop Development Centre, University of Saskatchewan	Meridian Seed
CDC Orion		Meridian Seed
CDC Leader		Great Northern Ag
CDC Frontier		Meridian Seed
ND Crown	North Dakota State University	WREC Foundation Seed
Royal	USDA-ARS, Pullman, WA	WREC Foundation Seed
Sierra		Washington State Crop Improvement
Sawyer		Washington State Crop Improvement
New Hope	University Nebraska - Lincoln	Meridian Seed

Results

Table 1. Ascochyta blight severity, yield and protein of chickpea varieties in 2020 and 2021

	Ascochyta Blight (%)		Yield (lb/ac)		Protein (%)	
Variety	2020	2021	2020	2021	2020	2021
CDC Frontier	4.9 c	1.3 b	1822.8 a	1374 ab	20.3 ab	20.8 ab
ND Crown	4.3 c	0.9 b	1604.7 a	1075 cde	21.8 a	22.1 ab
CDC Leader	17.1 abc	1.1 b	1468.3 a	1312 abc	19.1 b	20.8 ab
CDC Orion	9.7 bc	2.0 ab	1710.3 a	1250 abc	19.2 b	20.5 ab
Sawyer	8.3 bc	2.3 ab	1431.8 ab	1147 bcd	20.9 ab	21.9 ab
Royal	27.1 a	5.3 ab	898.0 bc	970 de	21.7 a	22.7 a
Sierra	24.2 ab	7.2 a	838.8 c	860 bcd	22.2 a	22.5 a
CDC Palmer		2.5 ab		1417 a		20.1 b
New Hope		2.0 ab		917 de		22.6 a
p-value (α < 0.05)	0.0008	0.0157	< 0.0001	< 0.0001	0.0002	0.0017

Treatments with overlapping letters are not significantly different (α < 0.05). Ascochyta severity was based on the percent of the crop canopy exhibiting symptoms as rated on 7/17 and 7/16 in 2020 and 2021 respectively.

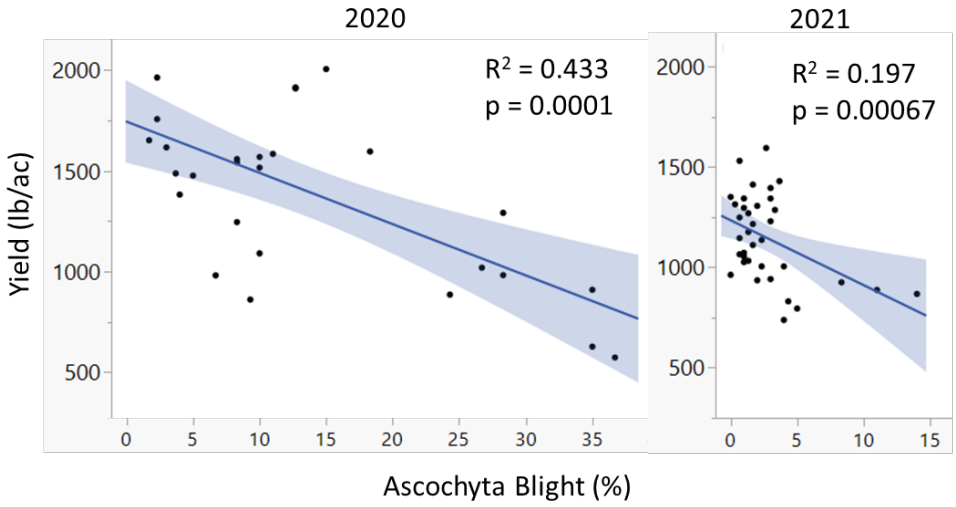


Figure 1. Relationship between Ascochyta blight severity and yield in 2020 and 2021. Fit line (blue). Black dots are plot level data. The R^2 value indicates the strength of the association between yield and Ascochyta blight severity, values closer to 1.0 indicate a stronger association. The p-value indicates statistical significance (α < 0.05).

Conclusions

Royal and Sierra were the most susceptible to Ascochyta blight, while CDC Orion, CDC Frontier, CDC Leader, ND Crown and Sawyer had lower levels of disease in both study years. CDC Palmer and New Hope were comparable to these more resistant varieties in 2021 (Table 1). CDC Frontier and ND Crown stood out as the most resistant varieties, however drought conditions were present in both years so it will be important to confirm these findings under a higher rainfall environment to better separate resistant from susceptible genetics. We evaluated yield in the absence of fungicide application. The CDC varieties, ND Crown and Sawyer had the highest yield in 2020. In 2021, the CDC varieties were the highest yielding with ND Crown and Sawyer being intermediate and Sierra, Royal and New Hope being the lowest yielding. ND Crown had consistently high protein across both years, along with Sierra and Royal. New Hope also had high protein in 2021 compared to CDC Palmer.

Chickpea-Flax Intercropping under Irrigated environments in Sidney, MT

EARC, Sidney, MT

William Franck, Yi Zhou, Sooyoung Franck, and Chengci Chen

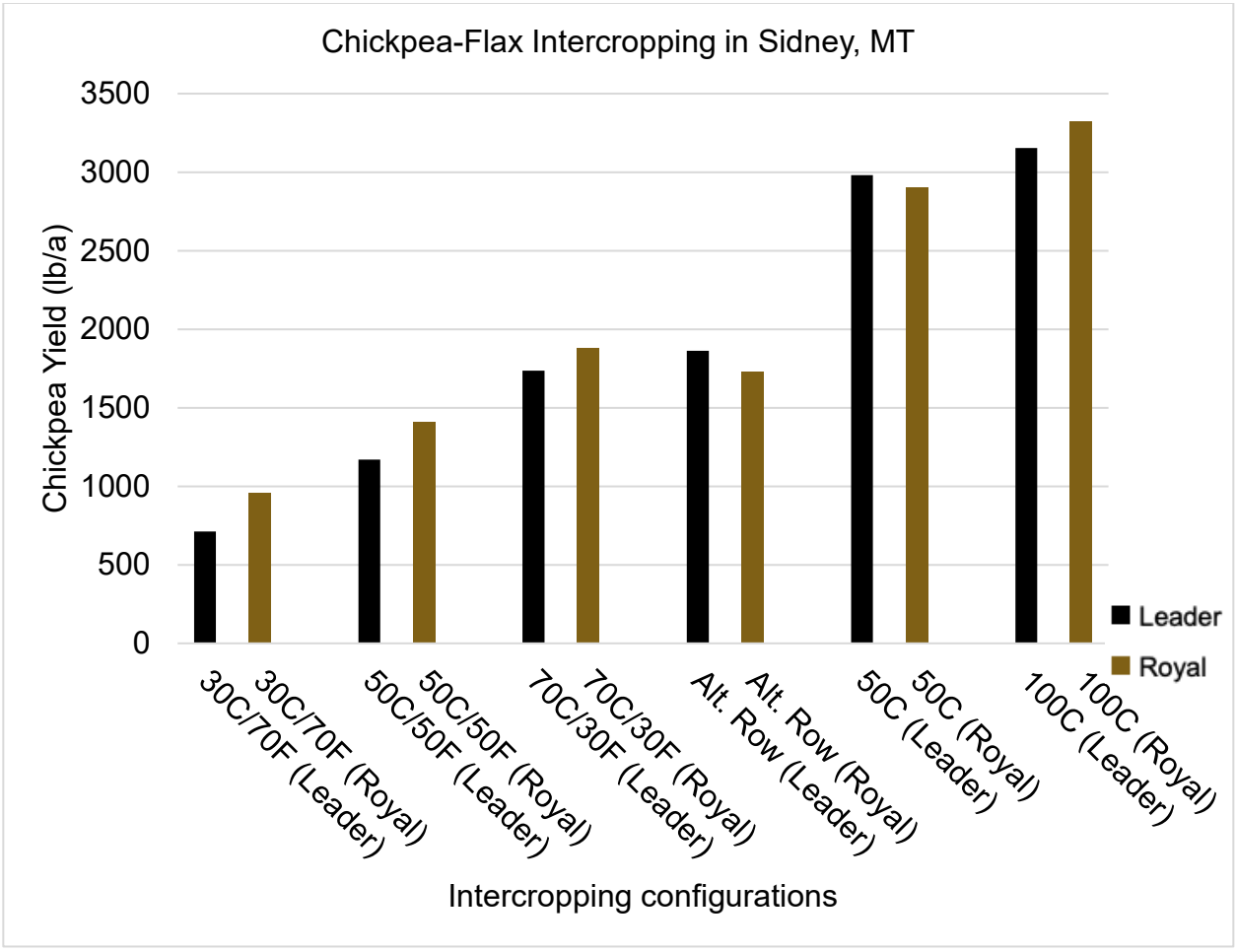
Objective: The objective of this study was investigating the seeding rate and row configuration impact on yield, disease incidence, and disease severity of chickpea in chickpea-flax intercropping systems.

Materials and Methods:

Sidney, MT
Location: EARC
Latitude: 47.7288 N; Longitude: 104.1501 W
Elevation: 1949 ft.
Planting Date: 5/12/2021
Tillage: No-till
Experimental design: Randomized Complete Block
Replications: 4
Plot size: 5’ x 20’
Cultivars: CDC Leader and Royal chickpea, CDC Glas flax
Treatments: 100% chickpea, 50% chickpea, 100% flax, 70% chickpea-30% flax mixture, 50% chickpea-50% flax mixture, 30% chickpea-70% flax mixture, 50% chickpea-50% flax in alternate rows
Rainfall: April to September: 5.39”
Previous crop: Sugar Beets
Soil type: Savage Silty Clay Loam
Fertilizers: None
Herbicide: Sonalan HFP at 2 pts/a on 4/30
Pesticide: Miravis Neo at 13.7 oz/a on 6/25 and Miravis Top at 4 oz/a on 7/14
Irrigation: 0.5" on 5/7; 1.0" on 6/2; 1.14"on 6/21; 1.33” on 6/29
Harvesting Date: 8/16/2021
Disease evaluation: 7/28/2021

Results:

1. Chickpea and Flax Yields in Sidney, MT



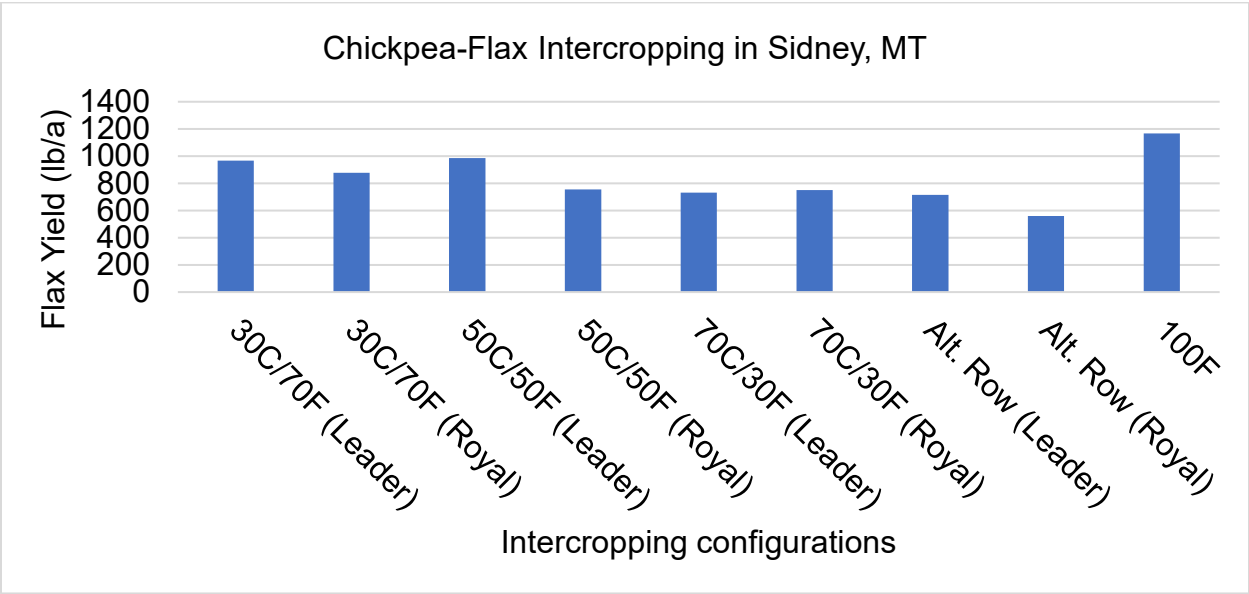
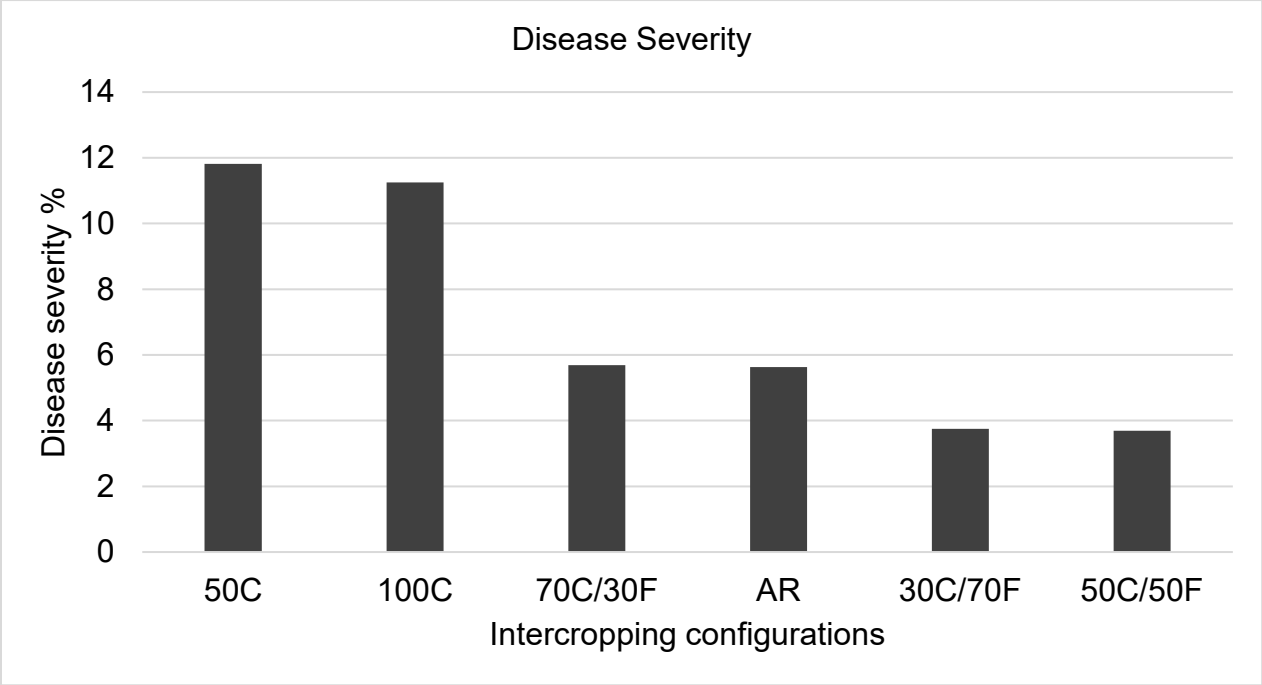


Fig. 1. The yield of chickpea (top) and flax (bottom) in a chickpea-flax intercropping with different intercropping configurations under an irrigated environment in Sidney, MT in 2021.

2. Disease severity and disease incidence of Ascochyta blight on chickpea



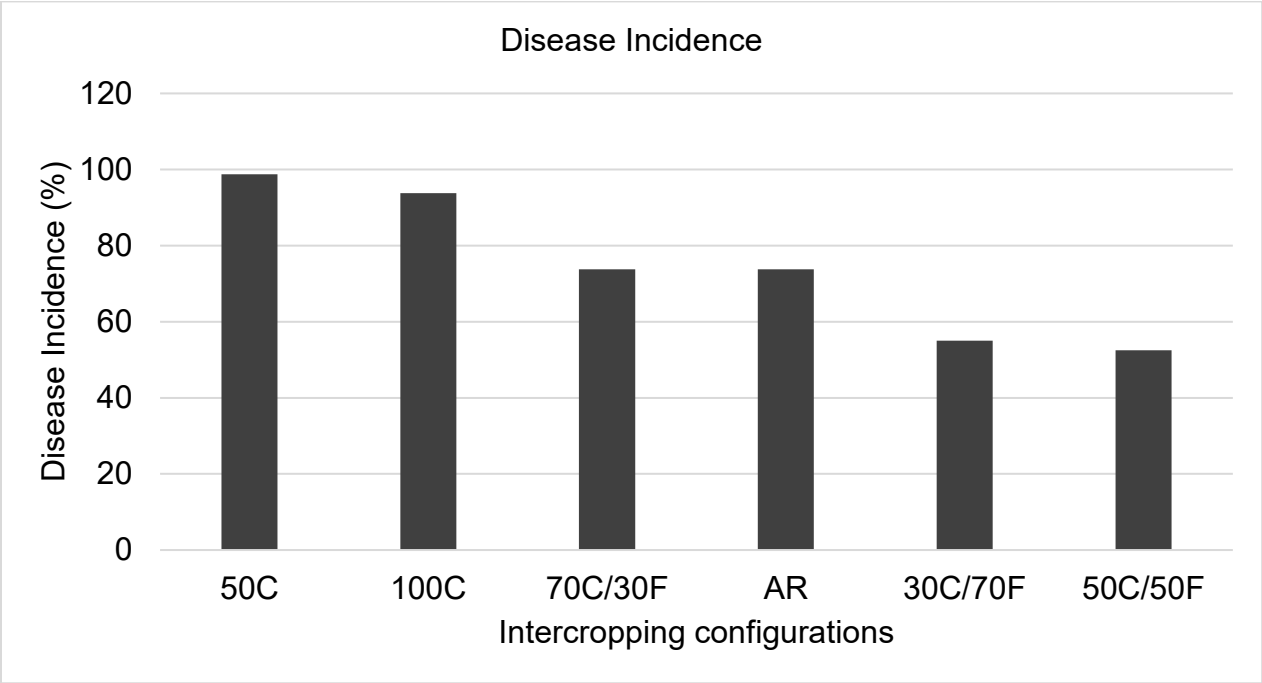


Fig. 2. The disease severity (top) and incidence (bottom) of chickpea Ascochyta blight in a chickpea-flax intercropping with different intercropping configurations under an irrigated environment in Sidney, MT in 2021.

Summary: Chickpea yields increased with increasing percentages of chickpea seeds in the planted mixture. The alternate row configuration planted with the same rate of chickpea as the 50%-50% mixture produced a significantly higher yield than the 50%-50% mixture. For flax yield, the alternate rows produced a lower yield than 50%-50% mixture, and flax yield increased with increasing the

percentage of flax in the mixture. The disease evaluation results show that chickpea cultivar did not significantly affect disease severity (SEV) and disease incidence (INC) (data not shown). SEV and INC of all intercropping configurations were lower than 50% solo chickpea and 100% solo chickpea. Chickpea-flax at 30%-70% and 50%-50% ratios had the lower SEV and INC than other configurations. In addition, SEV and INC of alternate rows were higher than the 50%-50% mixture. There were no significant differences between 50% solo chickpeas and 100 solo chickpeas.

Effect of starter fertilizer and inoculation on chickpea nodulation and yield

Audrey Kalil, Taheni Gargouri Jbir, Jim Staricka, Ariel Wertheim, Evana Somlyay, Erin Rosebrock, Katherine Troutman, Marguerite Wheeler, Alyssa Wilkins, Evan Herman, Kate Pearson, and Kaleb Jimison

Introduction

Chickpea, like many legumes, derives the majority of its nitrogen needs from biological nitrogen fixation by rhizobia bacteria housed in root nodules. Achieving good nodulation through inoculation is therefore crucial to maximizing chickpea yield. Fertilization with phosphorous and sulfur at planting can improve chickpea yield and nitrogen fixation where they are deficient, however, sulfur soil tests are not considered reliable. Studies in other leguminous crops have shown sulfur fertilization can improve nodulation and nitrogen fixation, but the improvement plateaus at higher rates. The effect of fertilization at planting both with and without additional sulfur were evaluated to determine necessary rates to improve nodulation and yield in chickpea. This study was funded by the USDA-NIFA Pulse Crop Health Initiative.

Methods

The trials were set up in a randomized complete block design, with 5 x 25 ft. plots and six replicates. The field site had no previous history of chickpea production. Soil was tested in the fall prior to each study year to determine N (0-24 inches), P, K and pH (0-6 inches) (Table 1). The chickpea variety was CDC Leader and seed was treated with Vibrance Maxx (1.54 fl.oz. /cwt). Uninoculated plots were planted first. Inoculated plots received 8.6 g each of Primo GX2 chickpea, lentil, pea and vetch granular inoculant (effective rhizobial species: *Mesorhizobium ciceri*). Starter fertilizer treatments were monoammonium phosphate (11-52-0-0) and Micro-Essentials S10 (MES) (12-40-0-10) at three rates: 20, 40 and 60 lbs/ac. Starter fertilizer was applied at planting, in the furrow with the seed. Nodulation was assessed on 15 plants per plot at the late vegetative to early flowering growth stage. Biomass was collected from 10-15 plants per plot by cutting off the above ground growth and drying the samples in an oven for 48 hours before submission to Cumberland Valley Analytical Services for analysis. Soil was collected post-harvest to evaluate effect of fertility treatments and inoculation on residual soil N.

Table 1. Soil test results prior to each study year

Study Year	N lb/ac	P ppm	K ppm	pH
2020	11	18	216	5.4
2021	21	30	300	5.7

Results

2020

Uninoculated treatments had little to no nodulation, yield was reduced by 600-800 lbs/ac and seed protein was also reduced (Table 2). There was no yield response to starter fertilizer treatments as the inoculated, unfertilized treatment yielded similarly to the treatments where starter fertilizer was applied and seed protein was also similar (Table 2). Nodulation levels were similar across levels of MES fertilization, thus there did not appear to be a nodulation response to sulfur fertilization. Biomass sulfur did not increase with increasing MES application, so it would seem that sulfur was also not a limiting factor for plant growth either. There was no response to treatments in soil N following harvest despite differences in nodulation and nitrogen in the plant biomass (Table 2), however organic forms of nitrogen would not be evident in this analysis.

Description	Nodule Number	Seed Protein (%)	Yield (lb/ac)	Sulfur (% DM)	Nitrogen (% DM)	Soil N (lb/ac)
Inoculated, Unfertilized	10.0 abc	19.3 a	1694 a	0.22 ab	16.2 a	16
MES @ 20 lbs/ac	7.6 bcd	18.7 a	1717 a	0.23 ab	17.4 a	9
MES @ 40 lbs/ac	10.7 abc	18.8 a	1660 a	0.23 ab	16.4 a	11
MES @ 60 lbs/ac	11.6 ab	18.6 ab	1604 a	0.24 ab	16.4 a	16
11-52 @ 20 lbs/ac	14.1 a	19.0 a	1739 a	0.24 ab	17.6 a	10
11-52 @ 40 lbs/ac	4.9 cde	18.9 a	1890 a	0.22 b	15.7 ab	13
11-52 @ 60 lbs/ac	6.8 bcd	18.4 ab	1728 a	0.22 ab	15.8 ab	14
Uninoculated, MES 40 lbs/ac	0.2 e	16.8 c	1123 b	0.24 ab	12.8 c	10
Uninoculated, Unfertilized	1.3 de	17.5 bc	1003 b	0.25 a	13.3 bc	13
p-value ($\alpha < 0.05$)	0.0007	< 0.0001	< 0.0001	0.0032	< 0.0001	NS

Table 2. 2020 data. Different letters within columns indicate significant differences. % DM = percent plant dry matter. Statistical significance determined by ANOVA ($\alpha < 0.05$). Means followed by a common letter are not significantly different as determined by Tukey's HSD or Student's t-test ($\alpha < 0.05$).

2021

Similar to 2020, uninoculated treatments had little to no nodulation (Table 3). However, in this case there was no effect of inoculation on yield or seed protein. Likely drought conditions affected both yield and nodulation leading to this result. There was no response to starter fertilizer in any of the evaluated variables. Levels of sulfur and phosphorous in the soil therefore sufficient to meet the plant needs. Similar to 2020, there was no difference in soil N post-harvest among treatments and the overall levels are similar the previous fall (Table 1).

Description	Nodule Number	Seed Protein (%)	Yield (lb/ac)	Sulfur (% DM)	Nitrogen (% DM)	Soil N (lb/ac)
Inoculated, Unfertilized	3.3 abc	22.3 a	836	0.20	18.6	32
MES @ 20 lbs/ac	2.9 abc	22.1 ab	773	0.19	18.2	35
MES @ 40 lbs/ac	5.6 ab	21.6 ab	813	0.20	18.3	29
MES @ 60 lbs/ac	2.8 abc	22.5 a	835	0.20	17.7	37
11-52 @ 20 lbs/ac	5.7 ab	21.8 ab	782	0.19	18.3	32
11-52 @ 40 lbs/ac	4.7 abc	21.8 ab	843	0.19	17.0	37
11-52 @ 60 lbs/ac	6.4 a	21.8 ab	826	0.18	16.9	37
Uninoculated, MES 40 lbs/ac	0.0 c	21.3 ab	744	0.19	17.8	37
Uninoculated, Unfertilized	0.4 bc	21.0 b	728	0.19	18.1	35
p-value ($\alpha < 0.05$)	0.0024	0.0193	NS	NS	NS	

Table 3. 2021 data. Different letters within columns indicate significant differences. % DM = percent plant dry matter. Statistical significance determined by ANOVA ($\alpha < 0.05$). Means followed by a common letter are not significantly different as determined by Tukey's HSD or Student's t-test ($\alpha < 0.05$).

Conclusions

Inoculation is key to maximizing chickpea yields (Table 2), although under severe drought conditions yield may not reflect a response to inoculation (Table 3). Despite a lack of yield response to inoculation in 2021, increased nodulation in the inoculated treatments may impact the soil microbiome or organic pools of soil nitrogen that would become available in future years. In both study years, there was no yield, biomass S or N, seed protein or nodulation response to starter fertilizer. The soil where these studies were planted had sufficient phosphorous to meet plant needs (> 16 ppm P) and thus our data suggests that under these conditions using a starter fertilizer will not provide a benefit to the chickpea. Soil S cannot be reliably measured, so growers should consider their field history of S deficiency to determine the economic benefit of this practice in chickpea.

Evaluating Chickpea Planting Date for Disease Management and Yield

Audrey Kalil, Taheni Gargouri-Jbir, Evana Somlyay,
Marguerite Wheeler, Katherine Troutman, Alyssa Wilkins and Erin Rosebrock,

Introduction

Chickpea planting dates recommended by crop insurance have not been updated in many years. Currently, the final planting date for all of North Dakota and all of Montana is May 20th. The first planting date can be as early as April 1st. Avoiding cool soil temperatures by delaying planting results in reduced susceptibility to Pythium seed rot and damping off. Later planting could also affect Ascochyta blight severity based on environment and crop maturity. This research sought to determine if delaying planting past the current last plant date of May 20th reduces yield. Furthermore, both seedling emergence and Ascochyta blight foliar disease were monitored to determine if delaying planting results in improved disease management.

Methods

This study was conducted across multiple sites in ND and MT, but only the results from the Williston REC Dryland research center are presented here. The study was a split plot design where planting date was the main effect, and fungicide followed by variety were the split effects. The plots were 5 ft x 19 ft with 4 replicates per treatment. No supplemental irrigation was provided. Planting dates, dates of emergence and harvest dates are indicated in Table 1. The trial was not inoculated so disease pressure was from the enviornment. Emergence was measured in early to mid June by counting the number of plants along a 10 ft length in the 2nd and 4th row of the plot and converting this value to plants/square feet. Ascochyta blight was rated June 23rd, July 8th and July 23rd either by rating 10 plants per plot for disease severity and incidence or evaluating canopy level symptoms. Canopy level symptoms were rated based on the percent of the crop canopy with Ascochyta blight lesions. Fungicides were applied for control of Ascochyta blight to half of the split plots on June 25th (Miravis Top 13.7 fl oz/ac) and July 7th (Proline 5.7 fl oz/ac + Bravo WS 1.38 pt/ac). Maturity was rated August 5th based on the percent of the plot that was brown and mature.

Treatments

The study treatments were three planting dates (Table 1), two chickpea varieties and fungicide treatment. Chickpea varieties were selected which differ in growth habit. Sawyer (USDA-ARS, Pullman, WA) has the simple leaf type and CDC Orion (Crop Development Center, University of Saskatchewan) has the compound leaf type.

Table 1. Study treatment planting, emergence and harvest dates

Planting Date Treatments	Planting Date	Date of Emergence	Harvest Date
1	May 3	May 17	August 11
2	May 19	May 28	August 17
3	May 25	June 4	August 17

Results and conclusions

Emergence, Ascochyta disease severity, crop maturity, and yield are shown in Table 2. Only disease data from the canopy necrosis ratings conducted on July 23rd are presented. There was very little Ascochyta blight present in this study due to drought conditions, and thus there was no effect of the planting date, fungicide or variety on disease severity.

Table 2. Means across all treatments (Williston, ND)

Planting Date	Variety	Fungicide	Plants/ft^2		Ascochyta Severity (%)	Maturity (%)		Yield (lb/ac)	
1	Sawyer	-	6.5	a	1.50	97.8	a	1110.1	ab
1	Orion	-	5.7	ab	0.13	95.0	ab	1246.4	a
1	Sawyer	+	6.3	a	0.25	98.8	a	1055.4	abc
1	Orion	+	5.8	ab	0.25	95.8	ab	1232.1	a
2	Sawyer	-	6.9	a	0.25	94.0	ab	996.0	bc
2	Orion	-	6.5	a	0.38	86.3	ab	941.6	bcd
2	Sawyer	+	6.2	a	0.00	91.3	ab	947.4	bcd
2	Orion	+	5.2	ab	0.00	91.3	ab	1035.9	abc
3	Sawyer	-	5.1	ab	0.13	67.5	cd	768.9	d
3	Orion	-	4.2	b	0.50	62.5	d	903.4	bcd
3	Sawyer	+	4.3	b	0.13	80.0	bc	860.6	cd
3	Orion	+	4.2	b	0.25	52.5	d	954.3	bcd
		p-value	< 0.0001		NS	< 0.0001		< 0.0001	

Treatments sharing letters are not significantly different ($\alpha < 0.05$). NS = not statistically significant. Ascochyta severity are from canopy necrosis ratings on July 23rd

Emergence was higher in the first two planting dates compared to the last planting date (Table 1). This result was unexpected as delayed planting can reduce seed rot disease, however, soils warmed quickly this past spring and also dry conditions may have been a contributing factor for this result. Visual estimation of crop maturity on August 5th was similar for the first two planting dates, while the last planting date was less mature at this point (Table 1, Figure 1). Dry conditions still allowed for timely harvest for all three planting dates however.

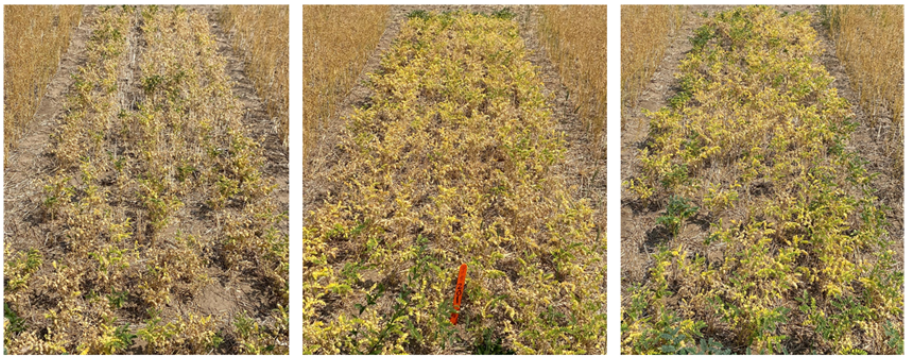


Figure 1. Non-treated (no fungicide) Orion plots on August 5th across the three planting dates

Due to unusually dry conditions and low disease pressure, fungicide treatment had no effect on yield. Across fungicide treatments, yield was highest for the earliest planting date for Orion with a reduction in yield between the first (1239 lb/ac) and second planting date (988 lb/ac). There was no significant differences between yield for the second and third planting date (929 lb/ac). Yield of Sawyer was impacted by delayed planting, where yield was highest at the first planting date (1083 lb/ac), intermediate at the second planting date (972 lb/ac) and lowest for the last planting date (815 lb/ac).

Funding Acknowledgement
This work was supported by a grant from the Northern Pulse Growers Association

Effect of seed treatments on nodulation and yield in chickpea

Audrey Kalil, Taheni Gargouri Jbir, Jim Staricka, Evana Somlyay,
Erin Rosebrock, Alyssa Wilkins, Katherine Troutman, and Marguerite Wheeler

Introduction

Chickpea is highly susceptible to soil-borne seed rotting and seedling blight pathogens including the oomycetes in the *Pythium* genus. Seed treatments that include the active ingredient metalaxyl, mefenoxam or ethaboxam are effective for management of *Pythium* in North Dakota and is the primary means by which this disease is controlled. Studies have linked some seed treatment products to reduced nodulation under laboratory or greenhouse conditions. This study was conducted to evaluate the effect of seed treatments on nodulation under field conditions. Root disease and emergence were evaluated concurrently to contrast any possible detrimental effect on nodulation with the beneficial effect on disease control. This study was funded by the USDA-NIFA Pulse Crop Health Initiative and will be repeated in 2022

Methods

The trial was set up in a randomized complete block design, with 5 x 25 ft. plots and five replicates. The field site had no history of chickpea production and has been in no-till for more than five years. The chickpea variety was CDC Frontier. Seed was treated with the selected seed treatments and allowed to dry (Table 1). All treatments except the non-inoculated (treatment 1), non-fungicide treated plots received a liquid rhizobial inoculum for chickpea (PRIMO, Verdesian), which was applied immediately prior to planting. The trial was planted April 22nd when soil temperature was 48°F. Soil testing was conducted in the fall prior to planting to determine fertilizer needs. Phosphorous (34 ppm; 0-6 inches) and nitrogen (21 lb/ac; 0-24 inches) was adequate for chickpea grown under no-till conditions so no additional fertilizer was applied. Plant population was assessed on May 19th at the V1-V5 growth stage by counting all plants along a 10-ft length in two rows per plot. Nodulation and root rot were assessed June 28th on 15 plants per plot at the late vegetative to early flowering growth stage. Root rot was rated on a 0 to 5 severity scale where 0 = no disease/white root and 5 = completely black root/dead plant. Biomass was collected from 10-15 plants per plot by cutting off the above ground growth and drying the samples in an oven for 48 hours before submission to Cumberland Valley Analytical Services for nitrogen analysis. Plot lengths were measured prior to harvest to account for plants removed for biomass/root rot assessments. The trial was harvested August 17th. Soil was collected post-harvest to evaluate effect of treatments on residual soil N.

Table 1. Fungicides used in seed treatment study. Active ingredient and application rates are from the 2021 North Dakota Field Crop Plant Disease Management Guide (PP622-21)

Fungicide name	Application Rate	Active ingredient
Mertect 340F	2.04 fl. oz./cwt	Thiabendazole (42.3%)
Intego Solo	0.6 fl. oz. /cwt	Ethaboxam (34.2%)
Obvius	4.6 fl. oz. /cwt	Metalaxyl (1.26%), Pyraclostrobin (1.58%), Fluxapyroxad (1.58%)
Rancona CTS	1.53 fl. oz. /cwt	Metalaxyl (1.94%), Ipconazole (2.42%)
Apron Maxx RTA	5 fl. oz. /cwt	Mefenoxam (1.1%), Fludioxonil (0.73%)
Cruiser Maxx Vibrance Pulses	5.0 fl. oz /cwt	Mefenoxam (1.06%), Sedaxane (1.41%), Fludioxonil (0.71%), Thiabendazole (4.24%), Thiamethoxam (8.48%)
Allegiance	0.75 fl. oz /cwt	Metalaxyl (28.35%)
Vibrance Maxx	1.54 fl. oz./cwt	Mefenoxam (3.52%), Sedaxane (4.69%), Fludioxonil (2.35%)
Vibrance Maxx Pulses	5 fl. oz. /cwt	Mefenoxam (1.07%), Sedaxane (1.43%), Fludioxonil (0.71%), Thiabendazole (4.3%)

Results

#	Treatment	Plants/ft^2		Root Rot (0-5)	Nodule #	Yield (lb/ac)		Nitrogen (% DM)	Soil N (lb/ac)	
1	No fungicides, non-inoculated	0.2	e	2.36	0.96	157	b	21.00	66.8	a
2	No fungicides, inoculated	0.3	e	2.48	0.10	270	b	20.30	57.6	ab
3	Mertect 340F	1.0	de	1.90	0.68	849	a	22.10	33.6	bc
4	Intego Solo	1.9	cd	1.72	2.02	867	a	22.90	27.8	bc
5	Obvius	1.8	cd	1.86	2.10	964	a	21.60	40.6	abc
6	Rancona CTS	3.0	abc	1.78	2.64	944	a	20.30	22.6	c
7	Apron Maxx RTA	2.6	abc	1.94	1.06	1152	a	21.60	28.4	bc
8	Cruiser Maxx Vibrance Pulses	3.3	ab	2.28	0.74	1079	a	20.80	29.8	bc
9	Allegiance	2.3	bcd	2.32	0.14	989	a	20.60	26.2	bc
10	Vibrance Maxx	3.6	ab	1.96	0.74	1099	a	21.70	30.2	bc
11	Vibrance Maxx Pulses	3.7	a	2.06	1.08	1113	a	20.50	24.4	c
	ANOVA ($\alpha < 0.05$)	< 0.0001		NS	NS	< 0.0001		NS	0.0001	

Table 2. Results of 2020 chickpea seed treatment trial. Inoculation refers to rhizobial liquid inoculation. % DM = percent plant dry matter. Statistical significance determined by ANOVA ($\alpha < 0.05$). Means followed by a common letter are not significantly different as determined by Tukey's HSD ($\alpha < 0.05$).

Stand count (plants/ft^2) was lowest in the no fungicide treatments and the Mertect 350F treatment. Mertect does not include an active ingredient for control of Pythium seed rot so this suggests that *Pythium* was causing significant disease in this trial. Stand counts were also lower in the Intego Solo and Obvius treatments but not significantly different from Rancona CTS, Apron Maxx RTA, or Allegiance, which all contain active ingredients labeled for control of *Pythium* (Table 2, Figure 1). Vibrance Maxx Pulses, Vibrance Maxx, and Cruise Maxx Vibrance Pulses had higher stand counts than Intego Solo and Obvius (Table 2, Figure 1). There was no effect of seed treatment on root rot (Table 2).

Figure 1. Plot images taken July 14th, 2021

There was no effect of seed treatment on nodulation, which was very low across all treatments (Table 2). Drought conditions likely impacted this result. Yield was greatly reduced where no seed treatment was used, but not significantly different among the different seed treatment products. Plant biomass nitrogen was not affected by seed treatment but soil nitrogen was significantly higher where the seed treatment was not used. With such low nodulation in all treatments, it is likely that the chickpea plants needed to rely upon the soil as a nitrogen source. Thus, as stand count and yield increased, plant available soil nitrogen decreased ($p = < 0.0001$). The relationship with stand count was more closely associated with soil nitrogen removal than yield. Following degradation of chickpea above ground and below ground biomass, however, these soil N pools will likely change.

Evaluation of New Oil Crop (Sesame, *Sesamum indicum* L.) for Adaptation to MonDak Region

Rojee Chipalu Pradhan and Gautam Pradhan
NDSU – Williston Research Extension Center

Background

Crop diversification has been recognized as one of the best practices to enhance sustainable crop production and rural economy. Growing different field crops on a piece of land breaks insect and disease cycles, reduces weeds, check soil erosion, improve soil physical and chemical property including soil moisture status. Crop diversification also lessens the impacts of agriculture on environmental resources, spreads producers' economic risk, exploits profitable niche markets, creates new industries, and supports the national economy via import substitution. Therefore, evaluating exotic species, crop varieties, and breeding lines for biotic and abiotic stress tolerance and adaptation to the semiarid conditions of the MonDak region has remained one of our main goals. In this regard, this year, we began studying sesame crops for their suitability to grow in the MonDak region.

Objectives

1) To identify sesame germplasm that can be grown in the MonDak region.
2) To enhance crop diversity and rural economy.

Materials and Methods

Two hundred sesame germplasms, belonging to 24 countries, were seeded on June 2nd, 2021 in 2-gallon pots filled with potting mix. The seeds source was the Plant Genetic Resources Conservation Unit, Georgia, USA. The plants were frequently irrigated until old leaves started yellowing.

Results

Plant height ranged from 29 inches to 71 inches. Altogether, 167 germplasms produced pods and seeds. We dried plants with pods under the sun, followed by air drying. The pods will be threshed, and grain yield will be quantified in the coming days.

(A) 34 days old sesame plants.

(B) 51 days old sesame plants.

(C) A sesame plant with pods.

Dryland Crop Performance Comparisons – Williston, ND 2021

Gautam Pradhan, Jerald Bergman, Kyle Dragseth

Crop	Type	Variety	Yield 3 Year Avg* (bu/a)	Market Price† ($/bu)	Gross Return ($/a)	+ or - spring wheat ($/a)
HR Spring Wheat		ND VitPro	35.3	9.72	343.44	0.00
Durum Wheat		ND Riveland	37.8	16.00	604.80	261.36
Barley	(Feed)	ND Genesis	56.4	6.50	366.36	22.92
Oats		Jury	91.1	4.25	387.32	43.88
Soybeans	(Roundup Ready)	ND 17009GT	21.0	12.20	256.20	-87.24
Field Peas	(Green)	Arcadia	32.9	10.00	329.17	-14.27
	(Yellow)	Agassiz	33.7	13.00	438.71	95.27
Flax		Average‡	13.3	32.50	432.90	89.46
			lb/a	**(¢/lb)**		
Lentils	(Medium green)	Avondale	1501.1	32.00	480.34	136.90
Chickpeas	(Large Kabuli)	CDC Frontier	1504.1	33.00	496.36	152.92
Canola	(Roundup Ready)	Average‡	821.4	33.00	271.06	-72.38
Safflower		MonDak	1083.7	28.00	303.43	-40.01
Sunflower	(Oil)	H45NS16CL	1405.3	28.00	393.49	50.05

**The average yield of a crop/variety was based on a three-year average yield (2019, 2020, and 2021) from dryland varietal trials.

†The market price was obtained in the second week of December 2021 from grain elevators in and around Williston.

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

Sustainable Agroecosystem for Soil Health in the Northern Great Plains (Williston, ND - 2021)

Gautam Pradhan, Jim Staricka, Audrey Kalil, Jerry Bergman, Cameron Wahlstrom, Kyle Dragseth, Taheni Gargouri Jbir, David Weltikol, Lynn Staricka, Rojee Chipalu Pradhan, Christy Sperling, Kaleb Cornell

Introduction

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 were five fixed and six dynamic rotations. Every year, each phase of every fixed rotation has been included. The experimental design is a randomized complete block with four replications. The plot size is 60 ft. x 200 ft. In 2019/2020, based on the results from the previous five years, the treatment structure was modified to seven fixed rotations and two dynamic rotations, which are as follows:

Fixed Rotations from 2019

Rotation #	2019	2020	2021	2022	2023	2024
1	Durum	Fallow	Durum	Fallow	Durum	Fallow
2	Durum	Durum	Durum	Durum	Durum	Durum
3	Cover Crop	Sunflower	Pea	Durum	Safflower	Cover Crop
4	HRWW	Safflower	Pea	Durum	Sunflower	HRSW
5	Lentil	Durum	Pea	Durum	Lentil	TBD
6	Durum + SC	SC	Durum + SC	SC	Durum + SC	TBD
7	Perennial Mix	Perennial Mix	Perennial Grass	Perennial Mix	Perennial Mix	Perennial Mix

Note: Cover crop is a mixture of turnip, soybean, flax, sorghum sudangrass, and oats. HRWW = hard red winter wheat, which was replaced by hard red spring wheat (HRSW) in 2020 as HRWW was winter killed; SC = sweet clover. SC + Durum = sweet clover is companion cropped with durum.

Dynamic Rotations from 2019

Rotation #	2019	2020	2021	2022	2023	2024
8	Durum	Safflower	HRSW	TBD	TBD	TBD
9	Safflower	HRSW	Sunflower	TBD	TBD	TBD

- 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).

Materials and Methods

The experimental design was a randomized complete block design with four replications. The treatment number and corresponding rotation and crops are given in Table 1. The seeding date, seeding rate, varieties, and harvest dates are indicated in Table 2. Crops were differentially fertilized based on soil tests and crop history. Durum and safflower received 50 lb of MEZ (12-40-0-10S-1Zn). Regarding N fertilization, durum and hard red spring wheat were fertilized based on a 130 lb/ac target minus a 50 lb no-till credit and a 40 lb/ac legume credit. Safflower was fertilized based on an 80 lb/ac target minus a 30 lb/ac no-till credit. The cover crop was fertilized based on 120 lb/ac. Pea, sweet clover, and the perennial mix did not receive fertilizer. The soil test N and starter fertilizer N, where applicable, were deducted in calculating the amount of N fertilizer for each crop. The chemicals applied on different crops/plots are given in Table 3.

Table 1. Treatment number, rotation type, and Crops in 2019, 2020 and 2021.

Treatment	Rotation		Crop and Year		
#	Type	#	2019	2020	2021
1	Fixed	1	Durum	Fallow	Durum
2	Fixed	1	Fallow	Durum	Fallow
3	Fixed	2	Durum	Durum	Durum
4	Fixed	3	Cover crop	Sunflower	Pea
5	Fixed	3	Pea	Durum	Safflower
6	Fixed	3	Durum	Safflower	Cover crop
7	Fixed	3	Safflower	Cover Crop	Sunflower
8	Fixed	3	Canola	Pea	Durum
9	Fixed	4	HRWW	Safflower	Pea
10	Fixed	4	Pea	Durum	Sunflower
11	Fixed	4	Durum	Sunflower	HRSW
12	Fixed	4	Safflower	Pea	Durum
13	Fixed	4	Canola	HRSW	Safflower
14	Fixed	5	Lentil	Durum	Pea
15	Fixed	6	Durum+SC	(SC)	Dur+SC
16	Fixed	5	Pea	Durum	Lentil
17	Fixed	6	(SC)	Durum+SC	(SC)
18	Fixed	5	Durum	Lentil	Durum
19	Fixed	5	Durum	Pea	Durum
20	Fixed	7	P. Mix	P. Mix	P. Mix
21	Dynamic	8	Durum	Safflower	HRSW
22	Dynamic	9	Safflower	HRSW	Sunflower

Table 2. Variety, seeding rate, and seeding date of different crops.

Crop	Variety/Type	Seeding Rate	Seeding Date
Durum	ND Riveland	1,000,000 pure live seeds/ac	05/05/2021
HRSW	Lanning	1,000,000 pure live seeds/ac	05/11/2021
Lentils	Avondale	65 lb/ac	05/05/2021
Peas	Mystique	350,000 pure live seeds/ac	05/05/2021
Safflower	Linoleic Exp	20 lb/acre	05/05/2021
Sunflower	N4H302 E/High Oleic	18,000 pure live seeds/ac	05/24/2021
Sweet Clover	Yellow Blossom	8 lb/acre	05/05/2021

Table 3. Name, rate, and date of chemical applications on different treatments.

Trt #	Crop 2021	Preemergence		Postemergence
		Fall application: 10/25/2020	Spring application: 05/02/2021	Bromoxynil, Clethodim: 06/14/21; Express/Clethodim: 06/17/21
1	Durum	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Bromoxynil 1.5 pt/ac
2	Fallow	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	-
3	Durum	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Bromoxynil 1.5 pt/ac
4	Pea	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Clethodim 8 oz/ac
5	Safflower	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Express/Clethodim 0.5 oz/ac
6	Cover crop	-	-	-
7	Sunflower	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Express/Clethodim 0.5 oz/ac
8	Durum	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Bromoxynil 1.5 pt/ac
9	Pea	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Clethodim 8 oz/ac
10	Sunflower	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Express/Clethodim 0.5 oz/ac
11	HRSW	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Bromoxynil 1.5 pt/ac
12	Durum	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Bromoxynil 1.5 pt/ac
13	Safflower	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Express/Clethodim 0.5 oz/ac
14	Pea	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Clethodim 8 oz/ac
15	Dur+SC	-	Glyphosate 1 qt/ac	-
16	Lentil	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Clethodim 8 oz/ac
17	(SC)	-	-	-
18	Durum	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Bromoxynil 1.5 pt/ac
19	Durum	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Bromoxynil 1.5 pt/ac
20	P. Mix	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	-
21	HRSW	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Bromoxynil 1.5 pt/ac
22	Sunflower	Valor 3 oz/A + Glyphosate 1 qt/ac	Glyphosate 1 qt/ac	Express/Clethodim 0.5 oz/ac

Safflower was sprayed with fungicide Priaxor @ 6 oz/ac on 7-4-21.

Results – Agronomic

There was a significant effect of crop rotation on durum plant height, test weight, and thousand kernel weight. The rotation effect was not evident for durum grain yield and protein (Table 1). Durum following fallow (Trt. 1) had the tallest plants (28.1 in), and those following pea and lentil (Trt. 8, 12, and 18) had the shortest plants (~22.6 in). Durum following durum (Trt. 3) had the lowest test weight (58.6 lb/bu);

other treatments had test weight ranging from 59.8 to 61.0 lb/bu. Durum following pea (Trt. 8 and 12) had the heaviest kernel (~37.4 g/1000 kernels), and durum following fallow (Trt. 1) or durum (Trt. 3) had the lightest kernel. The durum yield averaged across the treatment was 25.8 bu/ac with 18.4 % grain protein.

Table 1. Durum growth, yield, and quality under different treatments.

Trt	Crop and year			Plant height	Thousand kernel weight	Test weight	Grain protein*	Grain yield*
#	2019	2020	2021	(in)	(g)	(lb/bu)	(%)	(bu/ac)
1	Durum	Fallow	Durum	28.1 A	32.7 B	59.9 AB	18.6	31.1
3	Durum	Durum	Durum	25.8 AB	32.2 B	58.6 B	18.7	25.4
8	Canola	Pea	Durum	23.8 BC	37.5 A	61.0 A	18.2	25.4
12	Safflower	Pea	Durum	22.5 C	37.3 A	60.7 A	18.5	23.9
18	Durum	Lentil	Durum	22.3 C	35.8 AB	60.6 A	17.8	25.1
19	Durum	Pea	Durum	21.6 C	35.2 AB	59.8 AB	18.6	24.1
Mean				24.0	35.1	60.1	18.4	25.8

*Not Significant at *p=0.05.*

Table 2. Pea growth, yield, and quality under different treatments.

Trt	Crop and year			Plant height*	Thousand kernel weight	Test weight	Grain protein*	Grain yield*
#	2019	2020	2021	(in)	(g)	(lb/bu)	(%)	(bu/ac)
4	Cover Crop	Sunflower	Pea	15.2	44.2B	62.8AB	23.7	15.5
9	Winter wheat	Safflower	Pea	15.8	45.2B	63.1A	24.4	16.6
14	Lentil	Durum	Pea	17.2	47.2A	62.5B	23.5	22.2
Mean				16.1	45.6	62.8	23.9	18.1

*Not Significant at *p=0.05.*

There was a significant effect of crop rotation on pea thousand kernel weight and test weight. The rotation effect was not evident for pea height, grain yield, and protein (Table 2). Pea following durum (Trt. 14) had the heaviest kernel (47.2 g/1000 kernels) than the pea following sunflower (Trt. 4) and safflower (Trt. 9). Pea following safflower (Trt. 9) had the highest test weight (63.1 lb/bu) than the pea following durum (Trt. 14). The pea height, grain yield, and protein averaged across the treatments (Trt. 4, 9, and 14) were 16.1 in, 18.1 bu/ac, and 23.9 %, respectively.

There was a significant effect of crop rotation on safflower height, test weight, and grain yield. The rotation effect was not evident for safflower kernel weight and grain oil content (Table 3). Safflower following durum (Trt. 5) was 2 inches taller, had 0.6 lb/bu less test weight, and 27 % more grain yield than safflower following canola (Trt. 13). Safflower thousand kernel weight and grain oil content averaged across the treatment were 34.6 g and 38 %, respectively.

Table 3. Safflower growth, yield, and quality under different treatments.

Trt	Crop and year			Plant height	Thousand kernel weight*	Test weight	Grain oil*	Grain yield*	
#	2019	2020	2021	(in)	(g)	(lb/bu)	(%)	(lb/ac)	
5	Pea	Durum	Safflower	18.7A	34.1	39.9B	38.1	1130.2	A
13	Canola	HRSW	Safflower	16.7B	35.1	40.5A	38.0	822.6	B
Mean				17.7	34.6	40.2	38.0	976.4	

*Not Significant at *p=0.05.*

There was a significant effect of crop rotation on HRSW height and grain yield. The rotation effect was not evident for HRSW kernel weight, test weight, and grain protein (Table 4.). HRSW following sunflower (Trt. 11) was 1.4 inches taller produced 2.8 bu more grain per acre than HRSW following safflower (Trt. 21). HRSW thousand kernel weight, test weight, and grain protein content averaged across the treatment were 21.8 g, 52.6 lb/bu, and 19.8 %, respectively.

Table 4. Hard red spring wheat growth, yield, and quality under different treatments.

Trt	Crop and year			Plant height	Thousand kernel weight*	Test weight*	Grain protein*	Grain yield*	
#	2019	2020	2021	(in)	(g)	(lb/bu)	(%)	(lb/ac)	
11	Durum	Sunflower	HRSW	19.4A	21.9	52.8	19.6	17.1	A
21	Durum	Safflower	HRSW	18.0B	21.7	52.3	20.0	14.3	B
Mean				18.7	21.8	52.6	19.8	15.7	

*Not Significant at *p=0.05.*

There was no significant effect of crop rotation on sunflower growth, yield, and quality. Sunflower height, thousand kernel weight, test weight, grain yield, and oil content averaged across the treatments were 38.7 in, 52.3 g, 32.8 lb/bu, 626.4 lb/ac, and 38.5 %, respectively. This year, lentil (Trt. 16) height, thousand kernel weight, test weight, grain yield, and protein averaged across the replication were 9.7 in, 17.5 g, 61.6 lb/bu, 1185.4 lb/ac, and 25.4 %, respectively. This year, sweet clover (Trt. 15 and 17) was not harvested due to heavy weed infestation of pigeon grass, Russian thistle, and kochia.

Horticulture Program

Rojee Chipalu Pradhan

"Gardening is the art that uses flowers and plants as paint, and the soil and the sky as canvas." - Elizabeth Murray

This year we implemented a horticulture program in dryland as well as in irrigated areas. Regardless of manpower and weather, we could keep the WREC horticulture garden and landscapes at their absolute best. The total seasonal rainfall was 7.34 inches only. The last spring frost was on May 28, and the first fall-killing frost occurred on October 11, 2021.

All-America Selection Display Garden

Williston Research Extension Center garden has been an All-America Selection (AAS) public display garden for more than a decade. Our display garden participated in the All-America Selections 2021 Landscape Design Challenge "Diversity in The Garden." Our garden was awarded "Honorable Mention for Good Planning." "The judges' comments were: "A well-planned garden to be sure!", "Great plant health overall!", "Your dedication and creativity in bringing beauty and diversity to the community are greatly appreciated," and "Mission accomplished."

The project was started by stem cuttings of Begonia, Coleus, and different varieties of Geranium from the beginning of November 2020 and seeded flower and vegetable seeds in the Horticulture lab under the light shelves from the beginning of March to the first week of May 2021. The seeding date was based on the growing requirements of a variety given in a seed packet. Some varieties require at least ten weeks before they become suitable for planting outside. This year, 20 different All-America Selection flowers and 13 different vegetables were planted, mostly tomatoes (12 varieties) and peppers (seven varieties). Besides the All-America Selection varieties, there were other annual flowers and vegetables. Generally, the seedlings were transplanted in the garden from the end of May to the beginning of June. Around 500 lbs. of fresh vegetables (tomatoes, peppers, cucumber, squash, etc.) were harvested. Our garden received vegetables from All-America Selections around September/ October 2020 and live plants (flower) in April 2021. AAS sent us vegetable and flower varieties that won national or regional competitions. People interested in gardening can visit their website (https://allamericaselections.org) for cultivar information, gardening tips, latest winners as well as recipes, and landscape ideas.

1. Williston Research Extension Center Display Garden. Photo by Rojee Chipalu Pradhan.
2. All America Selections Marigold Big Duck Orange, MBD yellow, Vinca Polk Dot, Begonia, Canna, Celosia. Photo by Rojee Chipalu Pradhan.

Daylily Collection

The Williston Research Extension Center dryland station established The World Collection of Daylilies in 2004. Over the years, different cultivars of Daylilies have been added to the collection area. The Daylily plants were relocated in 2018 to another area to maintain plant distance, and landscape fabric was used

to reduce weed infestation. Some varieties of Daylily received from NDSU, Fargo in the fall of 2019, were transplanted in May 2020. Daylilies from the old bed were relocated to the new bed in 2020. The Daylily area has been maintained by watering once a week, regular hand weeding, and fertilization. There are around 125 different cultivars of Daylily in our collection.

Daylily collection. Photo by Rojee Chipalu Pradhan.

Master Gardener Certified Pollinator Garden

The objectives of Master Gardener Certified Pollinator Garden are to provide Master Gardeners with volunteering opportunities, build a habitat that will nourish pollinators, and create a public teaching garden that Master Gardeners and Extension Agents can jointly utilize. These activities encourage members of the general public to build home pollinator gardens. Like every year, in 2021, many pollinator-friendly annual flowers were planted in the pollinator garden and maintained by regular hand weeding and watering.

Certified Pollinator Garden. Photo by Rojee.

Landscape Management

One of the major tasks in the horticulture program is to manage the landscaping area around The Ernie French Center. The surrounding areas had new plantings in 2015 that highlight the ever-increasing hardy plant selections for western North Dakota. Besides all the perennial plants, every year, annual flowers are planted in the landscape to add multicolor and enhance the beautification of the periphery of the office building.

Annual flowers around the office building. Photo by Rojee Chiplau Pradhan.

Collaboration, Outreach Activities, and Dissemination of Information

- The activities and findings of the projects were delivered to the target audiences by presenting at:
  - **Horticulture Field Day**: Horticulture Field Day was held on July 14. 2021. Three speakers gave presentations: Summer lawn and garden Tips, Williston Beautification, and Growing Haskap in Western North Dakota.


Horticulture Field day visitors: Photo by Emily Casner.

- **Garden Tour**: Williston Research Extension Center Garden is a public display garden; hence some individuals and groups took a garden tour. We had North Dakota Horticultural Society members, Tioga Prairie Garden Club members, and SBARE board members.

Garden visitors. Photo by Dr. Gautam Pradhan

❖ 2021 North Dakota Exotic Woodboring/Bark Beetle Survey:

Every year, the North Dakota Department of Agriculture conducts a North Dakota Exotic Woodboring/Bark Beetle Survey in the Trees of Williston Research Extension Center. There were six different traps on six trees (four/five different cultivars). Six traps were installed on May 5, 2021, and removed on August 31, 2021. Lures were replaced according to scheduled instruction. Every two weeks, insects were collected and shipped to the ND Department of Agriculture.

Exotic wood borer trap hanging in WREC Tree.
Photo by Rojee Chipalu Pradhan.

❖ This year, around 70 pounds of fresh vegetables (tomato, pepper, squash, and pumpkin) were donated to the St. Joes Catholic School for the Farmers Market Event.



All America Selections Vegetables: Hot peppers/sweet peppers, Tomato (Early Resilience, Apple Yellow), and Pumpkin (Pepitas). Photo by Rojee Chipalu Pradhan.

Increasing the competitiveness of local fruit production with tunnel grown strawberry in North Dakota.

Rojee Chipalu Pradhan, Jerald Bergman, Tyler Tjelde

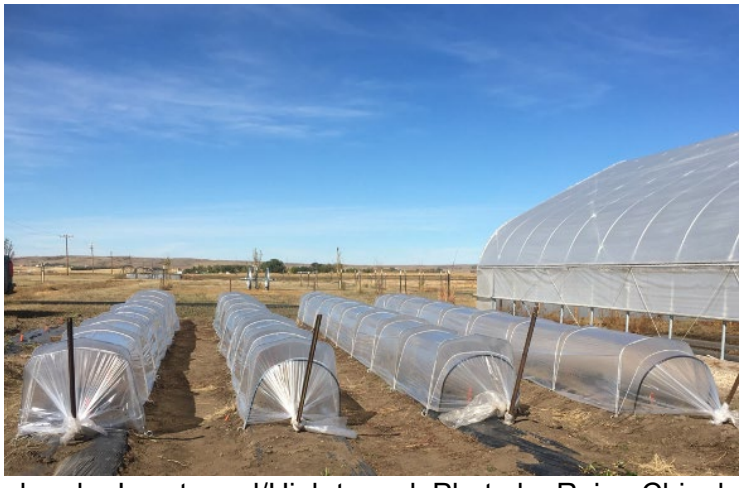
The experiment is conducted at the Nesson Valley Research and Development site to examine the production of strawberries under open field, low and high tunnels. The study will increase consumer knowledge about adapted strawberry cultivars and demonstrate the benefits of using tunnels for fruit production. The trial was established in collaboration with Dr. Harlene Hatterman-Valenti, Professor, High-Value Crop Production, NDSU, Fargo. This project is funded by the Specialty Crop Block Grant Program.

Materials and Methods

Six different day-neutral strawberry varieties (Table 1) were planted in June 2021 in randomized block design with four replications each in the high tunnel, low tunnel, and open field. Each treatment plot has five plants. Some strawberries plant did not survive but were replanted.

Table 1. Strawberry varieties and descriptions.

S.N.	Variety Name	Plant Habit	Fruit Size	Fruit Firmness	Fruit color
1.	Portola	6-9”	Large/VL	Firm	Fruit is lighter in color
2.	Fort Laramie	8 - 10 “	Large to Very large	Firm	Bright scarlet fruit
3.	Seascape	12-18”	Large	Firm	Brilliantly Red
4.	San Andreas	6-8”	Large/VL	Firm	Slightly lighter Red than for Albion
5.	Albion	8-10”	Large/VL	Very firm	Red in color
6.	Evie 2	14”	Large	Medium	Red in color



Strawberry planted under Low tunnel/High tunnel. Photo by Rojee Chipalu Pradhan.

Evaluating Haskaps in North Dakota for growth and production as a fruit wine

Rojee Chipalu Pradhan

Haskap or Honeyberry (Lonicera caerulea L.), also known as Honeysuckle, belongs to the Caprifoliaceae family. The name Haskap comes from Japan. The Haskap plants are native to cool temperate areas of the Northern Hemisphere, and deciduous cold hardy shrubs live up to 30 years. Haskap shrub grows about 3-6 feet tall and produces oblong and bluish to purple fruit. Haskaps are high in antioxidants and Vitamin C. The plant can stand frost -51°F, and flowers can tolerate up to 18°F in spring. The trial was established in 2017 at the Williston Research Extension Center dryland station in collaboration with Dr. Harlene Hatterman-Valenti, Professor, High-Value Crop Production, NDSU, Fargo. This project was partially funded by the State Board of Agricultural Research and Education (SBARE).

Materials and methods

This experiment was conducted in randomized block design with 12 varieties (Table 1) and four replications. Each plot had four plants. Most of the plants did not survive in spring 2018 (Fig:1). The Haskaps were replanted in May and September 2018. The haskaps were evaluated for survival and maintained with regular drip irrigation, hand weeding, and spraying preen (a weed preventer) during summer.

In the 2021 spring, plant height and width were measured, and pruning, i.e., removal of dead branches and fertilization of the shrub, was accomplished. Some early varieties started producing flowers in May. Hence, all the haskap shrubs were covered with bird netting in June. The harvesting of early maturing varieties began at the end of June, and late-maturing varieties were harvested in the middle of August. Berries were harvested by handpicking from each plant and weighed separately. Weight of 100 berries and berry length were recorded. Brix percentage was quantified using a Veegee Refractometer.

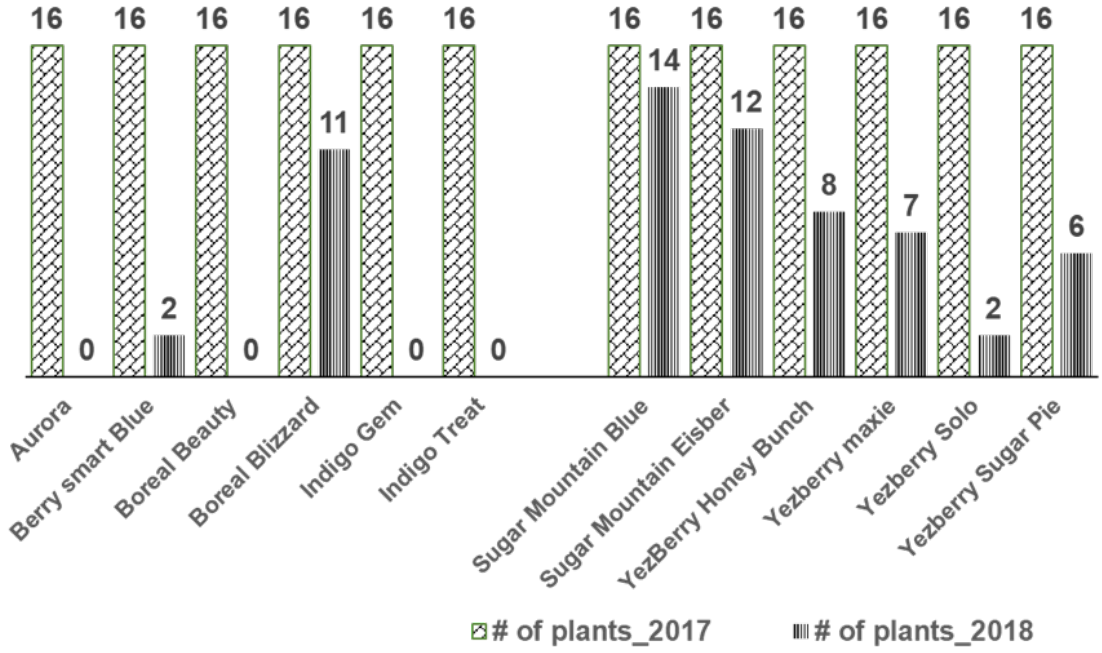


Figure:1 Haskap survival data. The digit at the top of the bar indicates the number of live plants.

Table 1. Williston haskap cultivar information.					
Cultivar	**Berry Flavor**	**Bloom Time**	**Ancestry/ Country of Origin**	**Breeder**	**Pollination information**
Aurora	Sweet	Early-mid	Japan/Russia	BB[1]	Pollinator for Borealis, Tundra, Indigo varieties
Berry Smart Blue	Sweet/Tart	Mid-Late	Russia	Jim Gilbert	Pollinates “Indigo” varieties
Boreal Beauty	Sweet	Mid-Late	Japan/Russia/Kuril e	BB	Pairs with other "Boreal" varieties
Boreal Blizzard	Sweet	Mid-Late	Japan/Russia	BB	Pairs with other "Boreal" varieties
Indigo Gem	Sweet/Tangy	Early	Japan/Russia/Kurile	BB	Needs a pollinator like Berry Smart Blue or Honeybee
Indigo Treat	Sweet	Early	Japan/Russia/Kurile	BB	Needs a pollinator like Berry Smart Blue or Honeybee
Sugar Mountain® Blue	Sweet	Early	Czech Republic	Frantisek Krejci	Pairs with Sugar Mountain®Eisbar
Sugar Mountain® Eisbar	Sweet/Tangy	Early	Czech Republic	Kordes Jungpflanzen	Pairs with Sugar Mountain®Blue
Yesberry®Solo	Sweet/Tangy	Late	Japan	MT[2]	Pairs with Maxie or other Yezberry® variety
YezBerry®Honey Bunch	Sweet	Late	Japan	MT	Pairs with other Yezberry® variety
Yezberry® Maxie	Sweet/Tangy	Late	Japan	MT	Pairs with Solo or other Yezberry® variety
Yezberry® Sugar Pie	Sweet	Late	Japan	MT	Pairs with other Yezberry® variety
[1]BB = Dr. Bob Bors - University of Saskatchewan breeding program.					
[2]MT = Dr. Maxine Thompson - Oregon State University.					

Results and discussions

Plant stand: As shown in Figure 1. Most of the Haskap plants did not survive in the first year. The haskaps were replanted in 2018. About 96 percent of plants survived and started producing berries.

Growth, yield, and berry quality: There was a significant difference among Haskap varieties for plant height, plant width, hundred berry weight, berry yield, and Brix percentage. The plant height and width ranged from 34 to 99 cm (Fig. 2A) and from 31 to 92 cm (Fig. 2B), respectively. The tallest and widest variety was Sugar Mountain Blue. The weight of hundred berries ranged from 45.8 to 152.0 grams (Fig. 2C). The YezBerry Maxie had the biggest berry. The berry yield per plant ranged from 18.1 to 454.9 grams (Fig. 2D). The Boreal Blizzard produced the highest yield, followed by Sugar Mountain Blue. The Brix percentage in berries ranged from 12.75 to 19.63 % (Fig. 3)

Haskap in different growth stages and management practices: 1. Haskap shrub. 2. Unripe green Haskap fruit. 3. Mature berry ready to harvest. 4. Netting Haskaps to prevent bird damage. 5. Manual Harvesting. 6. Harvested berries: Yezberry® Sugar Pie.

Photo by Rojee Chipalu Pradhan.

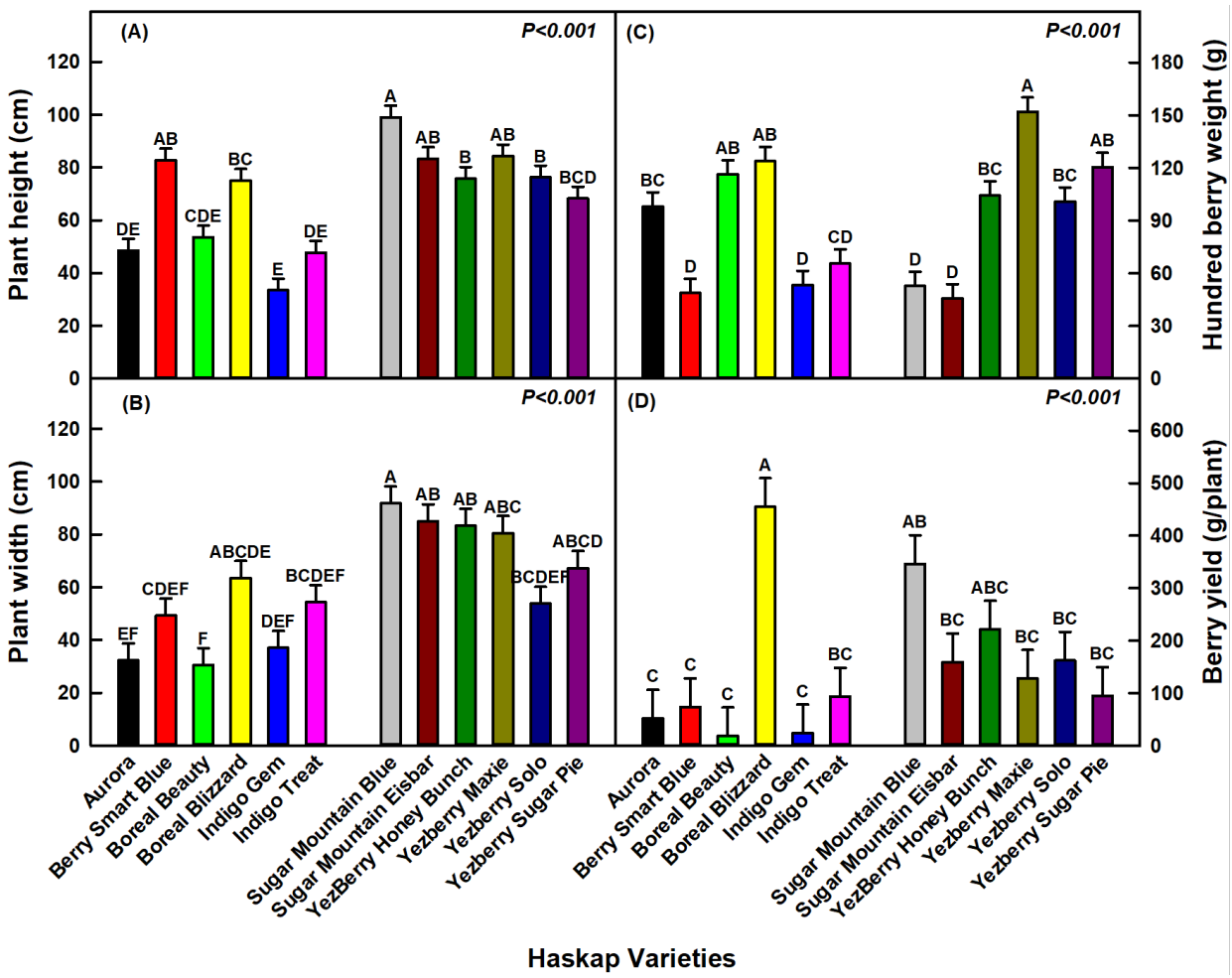


Figure 2. Growth and yield of Haskap varieties. (A) Plant height, (B) Plant width, (C) Weight of hundred berries, and (D) Average berry yield per plant.

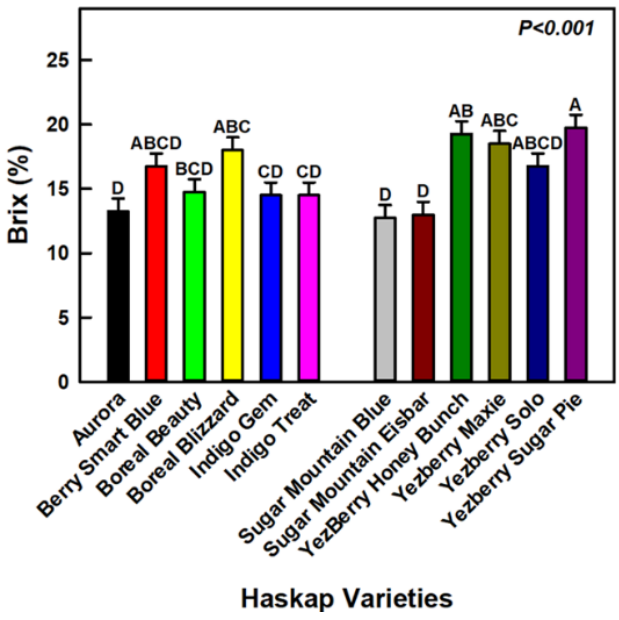


Figure 3. Percent Brix of Haskap cultivars.

Irrigation Research at Nesson Valley 2021

Justin Jacobs,
NDSU – Williston Research Extension Center

Weather Summary - Nesson Valley, ND[+]

	Precipitation		Temperature		
Month	2021	Avg‡	2021	Avg	Days above 89º
	-inches-		-------degrees Fº-------		
Oct-Dec. 2020	0.33	1.18			
April	0.23	0.73	40.0	34.4	0
May	1.77	2.10	51.0	49.1	0
June	3.55	2.90	67.0	60.2	6
July	1.12	2.18	73.0	64.5	12
August	1.35	1.45	67.0	65.0	6
September	0.23	2.19	61.0	53.3	2
April-July	6.67	7.92	57.9	52.1	18
April-Sept	8.25	11.56	60.0	54.4	26
Total- (Oct 2020 - September 2021)	8.58	12.75			

Last spring frost = May 11, 2021 (26.0°)

First fall frost = October 15, 2021 (31.0°)

[+] NDAWN Hofflund site
‡ Average since January 1, 2006

Much like 2020, 2021, provided challenges for agricultural production. While we began to experience signs of the drought in 2020, the effects were not as noticeable as the heavy rainfalls from the fall of 2019 carried over into that spring. Very little rainfall in 2020 started things off a very dry in 2021, and very little snow over the winter months provided little recharge in the soil for spring moisture. The open winter also resulted in above normal winter kill for fall seeded crops.

Once field work was completed in the spring, the first trials (spring wheat) were planted April 30, the final trial (sunflower) was planted June 1. In addition to the normal variety trials conducted, four breeding nurseries and three agronomic trials were planted. A total of 17 variety trials in 12 different crops were grown. The winter wheat variety trials were abandoned as a result of the winter kill. The varietal trials showed below average yields for 2021. A hailstorm on July 22, caused significant damage to the variety trials. Quality issues were observed in corn, sunflower, soybean, and dry bean as a result of the hail. The rainfall amounted to less than 10 inches during the growing season. As a result of the dry conditions nearly 15 inches of irrigation was applied to small grains and early season broadleaf crops such as canola, flax, pea, and safflower. The late season crops received 25 inches of irrigation. In addition to the trials at Nesson Valley, an off-station trial near Trenton under sprinkler irrigation, was conducted looking at corn and soybean varieties. The results can be found in this publication.

Crop (# of varieties)	2021 Average	Crop	2021 Average
Spring Wheat (54)	**71 bu/a**	Field Pea (11)	**31 bu/a**
Durum Wheat (27)	**59 bu/a**	Safflower (21)	**2,215 lb/a**
Barley (30)	**69 bu/a**	Canola (15)	**2,790 lb/a**
Oat (15)	**123 bu/a**	Sunflower (18)	**2,560 lb/a**
Corn (7)	**181 bu/a**	Soybean (42)	**53 bu/a**

Research was conducted again on irrigated canola production looking at planting rates and fertilizer application rates. The 2020 results showed that yields began to decline past planted populations of 520,000 seeds per acre and fertilizer rates past 150 pounds of applied nitrogen. In 2021, those results were not duplicated. Instead, canola yields continued to increase past planting populations of 520,000 seeds per acre and applied fertilizer applications of 225 pounds of applied nitrogen. Further discussion of the results can be found in the article Irrigated Canola Production: Population and Fertilizer, Year 2 in this publication.

In 2022 we will continue research on canola population and fertilizer rates along with some other projects that are in the works. As always, if there are any research ideas that you think need to be looked at, please let us know. Each year we will strive to continue to provide the best possible research and data for irrigated production in the MonDak region.

WREC Foundation Seed Increase Update

Kyle Dragseth, David Weltikol, Kaleb Cornell, Jerald Bergman, Violeta Hobbs
NDSU Williston Research Extension Center

Well another year came and went and the best way to describe this year at the WREC was dry! We had less than 4 inches of rain during the growing season and no shortage of wind. With the future outlook for agriculture shaky at best, with input prices soaring, there isn't a lot of optimism in the industry. However, we can help here at the Williston Research Extension Center. NDSU prides itself on truly caring about the state Ag economy and individual producers' profitability. The NDSU plant breeders are being very progressive to produce varieties to help the bottom line. We also increased some Canadian genetics of durum, oats, barley, and flax along with some Montana varieties of Spring and winter wheat. On a real positive note the new seed plant is up and running, so stop in for a tour.

A new NDSU chickpea (Crown) is on the horizon for availability in 2022.

Listed below are the varieties available for sale.

HRSW	**Durum**	**Lentil**	**Soybean**
Bolles	ND Riveland	Avondale	ND17009GT
ND Vit-pro	AAC Spitfire		ND21008GT
ND Frohberg	Lebsock		
ND Mott			
ND Lanning			

Oat	**Barley**	**Winter Wheat**	**Pea**
Paul (hulless oat)	CDC Maverick (forage and feed)	MT Ray (grain or hay)	ND Dawn (yellow)
CDC Haymaker (forage)	CDS Austenson (2-row feed)	ND Noreen	Hampton (green)

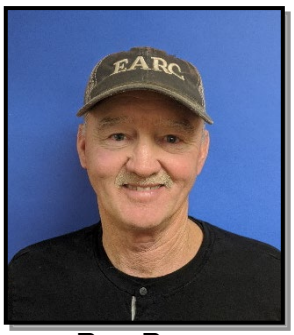
Please contact Kyle Dragseth at 701-770-1652, with any questions, availability, and prices.

MSU-EARC FACULTY & STAFF—2021

Dr. Chengci Chen
Superintendent/Professor

Dr. Frankie Crutcher
Assistant Professor

Cherie' Gatzke
Administrative Assistant



Ron Brown
Farm Manager
Foundation Seedstock

Dr. William Franck
Research Scientist

Dr. Kazi Kader
Postdoc Research Assoc.

Charlemagne Lim
Research Professional

Sooyoung Franck
Research Associate

Calla Kowatch-Carlson
Research Assistant

Thomas Gross
Research Assistant

Staci Hurley
Research Assistant

Nancy Gross
Research Assistant

Yi Zhou
Graduate Research Asst.

Employees Not Pictured:

Graduate Research Assistants
Maggie Brazier, Marie Dorval and Shreya Gautam

Students:
Jade Emly and Aaron Reitz

2021 Agricultural Research Update Sponsors

AGRI INDUSTRIES

horizonresources
Solutions for your success.

CASE IH AGRICULTURE
Border Plains Equipment
Williston, ND

MWEC
Mountrail-Williams Electric Cooperative
Your Touchstone Energy® Cooperative

CITY OF WILLISTON

SAFFLOWER TECHNOLOGIES
STI
INTERNATIONAL

Farmers Union INSURANCE

Western Cooperative CREDIT UNION

GARRATT INDUSTRIES LTD.

WESTERN REGION ECONOMIC DEVELOPMENT
Connecting Divide, McKenzie, Mountrail & Williams Counties, North Dakota