2022 Agricultural Research Update

MSU Eastern Agricultural Research Center

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NDSU Williston Research Extension Center

Serving the MonDak Region

NDSU
North Dakota State University
ND Agricultural Experiment Station

MONTANA STATE UNIVERSITY
Montana Agricultural Experiment Station

Regional Report No. 28—December 2022

NDSU | WILLISTON RESEARCH EXTENSION CENTER


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Retired 10/31/2022


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Soil Scientist


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Kaleb Cornell
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Farm and Seedstocks Manager


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Dr. Gautam Pradhan
Dryland Research Agronomist


Tyler Tjelde
Irrigation Scientist


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Irrigation Research Specialist


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Samuel Ortiz
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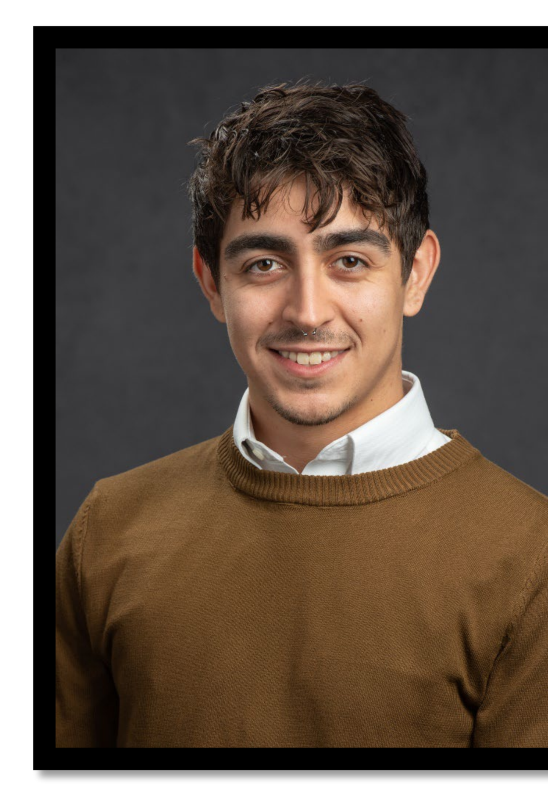
Rojee Chipalu Pradhan
Horticulture Research Specialist


Dr. Audrey Kalil
Plant Pathologist


Dr. Edson Ncube
Plant Pathology Research Specialist


John Teixeira
Plant Pathology Technician


Christy Sperling
Dryland Research Technician


Gabe Hobbs
Part-Time Technician


Lauren Holman
Plant Pathology Technician


Destiney Haug
Plant Pathology Technician

Current Vacant Positions:

Agronomy Research Specialist

Center Director

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Weather Information

Weather Summary — Williston, ND

Month	Precipitation 2022	Precipitation Avg	Temperature 2022	Temperature Avg	*
	- inches -		- degrees F -		
Oct-Dec. 2021	1.81	1.75			
January-March	0.41	1.19			
April	2.84	1.13	34.3	44.1	0
May	6.55	2.13	54.3	56.0	0
June	1.95	2.70	64.9	64.9	4
July	2.05	2.24	72.6	71.4	11
August	0.53	1.57	73.5	70.2	19
September	0.44	1.41	63.9	59.5	7
April-July	13.39	8.20			
April-Sept	14.36	11.19			
Total-Oct 21-Sept 22	16.58	14.13			

*Number of Days over 89° F

Last Spring Frost – April 27, 2022 (27.0° F)

First Fall Frost , October 7, 2022 (27.0° F)

Weather Summary — Sidney, MT

Month	Precipitation 2022	Precipitation Avg	Temperature 2022	Temperature Avg	*
	- inches -		- degrees F -		
Oct-Dec. 2021	2.31	1.82			
January-March	0.48	1.27			
April	1.79	1.13	35.8	44.3	0
May	5.64	2.19	54.0	55.9	0
June	2.68	2.70	63.6	64.6	1
July	1.81	2.05	70.9	70.2	8
August	.014	1.43	71.9	68.8	15
September	0.41	1.35	62.1	58.1	5
April-July	11.92	8.07			
April-Sept	12.47	10.85			
Total- Oct 21-Sept 22	15.26	13.94			

*Number of Days over 89° F

Last Spring Frost – May 2, 2022 (31.6° F)

First Fall Frost – October 6, 2022 (30.5° F)

Off-Station Precipitation* North Dakota

Site	April	May	June	July	Aug	Total
Beach	4.84	5.15	3.83	3.79	2.13	19.74
Crosby	1.36	5.53	2.02	3.88	1.15	13.94
Nesson Valley	2.31	6.47	2.33	2.69	0.16	13.96
Watford City	1.53	5.57	2.24	1.56	0.34	11.24

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

Off-Station Precipitation* Montana

Site	April	May	June	July	Aug	Total
Dagmar	0.65	2.63	2.80	2.32	0.38	8.78
E Fairview	1.79	5.64	2.68	1.81	0.14	12.06
Nashua	0.94	2.11	1.44	1.94	0.29	6.72
Poplar	0.26	2.05	2.36	3.53	0.08	8.28
Richland	0.38	1.43	2.25	2.48	0.13	6.67
Savage	3.55	2.54	2.23	3.11	0.18	11.61

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

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http://agresearch.montana.edu/earc/index.html

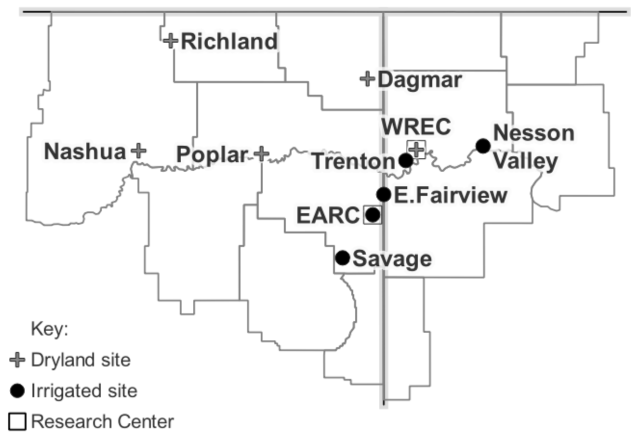
Off-Station Cooperators – Producers – CES Agents

MONTANA
SMALL GRAIN – PULSES:
Dagmar – Brian Kaae – Agent Jack Bazemore
Nashua – Bill Laukner – Agent Shelley Mills
Poplar – Mark Swank – Agent Wendy Becker
Richland – Richard Fulton – Agent Shelley Mills

SUGARBEET:
East Fairview – Philip/Laurie Hurley
Savage – Conradsen Land & Livestock, Inc.

NORTH DAKOTA
SMALL GRAIN:
Trenton – 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.

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HARD SPRING WHEAT VARIETY DESCRIPTIONS

VARIETY	ORIGIN[1]	YEAR	HEIGHT (IN)[2]	DTH[3]	Resistance to[4]					Quality Factors[5]	
					Lodging	Stem Rust	Leaf Rust	Foliar Disease	Head Scab	TW	Grain Protein
AAC BRANDON	CANADA	2014	31	49	MR/MS	MR/MS	MS/S	NA	MS	H	M
AAC STARBUCK VB	CANADA	2020	32	49	MR/MS	NA	MS/S	NA	MS	VH	M/H
AAC WHEATLAND VB	CANADA	2020	31	49	MR/MS	NA	MR/MS	NA	MS	VH	M
AP GUNSMOKE CL2	SYNGENTA/AGRIPRO	2021	30	48	MS/S	MR	MR	MR/MS	MR	M/H	M/H
AP MURDOCK	SYNGENTA/AGRIPRO	2019	2	49	MR/MS	MR	MS	MR/MS	MS/S	M/H	M/L
AP SMITH	SYNGENTA/AGRIPRO	2021	28	50	R/MR	NA	MR	MR	MR/MS	M/H	M/H
ASCEND-SD	SD	2022	34	50	MR/MS	NA	MR/MS	NA	MR/MS	M/H	M
BARLOW*	NDSU	2009	27	45	MR/MS	R	MR	MR/MS	MR/MS	H	H
BOLLES	MN	2015	28	56	MR/MS	MS	R/MR	MR/MS	MS	H	H
BOOST*	SD	2016	27	53	MS	R	MR/MS	S/VS	MS	M/H	M/H
CAG-JUSTIFY	CHAMPIONS ALLI. GRP	2021	31	51	MS/S	MR	R/MR	MS	MR	M	M/L
CAG-RECKLESS	CHAMPIONS ALLI. GRP	2021	32	49	MS	MR/MS	R/MR	MS/S	MR/MS	VH	M
CAG-RECOIL	CHAMPIONS ALLI. GRP	2022	29	55	MR	NA	R	NA	MR/MS	M	M
CDC SKRUSH	CANADA	2020	33	50	MR/MS	MR/MS	R/MR	NA	MR/MS	M/H	M
CP3099A	CROPLAN	2020	32	52	MS	S	MR	MR/MS	MR/MS	L/M	L
CP3119A	CROPLAN	2020	24	64	NA	NA	NA	NA	NA	VL	L
CP3188	CROPLAN	2020	30	49	S	S/VS	R/MR	MS/S	MR/MS	M	L
CP 3530	CROPLAN	2015	33	50	S	MR/MS	MS	MS/S	MS	M/H	M
DAGMAR	MT	2019	30	47	MS/S	MR	S	MR/MS	S	M/H	H
DRIVER	SD	2019	31	50	MR/MS	MR/MS	R	S	MR	VH	M
FALLER	NDSU	2007	32	50	MS/S	MS	S	S	MR/MS	M/H	M/L
GLENN	NDSU	2005	33	47	MR/MS	MS	MS/S	MS/S	MR/MS	VH	M/H
LANNING	MT	2017	30	50	MR	MS/S	S	MR/MS	MS/S	H	M/L
LCS ASCENT	Limagrain	2022	30	46	MR/MS	NA	MS/S	NA	MR/MS	H	M
LCS BUSTER	Limagrain	2020	32	53	MS	MR	MR/MS	MR/MS	MS	M	L
LCS CANNON	Limagrain	2018	29	45	MR/MS	MR	S	MS	MS/S	VH	H
LCS DUAL	Limagrain	2020	30	48	MR/MS	NA	MS/S	NA	MS	VH	M/L
LCS Hammer AX	Limagrain	2022	29	47	MR/MS	NA	MS/S	NA	MS	VH	M
LCS REBEL	LIMAGRAIN	2017	33	46	MS/S	MS/S	S	MR	MS	VH	M
LCS TRIGGER	LIMAGRAIN	2016	33	54	MS	S	R	MR/MS	MR	M/H	M/L
MN-ROTHSAY	MN	2022	29	51	MR	NA	MS/S	NA	MR/MS	H	M/L
MN-TORGY	MN	2020	31	50	MR/MS	MR	MR	MR	MR	VH	M/L
MN-WASHBURN	MN	2019	30	51	MR	MR	R	MS/S	MS	H	M
MS BARRACUDA	MERIDIAN SEEDS	2018	28	45	MR/MS	MR/MS	NA	S	MS/S	H	M/H
MS CHARGER	MERIDIAN SEEDS	2022	29	47	S	NA	R/MR	NA	MR/MS	VH	L
MS COBRA	MERIDIAN SEEDS	2022	29	48	MR/MS	MR	R/MR	MR/MS	MS	H	M
MS RANCHERO	MERIDIAN SEEDS	2020	32	53	MS	MS/S	MR/MS	MS	MS/S	M/H	M/L
ND FROHBERG	NDSU	2020	33	49	MS	MR	MS	S/VS	MS	H	M/H
ND HERON	NDSU	2021	31	46	MS/S	NA	S	NA	MR	VH	H
ND VITPRO	NDSU	2016	31	48	MR/MS	S	MR/MS	MS/S	MR/MS	VH	M/H
SHELLY	MN	2016	29	51	MR/MS	MR	MS/S	MR	MS	VH	M/L

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SY 611CL2	SYNGENTA/AGRIPRO	2019	28	48	MR	MR	MS/S	MR/MS	MS	VH	M
SY INGMAR	SYNGENTA/AGRIPRO	2014	29	50	MR	MR	MR	MS/S	MS	H	M/H
SY LONGMIRE	SYNGENTA/AGRIPRO	2019	29	49	MS	MR/MS	MS/S	MR/MS	S	VH	M
SY MCCLOUD	SYNGENTA/AGRIPRO	2019	30	48	MR/MS	MR	MS	S	MS	VH	M/H
SY VALDA	SYNGENTA/AGRIPRO	2015	29	49	MS	MR/MS	R/MR	S	MS	H	M/L
TCG-HEARTLAND	21st CENTURY GEN.	2019	28	47	MR	MR	MR	MR/MS	MS/S	VH	M/H
TCG-SPITFIRE	21st CENTURY GEN.	2015	30	51	MR	MR/MS	MS	MS/S	MS/S	H	M/L
TCG-WILDCAT	21st CENTURY GEN.	2020	30	49	MR	MR	MS	MS/S	MS/S	H	M
WB9590	WESTBRED	2017	27	48	MR	MR	MR	S/VS	MS/S	M/H	M/H

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

[2]Height data averaged from multiple locations in 2022.

[3]Days to head=the number of days from planting to head emergence from the boot, averaged based on data from several locations in 2022.

[4]R=Resistant; MR=Moderately Resistant; MS=Moderately Susceptible; S=Susceptible; VS=Very Susceptible; NA=Not Available.

[5]L=Low; VL=Very Low; M=Medium, H=High; VH=Very High. *Data From 2020.

NDSU-WREC

Dryland Spring Wheat Variety Trial - NDSU **WREC, Williston, ND 2022**

Variety/Line	Plant height	Days to Heading	Protein	Test Weight	Yield 2022	Yield 3 Yr. Avg.
	(in)	(DAP)	(%)	(lb/bu)	(bu/ac)	(bu/ac)
AAC BRANDON	26.6	47	13.7	57.8	31.2	-
AAC STARBUCK	25.6	47	14.7	58.8	33.3	-
AAC WHEATLAND	25.9	47	13.9	58.7	31.9	-
AP GUNSMOKE CL2	25.1	46	15.0	56.8	34.8	-
AP MURDOCK	22.7	47	13.4	56.6	33.2	25.2
AP SMITH	22.2	50	14.6	57.3	36.1	-
ASCEND-SD	26.4	49	13.7	57.0	37.9	-
BARLOW	27.0	45	15.5	57.9	30.0	-
BOLLES	26.2	53	16.0	57.9	31.6	24.3
BOOST	26.9	53	15.0	56.5	32.3	-
CAG-JUSTIFY	24.8	51	13.5	55.7	33.8	-
CAG-RECKLESS	25.3	48	13.7	58.5	36.1	-
CAG-RECOIL	24.8	55	13.6	56.3	37.7	-
CDC SKRUSH	27.3	48	14.2	57.1	36.3	-
CP3099A	24.8	53	12.2	54.5	34.6	-
CP3119A	24.9	56	11.8	53.2	36.9	-
CP3188	26.2	49	11.8	55.9	39.2	-
CP3530	26.9	48	14.3	57.2	33.4	26.8
DAGMAR	24.8	45	15.9	57.4	30.7	26.9
DRIVER	25.9	49	14.2	58.8	32.1	26.6
FALLER	24.7	52	13.3	56.7	31.1	28.4
GLENN	27.7	44	15.4	59.7	27.0	25.5
LANNING	24.4	52	13.2	58.1	34.6	28.9
LCS ASCENT	23.1	45	13.6	58.5	33.9	-
LCS BUSTER	26.4	54	12.0	56.0	40.0	-
LCS CANNON	23.5	44	15.8	59.7	28.1	24.0
LCS DUAL	25.1	47	13.2	58.6	32.8	-
LCS Hammer AX	24.7	45	13.6	58.5	36.8	-
LCS REBEL	26.5	45	14.0	59.2	34.9	28.4
LCS TRIGGER	26.4	56	12.6	56.9	36.5	29.2
MN-ROTHSAY	22.4	53	13.3	58.2	36.8	-
MN-TORGY	23.5	51	13.1	58.7	36.0	28.1
MN-WASHBURN	23.1	50	13.9	57.7	31.7	25.6
MS BARRACUDA	22.4	45	14.7	57.6	28.9	25.5
MS CHARGER	24.5	46	12.1	58.6	39.0	-
MS COBRA	23.0	47	14.2	57.9	32.9	-
MS RANCHERO	25.2	55	13.3	57.1	33.3	27.0
ND FROHBERG	26.5	46	14.9	58.2	34.4	26.5
ND HERON	24.7	45	15.5	59.4	30.5	25.1

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Variety/Line	Plant height (in)	Days to Heading (DAP)	Protein (%)	Test Weight (lb/bu)	Yield 2022 (bu/ac)	Yield 3 Yr. Avg. (bu/ac)
ND VITPRO	24.9	46	15.1	59.1	28.8	24.8
PFS BUNS	23.4	58	12.6	55.9	33.4	-
SHELLY	21.8	52	13.1	59.1	32.1	-
SY 611CL2	24.3	48	13.6	58.8	36.4	29.6
SY INGMAR	26.1	49	15.1	57.9	36.8	28.6
SY LONGMIRE	25.3	48	14.5	58.9	38.1	29.5
SY MCCLOUD	25.7	49	14.6	59.5	34.6	26.3
SY VALDA	24.4	49	12.9	58.2	35.4	26.9
TCG-HEARTLAND	23.2	46	15.4	59.0	30.1	27.2
TCG-SPITFIRE	17.5	54	13.1	57.6	38.7	30.2
TCG-WILDCAT	25.2	48	13.9	58.2	38.2	29.1
WB9590	22.0	47	14.9	57.5	30.6	-
Mean	24.8	49.0	13.9	57.6	34.5	-
CV %	8.7	2.5	4.4	0.9	7.1	-
LSD 0.05	3.5	2.0	1.0	0.9	4.0	-
LSD 0.1	2.9	1.7	0.8	0.7	3.3	-

Location: WREC; Latitude: 48.13006; Longitude: -103.74837.
Previous crop: Soybean; Soil type: Williams-Bowbells Loam. Altitude: 2105 ft.
Planted: 5/18/2022; Harvested: 8/22/2022.
Soil test (0-6 in): P= 21 ppm; K=265 ppm; pH= 6.1; and OM= 2%.
Soil test (0-24 in): NO_3N= 29 lb/ac.
Applied fertilizers (lb/ac): N=61; P=23.5; K=0.
Applied chemicals: Glyphosate 1 q/ac (05/22/2022).
Tombstone Helios 2 fl.oz/ac (06/22/2022)

Data includes only released varieties. Experimental lines are not included. Statistics reflect the entire trial.

Audrey Kalil presenting at NDSU-WREC Field Days

Dryland Preliminary Spring Wheat Trial - MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
CHOTEAU	29.9	182.5	62.6	13.3	43.7
DAGMAR	29.9	179.5	63.5	14.1	45.5
MCNEAL	31.1	184.0	61.9	13.3	40.3
MT 21120	27.4	182.0	63.4	13.4	39.7
MT 21121	27.6	182.0	63.7	13.2	43.9
MT 21124	31.3	182.5	63.3	13.2	48.3
MT 21125	27.6	180.0	62.8	13.0	43.1
MT 21127	29.0	181.0	63.2	13.8	42.6
MT 21143	30.7	185.0	63.2	13.3	43.7
MT 21147	31.3	185.5	62.8	14.1	43.7
MT 21148	28.3	181.5	63.6	14.0	46.4
MT 21149	29.7	182.5	63.4	13.1	47.3
MT 21150	29.7	186.0	63.2	13.5	44.4
MT 21152	29.5	184.5	62.5	11.6	46.4
MT 21157	28.2	182.5	64.3	13.9	44.8
MT 21160	31.3	185.0	62.6	13.6	46.2
MT 21161	28.0	185.0	63.4	12.9	44.6
MT 21170	28.9	182.0	61.7	13.4	49.2
MT 21171	28.2	182.5	62.1	13.5	39.7
MT 21173	30.5	180.5	63.6	13.4	54.7
MT 21174	29.7	180.0	63.8	13.5	50.1
MT 21176	30.3	181.5	62.8	13.2	49.1
MT 21178	30.3	180.0	62.6	13.3	55.0
MT 21180	29.7	179.5	63.5	13.3	54.2
MT 21183	30.7	180.0	61.1	13.1	50.8
MT 21184	30.7	180.5	62.8	13.7	56.8
MT 21186	29.1	180.5	62.1	13.8	47.2
MT 21196	31.1	185.0	61.1	12.6	34.0
MT 21210	30.1	181.5	64.1	13.3	43.8
MT 21211	27.4	182.5	64.7	13.1	51.9
MT 21212	30.5	184.0	63.5	12.4	37.0
MT 21214	30.1	182.0	63.6	14.4	54.3
MT 21215	28.0	177.5	64.0	13.5	48.9
MT 21218	31.7	181.5	62.7	13.5	51.7
MT 21220	30.9	181.5	63.4	13.5	60.0
MT 21222	28.6	185.0	62.3	13.0	46.6
MT 21224	31.5	179.5	64.0	13.9	46.9
MT 21229	30.5	185.0	62.1	13.0	46.3
MT 21230	30.3	182.0	63.6	13.1	52.1
MT 21232	29.5	181.5	62.6	13.7	49.6
MT 21234	30.7	181.5	65.2	13.5	47.5
MT 21235	31.3	180.5	64.4	14.7	47.2
MT 21239	32.9	181.5	64.9	14.1	46.1
MT 21241	31.7	180.0	64.5	14.1	48.1
MT 21242	29.5	182.5	63.8	13.9	46.7
MT 21247	29.9	180.5	62.5	13.9	54.3
MT 21250	30.3	179.0	63.5	13.9	45.3
MT 21257	32.5	184.0	63.8	14.2	50.1
MT 21261	28.9	182.0	63.8	13.5	45.9
MT 21262	28.0	182.5	62.4	14.3	42.3
MT 21263	31.1	185.0	63.7	13.4	44.8
MT 21266	30.3	181.0	62.5	13.9	41.6
MT 21269	33.1	185.0	61.1	13.8	48.0
MT 21270	31.3	180.5	63.8	13.5	45.6
MT 21272	32.1	183.0	63.2	12.5	57.5
MT 21275	30.9	185.5	63.0	14.5	45.2
MT 21280	30.5	185.0	62.3	12.1	48.8

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Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
MT 21282	30.5	180.5	64.2	14.9	52.9
MT 21284	28.9	182.0	64.0	12.7	53.0
MT 21286	30.3	185.0	63.5	12.4	42.0
MT 21288	30.5	185.0	63.0	12.6	48.0
MT 21297	30.3	182.5	64.6	14.0	42.3
MT 21298	31.9	180.0	64.1	14.7	53.4
MT 21301	31.9	178.5	65.4	14.0	50.4
MT 21304	32.5	180.0	64.0	14.0	49.6
MT 21305	30.9	179.5	64.1	13.5	52.6
MT 21306	29.5	178.0	64.0	14.3	50.7
MT 21309	30.5	182.0	63.9	12.8	55.2
MT 21313	28.5	179.5	62.6	13.3	45.2
MT 21314	31.7	177.5	63.6	12.9	59.3
MT 21320	31.3	183.5	63.5	12.7	47.2
MT 21323	32.1	181.5	64.6	13.1	48.9
MT 21324	30.5	184.0	64.5	13.4	40.5
MT 21325	31.1	181.5	65.8	13.1	43.7
MT 21335	29.5	182.0	62.5	12.9	42.0
MT 21337	28.9	185.0	63.8	12.7	39.8
MT 21341	30.7	181.0	63.6	12.9	58.7
MT 21342	32.3	182.0	62.5	13.3	50.4
MT 21345	31.7	182.5	63.5	12.4	46.6
MT 21346	30.5	182.0	62.3	13.4	52.8
MT 21352	32.1	178.5	64.1	13.2	49.6
MT 21354	29.3	181.5	62.3	13.6	39.6
MT 21356	30.3	182.0	63.6	14.0	46.9
MT 21359	31.7	179.5	62.7	13.7	60.0
MT 21362	31.1	179.5	62.4	13.4	48.8
MT 21366	31.1	180.5	62.8	14.0	47.8
MT 21371	30.1	182.5	63.7	12.9	47.9
MT 21373	30.5	182.0	63.3	13.0	48.1
MT 21375	31.1	181.5	61.9	13.3	50.9
MT 21380	30.7	182.5	64.0	13.9	44.2
MT 21384	30.3	180.0	62.5	13.2	49.1
MT 21387	30.7	181.5	62.3	13.1	42.9
MT 21395	31.7	185.5	62.3	13.6	40.9
MT 21401	30.3	181.0	63.4	12.9	40.1
MT 21415	29.2	180.5	62.6	12.8	50.1
MT 21425	27.0	181.5	61.7	12.3	47.1
MT 21429	29.5	185.0	62.1	13.5	46.1
MT 21430	30.9	181.5	61.9	13.0	44.9
MT 21432	30.5	179.0	63.3	13.8	44.7
MT 21439	28.8	178.5	64.5	13.2	49.6
MT 21450	29.9	182.5	62.8	13.6	45.6
MT 21455	29.9	180.5	65.1	13.2	41.7
MT 21456	31.3	183.0	61.6	13.7	45.5
MT 21458	32.1	182.5	61.4	14.4	50.9
MT 21459	31.1	178.0	63.0	13.9	48.1
MT 21460	29.8	182.0	61.9	14.2	45.0
MT 21466	30.7	180.5	63.1	13.4	51.5
MT 21467	30.7	180.0	63.0	13.7	60.9
MT 21470	31.3	182.0	63.9	13.2	44.4
MT 21472	32.7	182.0	62.1	13.0	49.4
MT 21473	29.5	181.0	62.6	13.4	47.9
MT 21476	32.1	180.5	62.2	14.2	52.2
MT 21478	29.0	182.5	62.1	14.9	45.8

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Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
MT 21479	30.1	180.0	63.5	13.4	48.1
MT 21480	31.3	180.5	62.5	13.8	55.5
MT 21484	30.1	180.5	63.9	13.8	55.1
MT 21485	31.3	180.0	62.9	14.2	52.6
MT 21487	31.1	180.0	63.8	13.8	59.7
MT 21490	27.8	178.0	63.5	13.5	49.8
REEDER	30.7	182.5	62.7	13.6	46.0
VIDA	29.2	182.5	62.0	12.7	52.1
Mean	30.3	181.7	63.2	13.4	47.9
P-Value	<.0001	<.0001	<.0001	<.0001	<.0001
CV (%)	3.9	0.4	0.6	2.6	9.5
LSD (0.05)	2.3	1.3	0.8	0.7	9.0

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N Available (lb/ac): 30
N added (lb/ac): 70
P2O5 Available (ppm): 11.3
P2O5 added (lb/ac): 11
Herbicide Application: Opensky @ 16 oz/ac on 6/3/22

Planted: 5/5/22
Harvested: 8/11/22
Previous crop: fallow
Soil Type: Williams Clay Loam
Crop Year Precipitation: 12.70 inch
Plot Width: 5 ft

Amy processing soil samples at MSU-EARC lab.

Dryland Spring Wheat Advance Yield Trial- MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
AAC Concord	31.9	184	62.6	14.1	39.9
AP Gunsmoke CL3	26.9	181	62.8	13.7	46.8
AP Smith	26.5	182	63.6	13.9	46.1
CHOTEAU	28.7	183	62.0	13.4	45.5
CORBIN	28.3	180	62.9	13.6	45.5
CP 3099A	30.0	186	58.8	11.9	43.2
CP 3119A	29.8	187	57.0	12.0	39.6
CP 3188	28.8	181	61.4	12.1	45.4
CP 3530	30.2	183	62.3	13.4	39.4
CPX 39120	31.1	189	56.8	12.7	37.2
DAGMAR	29.3	179	63.6	14.1	49.6
DUCLAIR	29.2	180	61.7	13.5	39.6
LANNING	27.8	180	63.2	13.7	48.7
LCS Ascent (LNR 0046)	28.3	179	64.9	13.0	49.7
LCS Dual	28.5	180	63.9	12.7	46.4
LCS HammerAX	27.4	181	63.5	13.1	45.8
MCNEAL	30.4	183	61.7	13.7	43.8
MS Cobra	29.0	180	63.6	13.7	46.6
MS Ranchero	31.4	182	62.5	12.9	42.2
MT1809	30.8	181	61.8	13.3	53.1
MT 1939	28.1	180	64.0	13.0	48.3
MT 2007	26.9	178	63.6	12.9	49.4
MT 2013	30.7	179	64.3	14.0	48.0
MT 2022	29.4	178	64.5	13.3	45.4
MT 2030	29.2	181	63.7	12.9	54.4
MT 2038	31.2	181	63.6	13.1	46.9
MT 2049	27.7	179	62.5	13.4	50.2
MT 2050	28.8	182	62.7	13.4	46.8
MT 2054	30.8	180	63.5	13.4	43.3
MT 2063	28.5	180	62.9	13.1	47.1
MT 21003	28.1	182	62.8	14.0	47.0
MT 21005	28.5	180	62.3	13.8	47.6
MT 21016	28.2	180	63.1	14.3	48.9
MT 21019	29.4	180	63.2	14.8	44.9
MT 21021	28.2	179	64.5	13.3	42.5
MT 21023	28.7	182	64.3	13.8	45.0
MT 21024	28.5	179	64.0	13.6	46.3
MT 21031	27.8	180	65.0	13.9	45.7
MT 21037	28.7	180	62.9	13.4	47.8
MT 21062	29.5	181	63.3	13.3	46.8
MT 21073	28.0	180	64.2	13.5	43.6
MT 21074	28.6	183	62.9	13.6	45.4
MT 21075	27.4	182	64.0	14.1	41.7
MT 21076	31.1	184	61.3	13.9	48.4
MT 21082	29.3	179	63.0	14.0	45.2
MT 21089	28.6	180	62.0	13.6	47.9
MT 21091	27.7	181	63.1	14.0	49.2
MT 21099	30.6	184	61.6	13.1	50.7
MT 21102	29.4	183	63.3	13.6	42.8
MT 21104	28.6	181	63.8	12.8	52.9
MT 21105	29.4	182	63.5	12.6	47.4
MT 21111	28.5	179	63.6	14.1	47.4
MT SIDNEY	29.0	180	64.1	13.2	48.7
ND HERON	28.9	178	64.7	14.3	44.4
NS PRESSER CLP	30.7	184	60.1	12.5	50.7
REEDER	31.8	182	62.6	13.4	45.9

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Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
ROCKER	30.0	184	63.0	13.5	47.4
SY INGMAR	27.9	181	64.4	13.9	42.2
SY Longmire	28.3	180	63.9	13.5	43.5
SYN 183	27.7	179	63.6	14.0	48.1
SY ROCKFORD	29.0	183	62.9	13.2	46.3
THATCHER	34.7	186	60.6	14.2	30.4
VIDA	29.3	183	61.6	12.7	48.6
WB 173	28.6	183	64.8	13.3	45.9
WB 211	29.5	183	64.1	12.5	48.9
WB 221	30.2	182	60.7	14.2	48.1
WB 222	26.4	178	63.6	14.9	40.9
WB 9879 CLP	28.1	181	63.3	13.8	44.4
WB GUNNISON	27.3	182	63.0	13.3	41.1
Mean	29.1	181	62.9	13.5	45.8
P-Value	<.0001	<.0001	<.0001	<.0001	<.0001
CV (%)	5.1	0.4	0.5	2.5	4.3
LSD (0.05)	2.4	1.2	0.5	0.5	3.2

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N Available (lb/ac): 30
N added (lb/ac): 70
P2O5 Available (ppm): 11.3
P2O5 added (lb/ac): 11
Herbicide Application: Opensky @ 16 oz/ac on 6/3/22

Planted: 5/5/22
Harvested: 8/12/22
Previous crop: fallow
Soil Type: Williams Clay Loam
Crop Year Precipitation: 12.70 inch
Plot Width: 5 ft

MSU-EARC summer crew planting veggies in the hoop greenhouse.

Roosevelt County Dryland Spring Wheat - MSU Poplar, MT 2022

Variety	Plant Height (inch)	Test Weight (lb/bu)	Protein (%)	Sawfly Damage	Grain Yield† (bu/ac)
Brennan	20.7	63.3	14.6	50.0	23.9
CP3099A	19.9	56.4	14.4	56.7	17.6
CP3119A	19.4	55.5	14.5	13.3	19.4
CP3188	22.6	58.4	14.2	73.3	19.6
CP3530	22.7	58.9	16.2	70.0	20.0
CPX39120	21.7	56.9	15.6	40.0	16.1
Dagmar	22.4	61.7	15.4	40.0	23.8
Duclair	20.2	59.6	15.2	26.7	22.5
Lanning	21.3	60.5	15.2	53.3	21.3
MT 1809	19.6	58.9	15.7	46.7	19.1
MT 1939	19.5	61.3	14.6	16.7	24.3
MT 2007	21.9	60.7	14.8	63.3	22.6
MT 2013	22.6	62.9	14.8	36.7	22.4
MT 2022	21.5	61.7	14.4	20.0	23.9
MT 2030	20.4	60.8	14.6	60.0	25.2
MT 2038	23.0	61.9	14.2	40.0	23.2
MT 2049	20.1	59.7	13.9	60.0	23.9
MT 2050	20.6	61.0	14.2	20.0	26.2
MT 2054	22.3	60.8	14.1	13.3	26.4
MT 2063	20.8	61.8	14.5	30.0	24.3
MT Sidney	22.0	60.8	14.3	43.3	23.1
NS Presser CLP	21.0	58.6	14.9	60.0	16.4
Reeder	20.2	61.4	14.9	43.3	16.5
SY Ingmar	21.1	61.4	14.8	63.3	18.9
SY Soren	20.9	61.2	15.1	53.3	20.1
Vida	21.0	59.3	14.5	36.7	18.3
WB 9879 CL	19.7	60.9	15.3	13.3	21.5
Mean	21.1	60.2	14.8	42.3	21.5
P-Value	0.111	<.0001	<.0001	<.0001	<.0001
CV (%)	7.3	0.6	2.6	22.3	10.5
LSD (0.05)	2.5	0.6	0.6	15.5	3.7

(Julian*) is a continuous count of days since January 1 — Planted: 4/27/22
† Grain yield adjusted to 12.0% moisture — Harvested: 8/2/22
Fertilizer: 75 lbs/ac MESZ 10-40-0-10S-1Zn; 46 lbs/ac N broadcast — Previous crop: chem fallow
Plot Width: 5 ft — Crop Year Precipitation: 8.28 inch

"The future belongs to the few of us still willing to get our hands dirty."
Roland Tiangco

Sheridan County Dryland Spring Wheat - MSU Dagmar, MT 2022

Variety	Plant Height (inch)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Brennan	26.1	63.7	13.4	52.6
Dagmar	32.0	62.9	11.9	67.3
Duclair	30.9	62.6	11.5	58.8
Lanning	30.6	62.4	12.5	59.5
MT 1809	29.3	62.4	11.5	63.6
MT 1939	29.0	62.5	11.3	64.1
MT 2007	28.9	62.9	11.9	65.1
MT 2013	31.8	63.3	11.6	65.5
MT 2022	30.0	63.5	11.5	62.5
MT 2030	31.8	63.4	11.9	64.9
MT 2038	33.9	62.8	11.6	62.9
MT 2049	30.3	61.4	11.9	63.2
MT 2050	31.8	62.3	11.6	58.1
MT 2054	31.4	62.2	11.5	58.0
MT 2063	31.5	62.9	10.4	67.0
MT Sidney	34.4	62.5	11.7	65.0
NS Presser CLP	32.4	62.0	11.2	68.5
Reeder	32.9	63.6	12.2	62.2
SY Ingmar	29.8	64.7	12.8	57.4
SY Soren	28.6	64.0	13.3	59.2
Vida	31.9	63.0	11.4	68.0
WB 9879 CLP	31.0	63.0	11.9	59.8
Mean	30.9	62.9	11.8	62.4
P-Value	0.0001	<.0001	0.0032	0.0004
CV (%)	5.4	0.5	6.1	6.1
LSD (0.05)	2.8	0.5	1.2	6.3

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N added (lb/ac): 80
P2O5 added (lb/ac): 30
Plot Width: 5 ft

Planted: 4/29/22
Harvested: 8/25/22
Previous crop: lentil
Crop Year Precipitation: 8.78 inch

Of course I
talk to myself.

SOMETIMES I NEED EXPERT ADVICE.

Valley County Dryland Spring Wheat - MSU Nashua, MT 2022

Variety	Plant Height (inch)	Test Weight (lb/bu)	Protein (%)	Sawfly Damage	Grain Yield† (bu/ac)
Brennan	22.7	62.4	17.4	23.3	28.9
Dagmar	23.5	61.5	18.4	16.7	24.3
Duclair	21.6	59.4	18.9	33.3	21.4
Lanning	20.6	59.6	18.6	23.3	25.6
MT 1809	22.2	60.0	18.2	43.3	24.3
MT 1939	22.3	60.8	17.5	16.7	29.1
MT 2007	20.1	60.6	17.4	20.0	28.9
MT 2013	23.5	61.7	18.0	30.0	23.9
MT 2022	22.7	61.3	18.3	16.7	27.9
MT 2030	22.3	59.9	18.5	26.7	23.6
MT 2038	24.3	60.7	18.0	20.0	24.9
MT 2049	21.0	60.1	17.3	30.0	28.1
MT 2050	21.4	61.1	17.5	33.3	25.1
MT 2054	20.2	61.1	17.4	20.0	25.4
MT 2063	22.9	62.6	17.9	33.3	25.4
MT Sidney	23.1	60.9	17.7	20.0	26.1
NS Presser CLP	19.8	60.2	17.0	43.3	21.5
Reeder	20.9	61.4	18.5	46.7	17.0
SY Ingmar	20.0	61.1	18.7	10.0	22.9
SY Soren	21.8	60.6	18.3	16.7	25.0
Vida	20.7	60.6	17.2	33.3	23.9
WB 9879 CLP	20.9	61.1	18.6	13.3	23.5
Mean	21.8	60.9	18.0	25.9	24.8
P-Value	0.0676	<.0001	0.0039	0.0084	0.0033
CV (%)	7.8	0.9	3.4	44.4	12.0
LSD (0.05)	2.8	0.9	1.0	18.9	4.9

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N added (lb/ac): 80
P2O5 added (lb/ac): 30
Plot Width: 5 ft

Planted: 4/28/22
Harvested: 8/3/22
Previous crop: chem fallow
Crop Year Precipitation: 6.72 inch

Variety	Plant Height (in)	Days to Head (DAP+)	Lodging (0 - 9*)	Protein† 2022 (%)	Protein† 2-Yr Avg (%)	Protein† 3-Yr Avg (%)	Test Weight (lb/bu)	Yield 2022 (bu/a)	Yield 2-Yr Avg‡ (bu/a)	Yield 3-Yr Avg (bu/a)
LCS Trigger	30	56	0	13.0	12.7	13.2	62.2	89.9	87.3	85.7
MN Torgy	31	51	0	14.6	14.9	15.7	62.8	96.3	84.9	84.8
CP3530	29	51	3	15.8	15.5	15.7	59.1	83.8	82.3	82.4
SY Ingmar	30	51	0	15.6	15.4	15.9	61.4	86.1	80.7	79.7
Dagmar	30	48	1	16.5	16.2	16.5	60.5	82.3	76.9	79.5
Lanning	30	50	0	15.8	15.6	16.2	59.6	77.1	74.1	79.2
MN Washburn	28	51	0	15.3	14.8	15.4	60.7	86.4	79.5	79.1
MS Ranchero	32	54	0	15.2	14.5	15.1	58.9	73.3	78.3	79.1
TCG Spitfire	30	53	1	14.1	14.1	14.8	59.6	88.8	79.8	78.9
Driver	31	52	0	15.0	14.7	15.4	60.8	81.5	78.6	77.7
Faller	31	52	1	14.8	14.8	15.4	59.1	78.5	76.8	77.3
TCG Heartland	28	50	0	16.7	16.4	16.7	61.5	78.2	75.8	76.9
Glenn	31	50	1	16.1	15.9	16.4	62.3	78.1	75.4	76.2
SY Longmire	26	51	1	15.5	15.6	16.2	60.6	79.0	77.0	76.0
ND Frohberg	31	50	0	15.6	15.6	16.0	61.4	81.8	73.4	75.4
ND VitPro	30	49	1	16.4	16.4	16.8	63.6	84.0	73.9	74.6
LCS Rebel	29	47	1	16.1	16.1	16.5	62.2	75.7	72.4	74.1
SY McCloud	30	50	0	15.8	16.1	16.5	62.5	82.4	72.0	72.9
TCG Wildcat	30	50	1	15.3	15.2	16.0	61.5	78.8	74.3	72.7
ND Heron	30	47	1	17.0	16.6	16.9	63.5	69.9	67.0	69.0
Bolles	30	53	1	16.7	16.8	17.5	60.7	81.0	71.9	68.9
LCS Buster	31	55	1	13.1	12.7	-	58.6	86.1	87.0	-
AAC Brandon	27	50	1	15.2	15.3	-	62.5	83.4	83.0	-
CAG Reckless	31	51	2	15.6	15.2	-	62.7	93.2	81.4	-
CAG Justify	28	51	1	14.7	14.4	-	57.5	83.5	77.6	-
CP3099A	29	55	0	13.9	13.5	-	56.3	82.7	77.2	-
MS Cobra	28	49	1	15.7	15.3	-	60.1	79.3	76.7	-
AP Smith	27	51	0	15.0	15.2	-	60.7	86.9	75.0	-
AAC Starbuck VB	30	49	1	16.6	16.5	-	61.8	77.1	74.4	-
AP Gunsmoke CL2	27	50	2	16.4	16.0	-	59.6	86.3	74.3	-
AAC Wheatland VB	31	49	1	16.9	16.2	-	60.2	74.9	74.4	-
WB9590	25	50	0	16.3	16.3	-	60.0	76.5	72.0	-
SK Rush	35	51	0	16.3	16.4	-	60.0	78.7	71.4	-
SY Valda	28	51	0	15.0	15.1	-	60.2	82.9	70.3	-
SY611CL2	27	48	0	15.8	15.6	-	62.5	77.5	69.4	-
CAG Recoil	30	56	0	15.2	-	-	60.3	95.1	-	-
LCS Ascent	27	47	1	14.3	-	-	63.5	90.7	-	-
MS Charger	28	48	1	13.8	-	-	61.4	90.1	-	-
Ascend-SD	32	51	0	15.5	-	-	61.3	89.6	-	-
LCS Hammer Ax	26	48	1	14.4	-	-	60.1	86.0	-	-
MN Rothsay	26	53	1	15.2	-	-	60.4	85.8	-	-
Shelly	28	52	0	15.0	-	-	61.2	85.4	-	-
AP Murdock	28	51	0	14.9	-	-	59.6	83.9	-	-
LCS Cannon	26	45	1	16.0	-	-	63.5	83.0	-	-
CP3188	26	51	2	14.0	-	-	58.5	79.8	-	-
LCS Dual	29	48	1	15.2	-	-	60.9	79.0	-	-
CP3119A	32	55	0	15.8	-	-	53.2	66.0	-	-
MEAN	29.2	50.6	0.7	15.37	15.36	15.93	60.66	82.48	76.46	77.15
C.V. (%)	-	-	-	6.74	-	-	1.71	7.57	-	-
LSD (5%)	-	-	-	1.68	-	-	1.68	10.13	-	-
LSD (10%)	-	-	-	1.40	-	-	1.40	8.47	-	-

+ Days after planting * 0: no lodging - 9: plants lying flat on the ground † Protein content adjusted to 12% moisture

‡ Hail storm in 2021 impacted yields

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

Soil Test (0-6 in.): P=18 ppm; K=270 ppm; pH=7.4; OM=2.7% — Previous crop: Potato

(0-24 in.): NO3-N=54 lb/a — Planted: 5/17/2022

Yield goal: 90 bu/a — Harvested: 8/30/2022

Planting population: 1.5 million seeds/a — Soil type: Lihen Loamy Fine Sand

Applied fertilizer: 320 lb/a of Urea (46-0-0)[5/10/2022] — Plot size: 90ft^2

Herbicides applied: Valor (3oz/a) [10/28/21] & Huskie FX (18oz/a), Varro (6.85oz/a), Class Act (1qt/100gal) [6/20] — Rainfall: 13.2 inches (4/1 - 8/30)

Fungicides applied: Prosaro 421SC (8.2oz/a) [7/21] — Irrigation: 11.0 inches (5/17 - 8/30)

Irrigated Advanced Spring Wheat Trial - MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
AAC Concord	37.7	181.3	64.0	15.2	79.9
AP Gunsmoke CL3	33.6	180.0	64.4	15.1	93.8
AP Smith	30.2	180.7	64.8	14.3	83.6
CHOTEAU	35.0	179.7	64.0	14.0	84.7
CORBIN	33.9	178.7	64.1	14.2	80.6
CP 3099A	35.8	155.7	63.4	12.1	100.2
CP 3119A	34.0	150.7	60.4	13.2	84.4
CP 3188	33.5	149.0	64.5	13.0	99.2
CP 3530	35.5	150.3	64.7	14.4	94.2
CPX 39120	36.3	156.3	61.6	12.7	90.9
DAGMAR	35.2	178.3	64.8	14.2	87.1
DUCLAIR	35.2	177.7	63.5	13.9	87.7
LANNING	33.5	178.0	63.8	14.9	87.1
LCS Ascent (LNR 0046)	32.6	177.7	65.8	13.6	95.4
LCS Dual	34.6	179.0	65.5	13.4	95.0
LCS HammerAX	29.5	178.3	64.6	13.8	90.6
MCNEAL	33.1	180.7	63.7	14.2	84.3
MS Cobra	33.6	179.3	64.9	14.3	90.5
MS Ranchero	35.7	182.0	64.3	13.5	90.1
MT 1809	34.6	150.0	63.1	14.5	86.2
MT 1939	33.1	178.0	64.5	13.8	90.4
MT 2007	33.2	177.7	64.3	14.2	86.8
MT 2013	35.0	146.7	65.3	14.1	87.4
MT 2022	32.8	177.3	65.0	13.9	79.6
MT 2030	32.8	178.7	64.2	14.1	92.8
MT 2038	36.2	178.7	63.6	15.1	92.2
MT 2049	31.6	178.0	63.5	14.6	86.7
MT 2050	33.5	180.0	63.7	14.2	86.1
MT 2054	37.3	179.3	63.6	14.3	84.4
MT 2063	33.4	178.7	64.4	12.8	88.6
MT 21003	32.8	179.7	63.9	14.6	86.9
MT 21005	34.3	178.3	63.1	14.3	83.2
MT 21016	33.7	178.7	63.7	15.4	82.7
MT 21019	34.4	177.7	64.4	14.8	85.7
MT 21021	33.6	177.7	65.0	14.3	87.3
MT 21023	36.5	178.3	64.9	14.6	84.9
MT 21024	32.8	177.7	64.7	13.9	83.2
MT 21031	33.7	177.3	66.2	15.1	82.7
MT 21037	33.6	178.0	63.7	14.9	87.4
MT 21062	33.1	178.0	64.4	14.1	87.1
MT 21073	31.1	178.0	64.5	14.3	74.8
MT 21074	32.4	180.7	64.6	14.5	81.3
MT 21075	33.0	179.3	64.2	15.0	71.8
MT 21076	35.7	182.0	63.3	15.2	85.5
MT 21082	34.9	178.0	63.8	14.9	90.9
MT 21089	34.0	178.7	63.5	14.3	92.3
MT 21091	32.8	179.3	63.8	15.0	87.8
MT 21099	35.5	180.7	63.7	13.7	90.0
MT 21102	33.4	180.0	65.6	14.3	93.8
MT 21104	33.2	179.7	64.9	13.7	88.4
MT 21105	34.4	179.3	64.9	13.4	90.1
MT 21111	34.5	177.0	63.9	15.3	87.5
MT SIDNEY	31.2	178.7	65.3	14.3	81.3
ND HERON	34.6	177.3	65.8	14.8	86.5
NS PRESSER CLP	36.6	153.0	61.9	14.0	78.9
REEDER	34.4	179.3	64.5	14.0	82.5
ROCKER	33.7	180.7	64.3	14.1	95.9

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Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
SY INGMAR	32.2	179.7	65.7	14.0	86.0
SY Longmire	33.2	179.3	65.0	14.3	91.3
SYN 183	30.4	145.0	65.2	14.0	91.9
SY ROCKFORD	33.6	182.0	63.9	14.1	88.9
THATCHER	42.1	183.7	63.8	14.4	75.1
VIDA	34.2	180.3	63.5	13.9	81.4
WB 173	31.8	180.3	67.0	13.7	95.9
WB 211	33.9	179.3	65.7	13.0	95.4
WB 221	34.5	180.0	63.1	14.2	84.2
WB 222	27.2	178.0	64.3	14.9	82.4
WB 9879 CLP	34.1	180.0	64.8	13.6	83.0
WB GUNNISON	30.8	180.0	63.8	14.1	77.7
Mean	33.8	175.5	64.3	14.2	87.0
P-Value	<.0001	0.7419	<.0001	<.0001	<.0001
CV (%)	4.1	10.4	0.3	3.2	5.7
LSD (0.05)	2.2	29.5	0.3	0.7	7.9

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N Available (lb/ac): 28.3
N added (lb/ac): 80
P2O5 Available (ppm): 19.4
P2O5 added (lb/ac): 30
Herbicide Application: Goldsky @ 16 oz/ac on 6/3/22

Planted: 5/4/22
Harvested: 8/15/22
Previous crop: sugarbeet
Soil Type: Savage Silty Clay
Crop Year Precipitation: 15.26 inch
Irrigation (Sprinkler): 2.25 inch
Plot Width: 5 ft

Ron, Doug, Amy & Lakayla planting a sugarbeet trial at MSU-EARC.

Durum Variety Descriptions

Variety	Origin[1]	Year	HEIGHT (IN)[2]	DTH[3]	Resistant to[4]					QUALITY FACTORS[5]	
					LODGING	STEM RUST	LEAF RUST	FOLIA DISEASE	SCAB	TEST WEIGHT	GRAIN PROTEIN
AAC SPITFIRE	Canada	2014	35	51	MR/MS	NA	NA	NA	NA	V HIGH	V HIGH
AAC STRONGHOLD	Canada	2016	36	52	MR	NA	NA	NA	NA	V HIGH	V HIGH
ALKABO	NDSU	2005	37	52	R/MR	R	R	MS	MS/S	HIGH	m low
CARPIO	NDSU	2012	38	54	MS	R	R	MS	MS	MEDIUM	M HIGH
CDC Defy	Canada	2019	38	51	MR	NA	NA	NA	NA	V HIGH	V HIGH
CDC Vantta	Canada	2021	32	58	MR	NA	NA	NA	NA	HIGH	V HIGH
CDC Verona*	Canada	2010	27	58	MS	R	R	MR/MS	S/VS	MEDIUM	M HIGH
DIVIDE	NDSU	2005	39	55	MS	R	R	MS	MS	MEDIUM	M HIGH
JOPPA	NDSU	2013	38	52	MS	R	R	MS	MS	V HIGH	V HIGH
LUSTRE**	MT	2020	31	54	R	NA	NA	NA	NA	V HIGH	V HIGH
MAIER	NDSU	1998	36	53	MR/MS	R	R	MS	S/VS	V HIGH	V HIGH
MOUNTRAIL	NDSU	1998	38	53	MS	R	R	MS	S/VS	V HIGH	V HIGH
MT BLACKBEARD**	MT	2022	33	55	R/MR	NA	NA	NA	NA	V HIGH	HIGH
MT RASKA**	MT	2022	24	50	R	NA	NA	NA	NA	V HIGH	HIGH
ND GRANO**	NDSU	2017	37	52	MS	R	R	S/VS	MS/S	HIGH	M HIGH
ND RIVELAND	NDSU	2017	38	53	MR/MS	R	R	MS	MS	HIGH	M HIGH
ND STANLEY	NDSU	2021	37	53	MR/MS	R	R	MS	MS	V HIGH	V HIGH
RUGBY	NDSU	1973	40	53	MS	R	R	MR/MS	S/VS	MEDIUM	MEDIUM
STRONGFIELD	Canada	2004	36	52	MS/S	R	R	MS/S	S/VS	MEDIUM	V HIGH
TIOGA	NDSU	2010	41	53	MS	R	R	MS	MS/S	M HIGH	M HIGH

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

[2]Height data averaged from several locations in 2022.

[3]DTH=Days to head; the number of days from planting to head emergence from the boot, averaged based on data from several locations in 2022.

[4]R=Resistant; MR=Moderately Resistant; MS=Moderately Susceptible; S=Susceptible; VS=Very Susceptible; NA=Not Available.

[5]L=Low; VL=Very Low; M=Medium, H=High; VH=Very High. *Data From 2022 ND multiple locations; ** Data from 2022 Nesson Irrigated Site.

"To be a farmer is to be a student forever, for each day brings something new."
John Connell

Dryland Durum Variety Trial - NDSU **WREC, Williston, ND 2022**

Variety/Line	Plant height (in)	Days to Heading (DAP)	Protein (%)	Test Weight (lb/bu)	Yield 2022 (bu/ac)	Yield 3 Yr. Avg.
ALKABO	24.1	51	13.9	59.7	32.8	25.5
CARPIO	25.5	53	14.2	59.2	37.3	28.4
DIVIDE	25.9	54	14.0	58.8	30.4	25.1
JOPPA	24.0	52	13.9	59.7	29.7	24.3
MAIER	25.3	51	14.6	59.6	30.6	22.5
MOUNTRAIL	24.7	52	14.2	58.4	35.8	25.9
ND GRANO	26.2	52	14.5	59.5	34.3	25.4
ND RIVELAND	25.3	52	13.8	58.6	37.6	27.5
ND STANLEY	23.9	52	14.8	59.9	29.8	-
STRONGFIELD	25.6	52	14.5	59.4	30.7	23.9
TCG-BRIGHT	25.5	52	13.7	59.1	29.2	-
TCG-WEBSTER	23.6	50	13.5	58.8	24.8	-
Mean	25.2	52.5	14.1	59.22	32.3	-
CV %	6.8	1.8	2.8	0.46	9.0	-
LSD 0.05	2.8	1.5	0.6	0.44	4.7	-
LSD 0.1	2.3	1.3	0.5	0.37	4.0	-

Location: WREC; Latitude: 48.130060; Longitude: -103.748373;
Previous crop: Soybean; Soil type: Williams-Bowbells Loam. Altitude: 2105 ft.
Planted: 5/19/2022; Harvested: 8/23/2022.
Soil test (0-6 in): P= 21 ppm; K=265 ppm; pH= 6.1; and OM= 2%.
Soil test (0-24 in): NO_3N= 29 lb/ac.
Applied fertilizers (lb/ac): N=61; P=23.5; K=0.
Applied chemicals: Glyphosate 1 q/ac (05/22/2022).
Tombstone Helios 2 fl.oz/ac (06/22/2022)

Data includes only released varieties. Experimental lines are not included. Statistics reflect the entire trial.

Farmer
POWERED
BY
Coffee

Dryland Statewide Durum - MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Alzada	27.7	182	63.1	13.6	57.0
Carpio	32.7	186	63.1	13.0	50.2
Divide	34.0	185	63.4	13.4	56.0
Joppa	34.3	186	63.4	13.1	52.7
Lustre	33.2	185	62.1	13.7	52.1
MTD18148	24.8	182	63.6	12.9	58.2
MTD18313	25.3	181	64.6	13.3	55.5
MTD18348	36.6	185	63.2	12.9	59.8
MTD19011	33.3	184	63.9	12.8	58.4
MTD19077	34.1	186	63.1	14.2	52.8
MTD19089	33.9	186	63.0	14.4	55.9
MTD19103	33.7	186	62.7	13.0	56.2
MTD19109	33.1	187	62.1	13.7	49.6
MTD19115	32.5	185	63.4	13.1	52.5
MTD19209	35.0	186	64.2	12.7	58.7
MTD19241	32.0	185	63.9	12.9	54.6
MTD19349	33.5	186	61.5	14.0	50.3
MTD19375	31.5	187	60.6	14.4	50.1
MTD19499	32.8	186	61.7	13.9	53.6
MTD19507	31.6	184	62.9	14.0	53.4
MTD19511	29.7	183	61.9	13.8	51.8
MTD19529	32.4	185	63.0	13.1	50.6
MTD19611	31.4	183	63.9	13.8	50.3
MTD19617	33.2	186	64.5	12.8	54.4
MTD19623	34.8	185	61.8	13.5	55.9
MTD19653	32.7	186	64.6	14.3	53.4
MTD19703	34.4	185	64.4	13.1	62.6
Mountrail	33.9	186	63.4	12.5	60.9
ND-Grano	33.1	185	63.9	13.3	55.7
ND-Riveland	34.9	187	62.6	12.8	55.4
Mean	32.5	185	63.1	13.4	54.6
P-Value	<.0001	<.0001	<.0001	<.0001	<.0001
CV (%)	3.5	0.4	0.6	3.5	5.5
LSD (0.05)	1.9	1.1	0.6	0.8	5.0

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

† Grain yield adjusted to 12.0% moisture

N Available (lb/ac): 30

N added (lb/ac): 70

P2O5 Available (ppm): 11.3

P2O5 added (lb/ac): 11

Herbicide Application: Opensky @ 16 oz/ac on 6/3/22

Planted: 5/5/22

Harvested: 8/12/22

Previous crop: fallow

Soil Type: Williams Clay Loam

Crop Year Precipitation: 12.70 inch

Plot Width: 5 ft

Start each day with a grateful heart... and a tractor... oh, and coffee.

Roosevelt County Dryland Durum - MSU Poplar, MT 2022

Variety	Plant Height (inch)	Test Weight (lb/bu)	Protein (%)	Sawfly Damage	Grain Yield† (bu/ac)
Alzada	19.7	62.3	14.1	30.0	21.0
CDC-Vivid	23.0	61.7	15.3	30.0	16.7
Carpio	21.8	62.3	14.6	63.3	15.1
Divide	20.7	62.6	14.2	60.0	17.0
Grenora	19.7	62.1	14.3	40.0	13.4
Joppa	22.6	62.6	14.1	53.3	16.7
Lustre	22.2	61.4	15.1	40.0	15.2
MTD18148	17.4	61.8	14.3	36.7	18.9
MTD18172	21.9	63.5	15.4	33.3	15.5
MTD18313	17.6	63.9	14.8	30.0	18.8
MTD18348	23.5	62.8	14.1	40.0	20.0
Mountrail	22.0	62.1	14.6	60.0	14.6
ND-Grano	23.5	62.6	14.8	46.7	15.8
ND-Riveland	24.1	62.7	14.5	63.3	14.3
Tioga	22.3	63.0	14.4	56.7	16.1
Mean	21.5	62.5	14.6	45.6	16.6
P-Value	<.0001	<.0001	0.0046	0.0282	0.0019
CV (%)	6.9	0.4	2.8	31.9	12.1
LSD (0.05)	2.5	0.4	0.7	24.3	3.3

(Julian*) is a continuous count of days since January 1 — Planted: 4/27/22
† Grain yield adjusted to 12.0% moisture — Harvested: 8/2/22
Fertilizer: 75 lbs/ac MESZ 10-40-0-10S-1Zn; 46 lbs/ac N broadcast — Previous crop: chem fallow
Plot Width: 5 ft — Crop Year Precipitation: 8.28 inch

Sheridan County Dryland Durum - MSU Dagmar, MT 2022

Variety	Plant Height (inch)	Test Weight (lb/bu)	Protein (%)	Lodging (%)	Grain Yield† (bu/ac)
Alzada	28.0	62.2	11.9	90.0	50.7
CDC-Vivid	34.4	63.6	11.3	0.0	61.8
Carpio	34.4	64.3	11.4	3.3	63.8
Divide	36.5	63.6	10.5	40.0	46.0
Grenora	33.9	63.0	10.6	0.0	66.4
Joppa	36.1	63.7	10.5	6.7	62.6
Lustre	34.5	62.4	11.0	86.7	61.5
MTD18148	26.5	62.9	11.2	16.7	59.3
MTD18172	34.9	64.4	10.7	0.0	62.9
MTD18313	29.0	63.7	10.7	0.0	57.5
MTD18348	37.7	64.1	10.4	6.7	64.5
Mountrail	35.4	63.8	10.2	36.7	68.1
ND-Grano	35.6	64.2	10.7	6.7	64.3
ND-Riveland	38.1	63.4	10.9	3.3	59.2
Tioga	37.9	63.2	10.0	30.0	64.1
Mean	34.2	63.5	10.8	21.8	60.8
P-Value	<.0001	0.0003	0.0869	<.0001	0.329
CV (%)	4.9	0.8	5.7	82.0	15.3
LSD (0.05)	2.8	0.9	1.0	29.9	15.6

(Julian*) is a continuous count of days since January 1 — Planted: 4/29/22
† Grain yield adjusted to 12.0% moisture — Harvested: 8/25/22
N added (lb/ac): 80 — Previous crop: lentil
P2O5 added (lb/ac): 30 — Crop Year Precipitation: 8.78 inch
Plot Width: 5 ft

Valley County Dryland Durum - MSU Nashua, MT 2022

Variety	Plant Height (inch)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Alzada	22.7	60.9	15.6	24.0
CDC-Vivid	24.9	59.8	17.3	18.3
Carpio	19.9	59.7	17.5	14.9
Divide	21.0	61.0	17.1	15.7
Grenora	20.3	59.9	16.0	14.5
Joppa	23.1	61.7	16.5	17.8
Lustre	20.1	59.0	17.7	15.6
MTD18148	18.9	61.2	15.9	21.3
MTD18172	22.8	61.9	17.2	15.7
MTD18313	20.5	62.5	15.7	23.0
MTD18348	22.2	60.6	16.8	17.5
Mountrail	21.1	59.9	17.2	17.5
ND-Grano	20.1	60.7	17.3	14.9
ND-Riveland	23.4	60.9	16.8	13.0
Tioga	21.9	61.7	17.3	15.9
Mean	21.5	60.8	16.8	17.2
P-Value	<.0001	<.0001	<.0001	<.0001
CV (%)	5.3	0.7	2.6	12.5
LSD (0.05)	1.9	0.7	0.7	3.6

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N added (lb/ac): 80
P2O5 added (lb/ac): 30
Plot Width: 5 ft

Planted: 4/28/22
Harvested: 8/3/22
Previous crop: chem fallow
Crop Year Precipitation: 6.72 inch

Irrigated Durum Variety Trial - NDSU **WREC, Nesson Valley, ND 2022**

Variety	Plant Height (in)	Days to Head (DAP+)	Lodging (0 - 9*)	Protein† 2022 (%)	Protein† 2-Yr Avg (%)	Protein† 3-Yr Avg (%)	Test Weight (lb/bu)	Yield 2022 (bu/a)	Yield 2-Yr Avg‡ (bu/a)	Yield 3-Yr Avg (bu/a)
ND Riveland	33	53	1	15.9	16.3	16.7	60.5	90.0	76.4	80.0
ND Grano	31	55	0	16.1	16.5	16.8	61.7	86.2	78.4	76.9
Joppa	30	53	1	15.8	16.1	16.6	61.4	88.2	74.5	76.5
ND Stanley	33	55	0	16.5	16.9	17.5	61.0	79.7	74.3	73.5
AAC Stronghold	30	54	0	17.3	17.2	17.8	60.2	84.7	71.3	72.7
Carpio	28	54	2	16.4	16.1	16.9	60.2	81.9	72.7	72.4
Tioga	34	54	1	16.4	16.9	17.2	61.4	85.3	72.3	72.1
Alkabo	30	51	0	15.4	15.8	16.3	61.9	79.2	70.6	71.0
Divide	33	56	1	17.1	17.2	17.6	59.9	81.0	66.4	67.9
Mountrail	28	55	3	15.7	15.9	16.8	60.8	86.9	64.9	66.7
CDC Verona	31	55	0	17.8	17.9	18.7	59.0	75.1	66.8	66.6
Strongfield	31	52	1	17.0	17.3	18.0	60.3	72.5	64.7	65.8
Maier	31	54	1	16.7	17.2	18.1	61.3	81.4	63.9	64.2
Rugby	34	54	2	17.0	17.5	17.9	59.9	70.5	56.6	61.1
CDC Defy	33	52	0	16.2	16.3	-	59.5	83.6	76.4	-
AAC Spitfire	28	54	1	17.0	17.3	-	58.8	75.6	67.5	-
MT Blackbeard	33	55	2	15.9	-	-	60.4	92.8	-	-
Lustre	31	54	1	16.9	-	-	59.9	80.5	-	-
CDC Vantta	29	58	0	17.6	-	-	57.9	76.5	-	-
MT Raska	24	50	0	16.6	-	-	62.1	75.2	-	-
MEAN	30.4	53.8	0.8	16.60	16.72	17.23	60.29	80.43	70.11	70.71
C.V. (%)	-	-	-	3.13	-	-	1.23	9.02	-	-
LSD (5%)	-	-	-	0.86	-	-	1.25	14.91	-	-
LSD (10%)	-	-	-	0.71	-	-	1.04	12.42	-	-

+ Days after planting * 0: no lodging - 9: plants lying flat on the ground † Protein content adjusted to 12% moisture

‡ Hail storm in 2021 impacted yields

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W

Soil Test (0-6 in.): P=18 ppm; K=270 ppm; pH=7.4; OM=2.7%

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

Yield goal: 90 bu/a

Planting population: 1.5 million seeds/a

Applied fertilizer: 320 lb/a of Urea (46-0-0)[5/10/2022]

Herbicides applied: Valor (3oz/a) [10/28/21] & Huskie FX (18oz/a), Varro (6.85oz/a), Class Act (1qt/100gal) [6/20]

Fungicides applied: Prosaro 421SC (8.2oz/a) [7/21]

Elevation: 1902 ft

Previous crop: Potato

Planted: 5/17/2022

Harvested: 8/19/2022

Soil type: Lihen Loamy Fine Sand

Plot size: 90ft^2

Rainfall: 13.2 inches (4/1 - 8/19)

Irrigation: 11.0 inches (5/17 - 8/19)

Irrigated Statewide Durum - MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Alzada	30.2	180	62.0	14.1	54.2
Carpio	35.6	182	64.9	12.8	72.5
Divide	36.1	183	64.9	12.5	67.9
Joppa	35.7	182	65.1	12.9	74.0
Lustre	36.6	182	64.2	13.2	74.3
MTD18148	28.0	180	63.7	13.9	66.7
MTD18313	28.6	179	64.4	13.9	59.4
MTD18348	37.7	183	64.7	12.7	76.3
MTD19011	36.2	183	63.9	13.5	70.1
MTD19077	36.6	184	65.0	14.7	77.3
MTD19089	38.1	185	65.3	13.8	77.3
MTD19103	34.3	183	64.4	13.3	74.1
MTD19109	33.9	185	64.5	12.3	81.2
MTD19115	34.9	181	64.4	13.2	71.1
MTD19209	38.2	183	64.6	13.5	70.5
MTD19241	35.3	182	64.9	13.6	74.5
MTD19349	35.2	182	64.1	12.8	75.5
MTD19375	36.4	184	62.7	14.0	75.6
MTD19499	35.3	182	63.6	13.3	69.3
MTD19507	34.8	180	64.4	14.3	81.8
MTD19511	33.6	181	63.1	13.8	67.4
MTD19529	34.3	182	62.9	13.1	59.8
MTD19611	32.2	181	64.9	14.0	70.5
MTD19617	34.9	183	65.4	12.8	72.0
MTD19623	35.7	182	64.1	12.1	73.2
MTD19653	35.7	182	65.5	12.9	70.0
MTD19703	36.6	182	64.9	13.3	72.6
Mountrail	35.4	182	64.3	13.1	70.2
ND-Grano	37.3	183	65.6	13.1	75.7
ND-Riveland	37.3	183	63.8	13.2	77.0
Mean	35.0	182.1	64.4	13.3	71.8
P-Value	<.0001	<.0001	<.0001	<.0001	0.0118
CV (%)	4.3	0.4	0.7	3.6	9.8
LSD (0.05)	2.5	1.3	0.8	0.8	11.6

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
Soil Test N Avail (lb/ac): 28.3
N added (lb/ac): 80
Soil Test P2O5 (ppm): 19.4
P2O5 added (lb/ac): 30
Herbicide Application: Goldsky @ 16 oz/ac on 6/3/22

Planted: 5/4/22
Harvested: 8/16/22
Previous crop: sugarbeet
Soil Type: Savage Silty Clay
Crop Year Precipitation: 15.26 inch
Irrigation (sprinkler): 2.25 inch
Plot Width: 5 ft

HARD RED WINTER WHEAT VARIETY DESCRIPTIONS

VARIETY	AGENT OR ORIGIN[1]	YEAR	HEIGHT (IN)[2]	DTH[3]	Resistant to[4]						
					LODGING	WINTER HARDINESS	STRIPE RUST	LEAF RUST	STEM RUST	SCAB	TAN SPOT
AAC Vortex	AAFC	2021	30	2	NA	2	NA	NA	NA	MR/MS	S/VS
AAC Wildfire	AAFC	2015	29	1	MR	3	R	MS	S/VS	MR/MS	MS/S
AC Emerson	Meridian	2011	30	1	R/MR	4	R	MS/S	R	MR	MS
AP Bigfoot	Agripro	2020	26	-3	MR/MS	6	NA	S	NA	MS	R/MR
Draper	SD	2019	27	-2	NA	NA	MR/MS	S	MR/MS	MR/MS	MS
Jerry	ND	2001	32	0	MS	3	S/VS	MR	R	S/VS	S/VS
Keldin	WB	2011	28	0	MR	5	R/MR	MR	MR	MS	MS/S
MS Iceman	Meridian	2021	25	0	NA	NA	S	S/VS	MS	MS/S	S/VS
MS Maverick	Meridian	2020	25	-1	NA	4	NA	MS/S	NA	S/VS	MR/MS
ND Noreen	ND	2020	31	0	MR/MS	3	MR	MR	R	MR	MR/MS
Northern	MT	2015	27	2	MR/MS	5	R	S/VS	R	S/VS	MS/S
Ray7	MT	2018	30	4	NA	NA	R	S/VS	NA	MS/S	MS/S
SD Andes	SD	2020	29	0	NA	NA	R/MR	MS/S	NA	MS	MS/S
SD Midland	SD	2021	30	0	MR/MS	4	R	S/VS	S	NA	S/VS
SY Monument	Agripro	2014	27	-2	MR/MS	3	MR	MR	R	S/VS	S/VS
SY Wolverine	Agripro	2019	25	-5	MR/MS	4	MR/MS	MR	R	MR/MS	MR
WB 4309	WB	2019	26	-2	NA	NA	MR/MS	MS/S	MR/MS	S	MR/MS
WB4510CLP	WB	2020	28	1	MR/MS	5	R/MR	NA	NA	MS/S	S/VS
Winner	SD	2019	27	-2	NA	NA	MS	NA	MR	MR/MS	S/VS

1Refers to developer: 1AAFC = Agriculture & Agri-Food Canada; MN = University of Minnesota; MT = Montana State University; ND = North Dakota State University; SD = South Dakota State University; WB=WestBred.

[2]Based on the average of several environments, and should be used for comparing varieties. The environment can impact the height of varieties.

[3]DTH=Days to Heading; Relative to Jerry.

[4]R=Resistant; MR=Moderately Resistant; MS=Moderately Susceptible; S=Susceptible; VS=Very Susceptible.

"Baling twine turns every farmer into MacGyver."
Unknown

Dryland Winter Wheat Variety Trial - NDSU **WREC, Williston, ND 2022**

Variety/Line	Height	Days to Heading	Protein	Test Weight	Yield 2022	Yield 3 Yr. Avg.
	(in)	(Julian+)	(%)	(lb/bu)	(bu/ac)	(bu/ac)
AAC Vortex	24.0	171.3	14.3	60.9	33.8	-
AAC Wildfire	24.4	174.3	12.0	60.4	38.7	36.0
AC Emerson	23.2	172.7	13.1	61.0	21.8	28.8
AP Bigfoot	20.5	167.0	11.5	61.1	16.6	-
Draper	21.1	166.0	12.8	61.0	23.0	-
Jerry	24.5	170.3	10.8	60.7	22.9	30.2
Keldin	22.7	171.3	11.6	61.1	32.4	30.7
MS Iceman	19.6	167.3	12.8	61.8	16.9	-
MS Maverick	19.2	166.7	12.1	60.7	18.2	-
ND Noreen	23.2	170.7	13.0	62.5	35.7	33.9
Northern	21.1	174.3	12.1	59.6	29.1	33.8
Ray	24.0	176.3	11.8	58.9	29.7	36.4
SD Andes	23.4	170.0	12.1	62.3	33.2	-
SD Midland	23.9	169.7	11.7	60.9	26.9	-
SY Monument	19.0	167.7	11.1	59.8	26.1	31.0
SY Wolverine	19.7	165.3	12.5	60.9	19.1	26.9
WB4309	19.9	166.3	12.0	60.7	24.0	-
WB4510CLP	22.7	168.3	12.8	62.4	30.9	-
Winner	20.7	166.3	12.6	61.9	24.0	-
Mean	21.9	169.5	12.2	61.0	26.9	-
CV %	5.8	1.0	7.9	1.1	15.6	-
LSD 0.05	2.1	2.7	1.6	1.1	6.9	-
LSD 0.1	1.8	2.2	1.3	1.0	5.8	-

Note: Winter wheat did not emerge during Fall 2021. Therefore, we could not quantify winter survival.

+Days after January 1, 2022.

Location: WREC Latitude: 48.13373 Longitude: -103.742638.

Previous crop: Soybean Soil type: Williams-Bowbells Loam. Altitude: 2105 ft.

Planted: 9/23/2021 Harvested: 8/5/2022

Soil test (0-6 in): P= 34 ppm; K=325 ppm; pH= 5.7; and OM= 2.3%.

Soil test (0-24 in): NO_3N= 92 lb/ac.

Data includes only released varieties. Experimental lines are not included. Statistics reflect the entire trial.

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There are only three seasons for farmers: before harvest, harvest and after harvest.

Dryland Intrastate Winter Wheat Evaluation - MSU					EARC, Sidney, MT 2021-2022
Variety	**Plant Height** (inch)	**Days to Heading** (Julian*)	**Test Weight** (lb/bu)	**Protein** (%)	**Grain Yield†** (bu/ac)
20Nord148	25.9	168	64.6	11.8	70.9
AAC Wildfire	26.6	171	63.7	11.5	61.5
AP 18 AX	23.4	167	63.1	11.1	59.3
AP Bigfoot	24.3	167	64.7	11.5	59.5
AP Solid	24.4	170	65.7	11.8	63.4
Balance	24.0	171	60.9	13.3	51.5
Battle AX	26.2	168	62.8	11.7	61.1
Bobcat	25.2	171	63.9	11.8	72.5
Brawl CLP PLUS	23.9	165	65.0	12.4	60.2
CP7017AX	22.4	165	63.1	10.9	54.8
CP7050AX	23.8	164	64.8	12.4	56.1
CP7909	24.1	164	64.1	10.7	64.4
Flathead	24.9	166	64.4	11.8	64.9
Fortify SF	25.6	168	64.1	11.4	62.5
FourOsix	25.5	170	63.3	11.4	67.2
Judee	25.6	171	65.0	12.4	59.1
Keldin	26.9	171	63.7	10.9	58.6
LCS Helix AX	24.3	165	64.8	10.8	61.3
LCS Julep	21.8	166	66.1	12.6	61.4
LCS Steel AX	27.7	171	63.0	10.3	62.0
Loma	24.9	171	63.9	11.5	65.1
MS 1022	24.9	164	64.3	11.3	71.7
MS Iceman	24.3	170	65.0	13.5	42.8
MS Maverick	23.5	169	64.5	12.4	59.7
MT1745	27.7	171	63.5	10.9	74.2
MT19159	24.4	172	63.6	11.5	69.8
MT19175	24.4	171	63.3	11.3	64.6
MT2019	23.9	171	62.3	10.9	79.4
MTCL19151	24.9	168	63.8	11.7	69.6
MTCL2010	24.5	169	64.0	11.4	72.6
MTCS20156	25.5	171	64.8	12.6	61.9
MTF20189	36.4	172	62.3	14.3	59.8
MTFH19132	26.8	170	62.5	12.1	61.8
MTFH20166	25.9	170	63.8	12.5	60.1
MTS18149	25.7	173	63.1	11.8	69.3
MTS1903	25.3	173	62.3	12.1	61.7
MTS1908	28.2	173	62.3	11.9	64.6
MTS2068	27.8	172	62.7	11.6	71.2
Milestone	25.5	172	60.3	11.5	56.3
Northern	26.9	172	63.5	12.0	62.9
Ramsay	27.4	171	64.4	11.1	57.5
SY Clearstone 2CLP	28.9	172	62.1	11.2	65.5
SY Wolverine	23.6	167	64.0	12.2	55.1
StandClear CLP	26.9	171	64.8	12.1	67.3
WB4510 CLP	26.2	171	65.3	12.1	56.4
WB4619	23.2	166	63.6	10.5	62.6
Warhorse	26.5	170	62.5	12.3	65.4
Whistler	26.4	170	64.0	11.3	63.2
Yellowstone	27.6	171	62.7	11.2	68.2
Mean	25.6	169	63.7	11.7	63.1
P-Value	<.0001	<.0001	<.0001	<.0001	0.0005
CV (%)	5.6	0.6	0.9	3.8	11.7
LSD (0.05)	2.3	1.7	1.0	0.7	11.9

(Julian*) is a continuous count of days since January 1 — Planted: 9/28/21

† Grain yield adjusted to 12.0% moisture — Harvested: 8/4/22

N Available (lb/ac): 92 — Previous crop: fallow

N added (lb/ac): 74 lb/ac — Soil Type: William Clay Loam

P2O5 available (ppm): 22.5 — Crop year precip: 12.70 inch

P2O5 applied (lb/ac): 30 — Plot Width: 5 ft

Herbicide Application: Opensky @ 16 oz/ac

Wheat Variety Comparisons, Williston, ND 2022

Gautam Pradhan

The gross return per acre was based on three-year average yield and protein (2020, 2021, 2022) from dryland varietal trials, and the market price obtained in the fourth week of December 2022 from grain elevators in and around Williston.

Spring Wheat

Variety	3 Yr Avg. Yield	3 Yr Avg. Protein	Market Price	Gross Return	+ or - ND Heron
	bu/a	%	($/bu)	$/a	$/a
AAC Brandon	28.7	16.7	8.74	251.19	32.11
AP Murdock	25.2	16.9	8.74	219.96	0.87
Bolles	24.3	18.3	8.74	212.41	-6.67
CP3530	26.8	16.4	8.74	234.09	15.00
Dagmar	26.9	17.2	8.74	235.40	16.31
Driver	26.6	16.2	8.74	232.48	13.40
Faller	28.4	16.6	8.74	248.46	29.38
Glenn	25.4	17.2	8.74	222.42	3.34
Lanning	28.9	16.7	8.74	252.92	33.84
LCS Cannon	24.0	16.2	8.74	209.63	-9.45
LCS Rebel	28.4	16.4	8.74	247.78	28.70
LCS Trigger	29.2	15.7	8.74	255.40	36.32
MN-Torgy	28.1	16.3	8.74	245.89	26.80
MN-Washburn	25.6	16.5	8.74	223.32	4.24
MS Barracuda	25.5	17.1	8.74	222.96	3.87
MS Ranchero	27.0	16.4	8.74	235.69	16.61
ND Frohberg	26.5	17.3	8.74	231.67	12.59
ND Heron	25.1	17.1	8.74	219.08	0.00
ND VitPro	24.7	16.4	8.74	216.31	-2.78
SY Ingmar	28.6	17.0	8.74	249.61	30.52
SY Longmire	29.5	17.1	8.74	257.84	38.76
SY McCloud	26.3	17.0	8.74	229.79	10.70
SY Valda	26.9	16.3	8.74	235.47	16.39
TCG-Heartland	27.2	17.5	8.74	237.51	18.43
TCG-Spitfire	30.2	16.3	8.74	263.96	44.88

Durum

Variety	3 Yr Avg. Yield	3 Yr Avg. Protein	Market Price	Gross Return	+ or - ND Riveland
	bu/a	%	($/bu)	$/a	$/a
Alkabo	25.5	16.5	9.5	242.04	-3.69
Carpio	28.3	16.3	9.5	269.28	23.56
Divide	25.2	17.1	9.5	238.98	-6.75
Joppa	24.3	16.5	9.5	230.56	-15.17
Maier	22.5	17.8	9.5	213.53	-32.20
Mountrail	25.9	17.0	9.5	245.73	0.00
ND Grano	25.4	17.3	9.5	240.93	-4.80
ND Riveland	27.5	16.9	9.5	261.38	15.65
Strongfield	23.8	18.1	9.5	226.54	-19.19

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 Connect	AAFC	M/F	2017	M SHORT	M LATE	R	R/MR	S	MS	MR	MEDIUM	MEDIUM
AAC Synergy	SY	M/F	2015	M SHORT	M LATE	MR	MR	NA	MR	MR	MEDIUM	M LOW
ABI Cardinal	BARI	M/F	2019	M	EARLY	M	NA	NA	MR	MR	NA	NA
Brewski	NDSU	M	2021	MEDIUM	NA	M	NA	NA	MR	MR	NA	NA
CDC Fraser	Canada	M/F	2016	M SHORT	LATE	R	R	R	NA	NA	MEDIUM	LOW
CDC Maverick	Canada	M	1999	TALL	M LATE	MS	MR	S	MS	VS	LOW	MEDIUM
Conlon	NDSU	M/F	1996	M SHORT	EARLY	MS	S	S	MR	MS	M HIGH	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	M/F	2008	MEDIUM	MEDIUM	MS	S	S	NA	NA	MEDIUM	M HIGH
ND Genesis	NDSU	M/F	2015	MEDIUM	M LATE	MR	S	NA	MR	MR	HIGH	LOW
Pinnacle	NDSU	M/F	2006	MEDIUM	M LATE	MR	S	S	MS	MR	HIGH	LOW
Six-Row												
Tradition	BARI	M/F	2003	M SHORT	MEDIUM	R	S	S	MS/S	MR/R	MEDIUM	M LOW
Specialty												
Cowgirl	MT	H	2022	NA	LATE	R	MS	NA	NA	NA	NA	NA
Haymaker	MT	H	NA	TALL	EARLY	NA	NA	S	NA	NA	NA	NA
Hays	MT	H	2003	M TALL	MEDIUM	MS	NA	NA	NA	NA	LOW	MEDIUM
MSU Lavina	MT	H	2007	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1]Refers to developer: BARI = Busch Ag Resources; Inc.; Canda represents developers from that country; MT = Montana State University; NDSU = North Dakota State University.

[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.

Cherries at NDSU-WREC

Dryland Barley Variety Trial - NDSU **WREC, Williston, ND 2022**

Variety/Line	Plant height (in)	Days to Heading (DAP)	Plump >6/64 (%)	Protein (%)	Test Weight (lb/bu)	Yield 2022 (bu/ac)	Yield 3 Yr. Avg. (bu/ac)
Two-rowed							
AAC Connect	19.7	56	81	10.3	45.4	41.2	31.0
AAC Synergy	21.8	55	88	10.8	45.2	42.1	31.4
ABI Cardinal	21.4	54	93	9.9	46.0	47.3	-
Brewski	25.5	54	94	11.2	43.9	37.1	-
CDC Fraser	20.2	56	93	11.3	45.5	37.7	-
Conlon	21.5	50	98	11.0	46.9	27.2	28.5
Explorer	18.6	54	94	10.2	46.7	41.6	35.0
ND Genesis	22.4	53	89	9.7	44.2	37.6	32.4
Pinnacle	21.9	53	93	9.5	46.6	34.0	31.4
Six-rowed							
Tradition	20.9	50	86	11.4	45.8	41.8	31.8
Mean	20.9	53	91	10.4	45.6	36.9	-
CV %	6.0	2.2	2.2	5.5	1.4	8.5	-
LSD 0.05	2.1	1.9	3.4	0.9	1.1	5.2	-
LSD 0.1	1.7	1.6	2.8	0.8	0.9	4.3	-

Location: WREC Latitude: 48.13006 Longitude: -103.748373 Altitude: 2105 ft.

Previous crop: Soybean Soil type: Williams-Bowbells Loam.

Planted: 5/19/2022. Harvested: 8/24/2022.

Soil test (0-6 in): P= 21 ppm; K=265 ppm; pH= 6.1; and OM= 2%.

Soil test (0-24 in): NO_3N= 29 lb/ac.

Applied fertilizers (lb/ac): N=4.7; P-23.5; K=0.

Applied chemicals: Glyphosate 1 q/ac (05/22/2022).

Tombstone Helios 2 fl.oz/ac (06/22/2022)

Data includes only released varieties. Experimental lines are not included. Statistics reflect the entire trial.

Agriculture looks different today - our farmers are using GPS
and you can monitor your irrigation systems over the Internet.

Dryland Preliminary Barley Evaluation - MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Plump >6/64 (%)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Buzz	24.2	177	96.9	53.7	10.4	58.1
FHB-2017-42-3	29.2	180	90.9	53.6	12.8	57.2
FHB-2017-59-2	25.4	175	96.7	55.1	12.6	55.5
Hockett	27.8	180	94.2	53.2	11.4	69.0
Merit 57	28.2	181	86.9	50.8	12.0	65.1
MT20_M006_07	24.8	180	97.4	51.0	11.7	63.5
MT20_M006_08	24.1	177	97.2	52.5	11.9	36.1
MT20_M008_04	27.2	177	97.8	52.8	11.9	69.4
MT20_M032_06	29.2	179	97.1	55.3	11.7	52.4
MT20_M033_01	27.4	178	95.3	51.8	11.4	77.5
MT20_M033_14	24.6	179	91.8	51.6	10.9	61.0
MT20_M035_13	22.0	184	78.2	49.6	11.3	53.5
MT20_M035_17	23.2	178	87.3	52.6	10.6	65.7
MT20_M036_05	30.0	180	89.7	52.1	12.1	59.6
MT20_M038_01	26.6	178	96.6	52.9	11.5	53.6
MT20_M038_20	24.8	182	92.3	52.6	12.2	57.2
MT20_M041_02	25.0	177	96.7	54.7	10.2	48.4
MT20_M042_04	25.0	178	94.7	55.4	11.5	58.6
MT20_M044_06	24.9	176	96.4	52.2	10.9	50.5
MT20_M047_06	23.6	178	97.1	53.8	10.6	52.8
MT20_M047_16	24.1	178	97.6	53.7	10.8	56.9
MT20_M048_02	25.0	180	93.4	54.5	11.1	42.4
MT20_M048_10	26.3	180	88.7	53.2	11.6	44.4
MT20_M049_09	25.0	182	93.6	53.1	11.0	46.7
MT20_M050_01	23.1	182	96.7	51.9	12.0	34.0
MT20_M050_03	24.5	180	95.9	54.6	11.0	41.6
MT20_M052_13	21.7	178	95.5	53.5	11.5	47.0
MT20_M053_02	26.5	179	92.3	52.8	11.4	63.9
MT20_M054_02	25.1	177	91.1	52.3	10.9	60.8
MT20_M054_05	24.4	175	97.8	54.5	11.7	39.0
MT20_M057_04	25.8	179	95.9	53.0	11.7	43.0
MT20_M062_02	24.2	181	86.7	51.5	11.5	51.7
MT20_M062_04	21.7	178	96.2	54.5	10.7	38.6
MT20_M063_01	24.6	176	94.7	52.8	10.9	42.2
MT20_M063_03	24.8	175	96.3	53.8	11.7	51.2
MT20_M063_12	27.5	178	96.5	54.7	11.7	52.4
MT20_M064_02	26.2	179	96.9	53.1	11.3	51.7
MT20_M064_13	24.8	176	93.0	53.2	10.9	54.6
MT20_M066_11	26.2	182	89.2	50.5	11.7	62.7
MT20_M071_06	27.1	175	95.0	53.4	11.0	39.1
MT20_M073_08	26.9	179	97.0	52.1	10.9	47.8
MT20_M073_10	24.4	175	97.9	54.4	11.5	43.6
MT20_M073_12	23.2	180	88.3	53.1	11.5	55.9
MT20_M074_02	22.5	180	95.3	53.2	10.1	70.1
MT20_M075_06	25.0	175	98.5	52.8	11.3	51.9
MT20_M079_10	25.8	183	90.7	50.2	11.5	64.0
MT20_M081_12	23.3	182	95.2	49.8	11.0	62.0
MT20_M081_16	22.5	181	95.4	49.6	11.8	69.8
MT20_M086_13	26.7	180	96.5	53.0	10.4	53.0
MT20_M086_20	28.2	179	95.3	51.8	12.0	72.3
MT20_M100_32	28.9	180	97.5	52.7	11.1	67.7
MT20_M101_03	23.2	182	91.7	52.3	10.9	44.5
MT20_M101_07	24.8	183	77.0	51.1	12.2	53.7
MT20_M102_03	27.5	180	90.6	48.9	11.5	56.8
MT20_M103_17	26.9	182	81.8	51.6	11.9	43.1
MT20_M106_17	27.0	180	96.8	53.2	11.8	49.8
MT20_M106_24	28.0	176	97.7	51.8	11.4	62.9
MT20_M117_10	27.2	182	81.9	50.0	11.1	61.7
MT20_M118_02	25.7	180	97.2	52.5	10.5	73.8
MT20_M118_15	22.1	179	92.4	52.3	11.1	68.9
MT20_M120_02	26.5	176	96.8	53.0	11.1	55.7
MT20_M120_05	24.5	178	97.3	52.2	11.6	45.1
MT20_M124_07	24.9	178	96.7	51.0	10.6	63.4
Odyssey	20.4	182	95.4	50.8	11.4	58.8
Mean	25.3	179	93.7	52.6	11.3	55.1
P-Value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
CV (%)	9.3	1.1	3.1	1.8	4.2	16.4
LSD (0.05)	3.8	3.1	4.7	1.6	0.8	14.6

(Julian*) is a continuous count of days since January 1
Planted: 4/11/2022
† Grain yield adjusted to 12.0% moisture
Harvested: 8/5/2022
N Available (lb/ac): 30 lb/ac
Previous crop: fallow
N added (lb/ac): 50 lb/ac
Soil Type: William Clay Loam
P2O5 Available (ppm): 11.3 ppm
Crop Year Precipitation: 12.70 inch
P2O5 added (lb/ac): 11 lb/ac
Plot Width: 5 ft
Herbicide Application: Axial Bold @ 15 oz/ac & Low-Vol 6 @ 20 oz/ac on 6/3/22

Dryland Intrastate Barley Evaluation - MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Plump >6/64 (%)	Regular>5/64 (%)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Buzz	25.1	180	97.4	2.4	53.2	10.9	60.3
Hockett	26.2	181	93.3	6.2	52.6	11.0	79.2
Merit 57	25.2	181	86.6	12.4	49.7	12.2	63.0
MT16M01801	28.2	179	95.5	4.1	51.7	10.8	80.6
MT16M02101	24.7	178	94.6	4.9	49.9	10.8	68.5
MT16M02201	24.2	179	97.3	2.5	51.3	11.0	65.5
MT16M09602	24.0	175	95.3	4.2	53.1	10.9	60.4
MT17M01711	26.0	177	93.7	5.6	50.2	11.3	74.6
MT17M01906	24.7	175	94.2	5.2	51.3	11.4	70.5
MT17M01908	26.5	176	98.4	1.4	53.5	11.0	62.1
MT17M02507	27.6	177	96.1	3.6	53.7	10.3	75.8
MT17M04801	26.8	179	93.5	6.1	53.1	11.3	73.7
MT17M05416	25.7	181	91.5	7.8	50.8	11.8	65.5
MT17M05808	24.2	181	92.7	6.9	49.8	12.0	59.6
MT18M06008	24.9	175	95.6	4.0	50.8	11.4	47.1
MT18M06009	23.6	175	96.6	3.2	51.0	11.4	56.2
MT18M06011	26.8	175	95.2	4.4	52.5	11.6	48.3
MT18M06012	22.7	176	97.2	2.6	52.3	11.1	50.0
MT18M09301	28.0	181	95.7	4.0	50.1	12.2	83.5
MT18M10106	26.4	180	95.5	4.1	53.4	10.9	87.2
MT18M10207	26.1	176	98.2	1.7	53.6	11.8	64.6
MT18M11002	28.7	180	91.1	8.1	52.7	11.6	89.6
MT18M11004	25.3	179	84.9	13.6	53.0	11.2	84.4
MT18M11006	28.6	178	91.2	8.1	52.1	11.6	74.8
MT18M11101	26.4	178	88.8	9.3	52.2	11.7	74.3
MT18M11103	28.1	181	87.4	11.1	48.0	11.4	69.0
MT18M11106	25.1	180	95.8	4.0	53.3	11.8	66.6
MT19_M022_10	22.8	182	96.7	3.1	50.8	11.6	71.0
MT19_M031_18	26.4	181	90.0	9.3	51.0	10.9	76.5
MT19_M034_16	26.1	180	89.9	9.5	52.8	10.9	89.1
MT19_M038_16	28.9	182	88.7	10.6	51.8	11.5	84.5
MT19_M041_01	24.0	181	89.6	9.7	52.0	11.3	63.9
MT19_M045_08	27.6	177	90.3	8.7	50.3	11.7	73.4
MT19_M045_11	28.4	181	93.0	6.5	49.7	12.3	59.1
MT19_M046_16	26.2	181	76.5	20.6	49.7	12.1	65.4
MT19_M051_03	23.0	184	88.3	10.5	50.1	11.3	83.5
MT19_M055_03	25.1	180	94.0	5.5	54.2	11.1	61.7
MT19_M060_06	28.1	179	94.2	5.2	53.2	10.8	71.6
MT19_M061_19	26.8	178	95.8	3.8	52.1	11.7	72.7
MT19_M064_04	28.5	181	94.4	5.1	51.3	10.8	91.1
MT19_M064_19	26.9	176	87.8	11.4	51.1	11.9	82.2
MT19_M065_05	27.7	181	87.1	11.5	50.2	10.6	82.6
MT19_M067_02	24.0	179	97.3	2.4	52.0	10.9	57.5
MT19_M071_21	21.8	179	92.4	7.0	53.7	11.0	55.6
MT19_M075_23	29.0	180	89.9	9.2	48.4	11.1	77.2
MT19_M080_13	24.4	175	96.9	2.9	51.8	11.3	74.8
MT19_M094_04	24.9	178	96.1	3.6	52.5	11.5	60.3
MT19_M095_04	26.4	177	94.4	5.0	54.0	11.7	72.4
MT19_M098_17	23.6	180	93.1	6.3	51.7	11.3	84.3
Mean	25.9	179	92.8	6.5	51.7	11.3	70.9
P-Value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
CV (%)	7.7	0.7	2.8	36.1	1.5	2.9	11.9
LSD (0.05)	3.2	2.0	4.2	3.8	1.2	0.5	13.7

(Julian*) is a continuous count of days since January 1 — Planted: 4/11/2022
† Grain yield adjusted to 12.0% moisture — Harvested: 8/5/2022
N Available (lb/ac): 30 lb/ac — Previous crop: fallow
N added (lb/ac): 50 lb/ac — Soil Type: William Clay Loam
P2O5 available (ppm): 11.3 ppm — Crop Year Precipitation: 12.70 inch
P2O5 added (lb/ac): 11 lb/ac — Plot Width: 5 ft
Herbicide Application: Axial Bold @ 15 oz/ac & Low-Vol 6 @ 20 oz/ac on 6/3/22

Dryland Hulless Barley Evaluation - MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Havener	26.5	182	62.6	12.8	55.9
MT16H09302	26.8	179	59.1	13.1	48.6
MT18H02702	29.3	179	61.3	13.2	60.6
MT18H03101	27.3	182	62.4	14.3	30.5
MT19_H09_09	30.3	184	62.5	15.6	24.9
MT19_H09_12	32.0	183	63.5	15.6	21.8
MT19_H11_01	29.8	181	62.8	14.7	44.7
MT19_H11_03	27.2	185	61.9	14.4	42.8
MT19_H11_04	30.6	182	60.8	14.9	55.1
MT19_H11_05	27.3	184	62.0	14.3	34.5
MT19_H11_17	28.3	182	62.2	14.9	43.0
MT19_H12_12	30.7	179	65.7	12.8	32.9
MT19_H14_02	29.8	182	62.9	15.0	25.5
MT19_H14_05	26.9	181	60.6	16.1	33.1
MT19_H14_06	25.6	184	60.7	14.5	27.7
MT19_H14_11	29.0	181	62.1	15.3	31.6
Mean	28.6	182	62.1	14.5	38.3
P-Value	0.0902	<.0001	<.0001	<.0001	<.0001
CV (%)	8.5	0.8	1.0	1.8	12.9
LSD (0.05)	4.0	2.3	1.1	0.4	8.2

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N Available (lb/ac): 30 lb/ac
N added (lb/ac): 50 lb/ac
P2O5 available (ppm): 11.3 ppm
P2O5 added (lb/ac): 11 lb/ac
Herbicide Application: Axial Bold @ 15 oz/1c & Low-Vol 6 @ 20 oz/ac on 6/3/22

Planted: 4/11/2022
Harvested: 8/5/2022
Previous crop: fallow
Soil Type: William Clay Loam
Crop Year Precipitation: 12.70 inch
Plot Width: 5 ft

Shreya and Thomas transplanting camelina at MSU-EARC.

Forage Barley - MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Forage Yield (ton/ac)	Grain Yield† (bu/ac)
Haymaker	32.0	178	51.1	12.1	2.6	68.7
Lavina	30.3	178	50.7	11.2	2.2	81.9
MT16F01601	29.3	177	50.9	12.4	2.3	71.7
MT16F02401	28.2	179	48.4	10.4	2.3	71.8
MT16F02405	26.1	176	48.6	10.5	2.2	66.2
MT16F02406	29.8	178	50.5	11.1	2.0	62.3
MT16F02903	31.5	177	51.7	11.7	2.4	64.8
MT17F01612	29.8	174	51.4	12.4	2.5	67.6
MT17F02410	25.9	180	49.9	11.1	2.2	73.7
MT18F00503	29.0	180	50.0	11.7	2.3	68.8
MT18F00507	28.3	180	48.0	12.0	2.6	69.8
MT18F00607	30.6	180	48.8	11.8	2.8	73.4
MT18F00714	28.2	183	47.0	11.8	2.6	53.2
MT18F00803	28.0	179	47.5	11.8	2.6	76.3
MT18F00812	29.5	183	43.7	13.4	3.4	58.7
MT18F00908	29.1	179	48.6	12.6	2.5	59.4
MT19_F01_01	28.9	175	50.3	11.8	2.7	63.5
MT19_F01_03	31.0	175	49.9	12.3	2.3	64.3
MT19_F03_01	31.2	176	49.5	12.6	2.2	69.7
MT19_F04_01	30.1	175	49.8	12.2	2.2	64.4
MT19_F04_02	30.6	180	48.1	11.9	2.8	69.8
MT19_F05_03	29.4	173	48.6	11.8	2.4	69.4
MT19_F06_02	26.5	176	48.5	12.4	2.2	71.7
MT19_F07_04	27.0	174	47.7	12.1	2.3	59.2
MT16F02902	30.6	179	50.9	11.7	2.3	69.7
Mean	29.2	178	49.2	11.9	2.4	67.6
P-Value	0.0065	<.0001	<.0001	<.0001	0.0468	<.0001
CV (%)	6.4	0.6	0.9	4.3	15.9	7.7
LSD (0.05)	3.1	1.8	0.7	0.8	0.6	8.5

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N Available (lb/ac): 40 lb/ac
N added (lb/ac): 60 lb/ac
P2O5 Available (ppm): 15 ppm
P2O5 added (lb/ac): 15 lb/ac
Herbicide Application: Axial Bold @ 15 oz/ac & Low-Vol 6 @ 20 oz/ac on 6/2/22

Planted: 4/11/22
Harvested: 8/1/2022
Previous crop: field pea
Soil Type: Williams Clay Loam
Crop Year Precipitation: 12.70 inch
Plot Width: 5 ft

"Those too lazy to plow in the right season will have no food at the harvest."
Proverbs 20:44

Irrigated Feed/Forage Barley Variety Trial - NDSU | **WREC, Nesson Valley, ND 2022**

Variety	Plant Height	Days to Head	Lodging	Protein† 2022	Protein† 2-Yr Avg	Protein† 3-Yr Avg	Test Weight	Forage Yield¥ 2022	Grain Yield 2022	Grain Yield 2-Yr Avg‡	Grain Yield 3-Yr Avg
	(in)	(DAP+)	(0 - 9*)	(%)	(%)	(%)	(lb/bu)	(ton/a)	(bu/a)	(bu/a)	(bu/a)
Tradition	29	51	2	14.7	14.4	14.0	47.8	5.1	103.1	86.6	104.2
Hockett	25	53	3	14.2	13.7	13.5	48.0	4.3	92.5	78.9	91.2
Conlon	24	53	5	15.1	14.5	14.0	49.3	4.2	56.3	50.0	71.5
Hays	28	57	1	15.5	-	-	48.5	5.2	104.2	-	-
CDC Maverick	23	57	0	14.8	-	-	43.5	6.0	96.8	-	-
Haxby	28	52	2	14.9	-	-	51.0	5.3	93.3	-	-
Cowgirl	29	55	3	15.9	-	-	45.6	4.4	92.4	-	-
Haymaker	28	53	3	16.5	-	-	47.1	5.4	92.0	-	-
Lavina	26	55	2	15.9	-	-	42.9	4.5	91.6	-	-
MEAN	26.5	54.0	2.4	15.26	14.20	13.83	47.07	4.72	91.36	69.53	87.43
C.V. (%)	-	-	-	4.05	-	-	2.75	21.11	15.88	-	-
LSD (5%)	-	-	-	1.07	-	-	2.24	1.52	21.18	-	-
LSD (10%)	-	-	-	0.88	-	-	1.84	1.26	17.56	-	-

+ Days after planting * 0: no lodging - 9: plants lying flat on the ground † Protein content adjusted to 0% moisture

‡ Hail storm in 2021 impacted yields ¥ Forage collected at soft-dough stage, and yield reported on a Dry-Matter basis

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

Soil Test (0-6 in.): P=26 ppm; K=225 ppm; pH=7.7; OM=1.9% — Previous crop: Sugarbeet

(0-24 in.): NO3-N=14 lb/a — Planted: 5/18/2022

Yield goal: 120 bu/a — Forage Harvested: 7/25/2022 — Grain Harvested: 8/23/2022

Planting population: 1.25 million seeds/a — Soil type: Lihen Loamy Fine Sand

Applied fertilizer: 235 lb/a of Urea (46-0-0) — Forage Plot size: 18 ft^2 — Grain Plot Size: 73 ft^2

Herbicides applied: Valor (3oz/a) [10/28/21] & Huskie FX (18oz/a), Axial Bold (15oz/a), Class Act (1qt/100gal) [6/20] — Rainfall: 13.2 inches (4/1 - 8/23)

Fungicides applied: Prosaro 421SC (8.2oz/a) [7/21] — Irrigation: 11.0 inches (5/18 - 8/23)

Old Farmers never die, they just go to seed.

Irrigated Intrastate Barley Evaluation - MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Plump >6/64 (%)	Regular 5/64 (%)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Buzz	30.7	179	98.3	1.6	53.2	11.0	108.7
Hockett	31.1	180	97.4	2.2	54.3	11.6	127.3
Merit 57	32.0	181	93.3	6.0	52.3	11.8	115.4
MT16M01801	32.4	181	97.9	1.8	53.2	11.1	114.6
MT16M02101	31.6	178	96.3	3.0	51.4	11.5	117.0
MT16M02201	31.4	179	98.8	1.0	51.4	11.4	111.0
MT16M09602	29.8	178	97.6	2.2	53.9	11.1	96.1
MT17M01711	28.9	178	96.1	3.4	51.6	11.4	113.7
MT17M01906	30.8	178	97.8	2.0	52.2	11.7	109.4
MT17M01908	32.4	178	98.4	1.4	54.0	10.8	110.0
MT17M02507	32.8	180	97.8	2.1	54.1	10.7	117.7
MT17M04801	32.6	180	96.8	2.8	54.4	11.2	117.4
MT17M05416	29.4	181	95.8	3.7	52.1	11.4	102.0
MT17M05808	30.6	180	97.5	2.3	52.6	11.9	114.0
MT18M06008	30.7	177	97.3	2.3	53.4	11.3	89.6
MT18M06009	30.0	178	98.4	1.5	53.2	11.6	101.3
MT18M06011	30.0	178	97.8	1.9	53.4	11.6	92.0
MT18M06012	29.0	179	98.5	1.4	53.0	11.3	86.3
MT18M09301	32.3	184	97.1	2.7	51.1	11.9	113.1
MT18M10106	33.1	181	97.4	2.3	54.7	10.3	129.0
MT18M10207	32.7	179	98.3	1.5	52.9	12.5	102.4
MT18M11002	33.1	182	94.1	5.3	54.1	11.7	124.8
MT18M11004	31.0	181	94.1	5.4	54.0	11.7	134.0
MT18M11006	31.8	180	94.0	5.2	53.6	11.3	111.8
MT18M11101	29.1	179	93.5	5.6	52.9	11.2	108.5
MT18M11103	31.6	183	93.6	5.7	50.8	11.1	116.8
MT18M11106	31.5	180	96.9	2.8	53.8	11.3	110.9
MT19_M022_10	31.6	187	95.9	3.8	51.2	10.8	124.4
MT19_M031_18	33.1	183	96.0	3.5	53.1	11.2	119.7
MT19_M034_16	31.1	182	94.9	4.6	53.5	11.0	121.2
MT19_M038_16	32.3	184	95.5	4.1	52.5	11.1	104.4
MT19_M041_01	29.2	183	92.7	6.3	52.8	10.8	106.9
MT19_M045_08	27.4	181	96.4	3.1	53.6	11.6	119.8
MT19_M045_11	29.9	182	95.8	3.9	53.0	12.0	113.9
MT19_M046_16	30.7	182	84.6	13.4	51.7	11.5	113.4
MT19_M051_03	27.6	188	92.1	7.0	50.4	11.1	117.8
MT19_M055_03	30.7	180	95.4	4.1	53.7	11.2	92.4
MT19_M060_06	31.9	180	94.8	4.4	54.0	11.1	108.9
MT19_M061_19	31.4	180	96.8	2.9	52.7	10.8	114.7
MT19_M064_04	30.0	182	96.3	3.2	51.4	10.8	117.3
MT19_M064_19	29.1	180	96.7	2.9	52.7	11.8	115.0
MT19_M065_05	31.4	186	94.7	4.5	52.7	10.3	123.3
MT19_M067_02	31.5	179	98.2	1.7	52.1	11.5	106.0
MT19_M071_21	27.8	179	96.4	3.3	54.3	11.1	105.8
MT19_M075_23	30.6	183	91.7	7.4	49.0	11.0	112.6
MT19_M080_13	28.6	177	98.3	1.5	51.3	11.4	100.6
MT19_M094_04	29.1	180	95.9	3.5	52.9	11.3	106.1
MT19_M095_04	30.2	178	97.4	2.3	55.2	11.4	115.5
MT19_M098_17	30.8	183	96.8	2.9	53.8	10.7	115.4
Mean	30.8	181	96.0	3.5	52.8	11.3	111.6
P-Value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
CV (%)	3.6	0.6	1.0	22.7	0.7	2.4	5.6
LSD (0.05)	1.8	1.7	1.6	1.3	0.6	0.4	10.0

(Julian*) is a continuous count of days since January 1 — Planted: 5/3/22
† Grain yield adjusted to 12.0% moisture — Harvested: 8/10/22
N Available (lb/ac): 28.3 lb/ac — Previous crop: sugar beet
N added (lb/ac): 70 lb/ac — Soil Type: Savage Silty Clay
P2O5 Available (ppm): 19.4 ppm — Crop Year Precipitation: 15.26 inch
P2O5 added (lb/ac): 26 lb/ac — Irrigation (sprinkler): 2.25 inch
Herbicide Application: Axial Bold @ 15 oz/ac & Low-Vol 6 @ 20 oz/ac on 6/3/22 — Plot Width: 5 ft

Irrigated Hulless Barley Evaluation - MSU EARC, Sidney, MT 2022

Variety	Plant Height (inch)	Days to Heading (Julian*)	Test Weight (lb/bu)	Protein (%)	Grain Yield† (bu/ac)
Havener	32.4	185	62.5	12.2	90.0
MT16H09302	31.5	180	59.8	12.8	82.4
MT18H02702	32.7	181	61.0	13.3	95.8
MT18H03101	33.1	182	62.2	15.2	68.5
MT19_H09_09	34.5	182	63.3	14.9	71.7
MT19_H09_12	36.1	183	64.5	15.6	61.2
MT19_H11_01	33.7	182	62.7	14.2	76.9
MT19_H11_03	32.2	187	61.7	13.6	81.6
MT19_H11_04	35.0	186	60.7	14.6	81.9
MT19_H11_05	33.5	184	61.5	13.9	82.5
MT19_H11_17	33.2	185	61.3	14.1	80.2
MT19_H12_12	36.1	180	66.7	13.5	60.3
MT19_H14_02	35.8	183	64.6	14.5	74.1
MT19_H14_05	31.5	182	61.5	15.3	75.3
MT19_H14_06	30.6	184	61.9	13.5	78.9
MT19_H14_11	31.0	182	61.6	14.7	77.0
Mean	33.3	183	62.4	14.1	77.4
P-Value	<.0001	<.0001	<.0001	<.0001	<.0001
CV (%)	3.7	0.7	1.1	1.9	5.4
LSD (0.05)	2.0	2.1	1.2	0.4	7.0

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N Available (lb/ac): 28.3 lb/ac
N added (lb/ac): 26 lb/ac
P2O5 Available (ppm): 19.4 ppm
P2O5 added (lb/ac): 26 lb/ac
Herbicide Application: Axial Bold @ 15 oz/ac & Low-Vol 6 @ 20 oz/ac on 6/3/22

Planted: 5/3/22
Harvested: 8/10/22
Previous crop: sugarbeet
Soil Type: Savage Silty Clay
Crop Year Precipitation: 15.26 inch
Irrigation (sprinkler): 2.25 inch
Plot Width: 5 ft

Maral and Amy at work during the sugarbeet harvest at MSU-EARC.

OAT VARIETY DESCRIPTIONS

VARIETY	ORIGIN[1]	YEAR RELEASED	GRAIN COLOR	HEIGHT (IN)[2]	DTH[3]	STRAW STRENGTH	Resistance To[4]			Quality Factors	
							Stem Rust	Crown Rust	Barley Yellow Dwarf	Test Weight	Grain Protein[5]
AAC Douglas	AAFC	2019	WHITE	39	52	NA	NA	MR/MS	MS	GOOD	M
Beach	NDSU	2004	WHITE	39	52	M. STRG	S/VS	MR/MS	MS/S	V. GOOD	M
CDC Minstrel	Canada	2006	WHITE	37	53	M. STRG	S/VS	S/VS	S/VS	GOOD	M
CS Camden	Canterra	2016	WHITE	36	54	STRONG	S/VS	MS/S	NA	GOOD	M
Deon	MN	2013	yellow	40	55	STRONG	S/VS	R/MR	R/MR	V. GOOD	M
HiFi	NDSU	2001	WHITE	40	55	STRONG	MR/MS	S/VS	R/MR	GOOD	M
Jury	NDSU	2012	WHITE	43	54	M. STRG	R	S/VS	MR/MS	V. GOOD	M
Killdeer	NDSU	2000	WHITE	35	52	STRONG	S/VS	MS/S	MR/MS	GOOD	M
Leggett	Canada	2005	WHITE	38	54	STRONG	MR	R	S/VS	GOOD	M
MN-Pearl	MN	2019	WHITE	39	54	NA	NA	S	MR/MS	GOOD	M/L
ND Heart	NDSU	2020	WHITE	40	53	STRONG	MR	MS/S	MR/MS	GOOD	H
Newburg	NDSU	2011	WHITE	39	56	MEDIUM	R	S/VS	MR/MS	GOOD	M
Otana	MT	1977	WHITE	41	55	STRONG	S/VS	S/VS	S/VS	V. GOOD	H
Paul	NDSU	1994	HULLESS	41	56	STRONG	R	MR/MS	R/MR	V. GOOD	M
Rockford	NDSU	2008	WHITE	41	55	STRONG	S/VS	S/VS	MR/MS	V. GOOD	M
SD Buffalo	SDSU	2021	WHITE	41	52	STRONG	NA	MS/S	NA	V. GOOD	M
Warrior	SDSU	2018	WHITE	37	52	STRONG	MS/S	R	NA	V. GOOD	M

[1]Refers to developer: 1AAFC = Agriculture & Agri-Food Canada; MN = University of Minnesota; MT = Montana State University; ND = North Dakota State University; SD = South Dakota State.

[2]Height data averaged from multiple locations in 2022.

[3]DTH=Days to head; the number of days from planting to head emergence from the boot, averaged based on data from several locations in 2022.

[4]R=Resistant; MR=Moderately Resistant; MS=Moderately Susceptible; S=Susceptible; VS=Very Susceptible; NA=Not Available.

[5]H=HIGH; M=MEDIUM; L=LOW.

NDSU-WREC Staff - 2022 Field Day

Dryland Oat Variety Trial - NDSU **WREC, Williston, ND 2022**

Variety/Line	Plant height (in)	Days to Heading (DAP)	Test Weight (lb/bu)	Yield 2022 (bu/ac)	Yield 3-Yrs-Average (bu/ac)
AAC Douglas	33.5	44.3	38.0	69.0	-
Beach	34.3	45.7	39.7	37.6	40.3
CDC Minstrel	32.7	46.3	37.2	25.5	36.5
CS Camden	32.7	46.7	34.6	42.1	49.3
Deon	35.3	49.0	36.1	33.6	41.8
HiFi	35.2	46.3	36.7	41.5	38.6
Hytest	34.8	44.7	37.7	29.9	33.3
Jury	39.1	45.3	38.6	55.1	48.3
Killdeer	30.7	45.0	37.6	41.0	46.7
Leggett	34.3	46.0	38.3	47.5	42.6
MN-Pearl	34.4	47.0	37.8	50.1	-
ND Heart	35.8	45.0	34.0	32.9	40.1
Newburg	36.7	48.7	34.7	20.1	39.1
ORE3541M	31.6	45.3	37.4	34.3	-
Otana	36.9	48.0	36.8	52.2	49.9
Paul	34.8	48.7	40.6	17.0	20.9
Rockford	34.6	46.3	37.2	36.2	45.9
SD Buffalo	35.6	44.0	38.4	48.7	-
Souris	30.3	45.0	39.1	38.7	-
Warrior	31.8	44.7	37.7	30.7	40.6
Mean	34.4	47	36.6	42.2	-
CV %	5.9	1.2	5.6	15.7	-
LSD 0.05	3.3	0.9	3.4	10.8	-
LSD 0.1	2.8	0.8	2.8	9.0	-

Location: WREC Latitude: 48.13245 Longitude: -103.744862.

Previous crop: Soybean Soil type: Williams-Bowbells Loam. Altitude: 2105 ft.

Planted: 5/26/2022 Harvested: 8/25/2022

Soil test (0-6 in): P= 21 ppm; K=265 ppm; pH= 6.1; and OM= 2%.

Soil test (0-24 in): NO_3N= 29 lb/ac.

Applied fertilizers (lb/ac): N=35; P=23.5; K=0

Applied chemicals: Tombstone Helios 2 fl.oz/ac (06/22/2022)

Data includes only released varieties. Experimental lines are not included. Statistics reflect the entire trial.

Irrigated Oat Variety Trial - NDSU | **WREC, Nesson Valley, ND 2022**

Variety	**Plant Height** (in)	**Days to Head** (DAP^+)	**Lodging** ($0 - 9^*$)	**Test Weight** (lb/bu)	**Yield** **2022** (bu/a)	**2-Yr Avg‡** (bu/a)	**3-Yr Avg** (bu/a)
CS Camden	36	54	1	36.8	178.6	158.2	178.2
Deon	37	54	2	39.0	173.7	151.3	166.9
ND Heart	38	53	2	38.7	176.3	152.7	166.8
Warrior	35	53	2	38.1	175.4	145.3	163.6
Rockford	37	54	0	39.6	169.7	146.8	-
Jury	39	54	1	36.4	166.3	143.7	-
Paul	37	54	0	46.4	129.4	118.6	-
MEAN	37.0	53.6	1.1	39.30	167.07	145.22	168.88
C.V. (%)	-	-	-	2.11	12.63	-	-
LSD (5%)	-	-	-	1.48	31.35	-	-
LSD (10%)	-	-	-	1.21	25.88	-	-

+ Days after planting   * 0: no lodging - 9: plants lying flat on the ground   ‡ Hail storm in 2021 impacted yields

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

Soil Test (0-6 in.): P=26 ppm; K=225 ppm; pH=7.7; OM=1.9% — Previous crop: Sugarbeet

(0-24 in.): NO3-N=14 lb/a — Planted: 5/18/2022

Yield goal: 200 bu/a — Harvested: 8/25/2022

Planting population: 1.25 million seeds/a — Soil type: Lihen Loamy Fine Sand

Applied fertilizer: 455 lb/a of Urea (46-0-0) — Plot size: 90 ft^2

Herbicides applied: Valor (3oz/a) [10/28/21] & Aim (1oz/a), Bison (1.5pt/a), Class Act (1qt/100gal) [6/20] — Rainfall: 13.2 inches (4/1 - 8/25)

Fungicides applied: none applied — Irrigation: 11.0 inches (5/18 - 8/25)

Safflower Variety Descriptions

Variety	Origin[1]	PVP[2]	Hull Type[3]	Oil Type[4]	Irrigated Yield[5]	Dryland Yield[5]	TWT[5]	Oil[5]	Maturity	Tolerance[6] Alt	Tolerance[6] BB
Cardinal	MT/NDSU	YES	N	HIGH LINO	V GOOD	V GOOD	HIGH	FAIR	MEDIUM	T	MT
Chickadee	STI	YES	N	HIGH LINO	V GOOD	V GOOD	HIGH	GOOD	MEDIUM	T	MT
Hybrid 1601	STI	YES	STP	HIGH OLEIC	V GOOD	V GOOD	MEDIUM	GOOD	M LATE	MT	MT
Hybrid 200	STI	YES	N	HIGH OLEIC	V GOOD	V GOOD	V HIGH	FAIR	MEDIUM	MT	NA
Hybrid 446	STI	YES	N	HIGH OLEIC	V GOOD	V GOOD	V HIGH	FAIR	MEDIUM	MT	NA
MonDak	MT/NDSU	YES	N	HIGH OLEIC	GOOD	V GOOD	HIGH	FAIR	M EARLY	T	MT
Montola 2003	MT/NDSU	YES	N	HIGH OLEIC	V GOOD	V GOOD	M HIGH	GOOD	M EARLY	MT	MT
Morlin	MT/NDSU	YES	STP	HIGH LINO	V GOOD	GOOD	MEDIUM	GOOD	M LATE	T	T
Nutrasaff	MT/NDSU	YES	RED	HIGH LINO	GOOD	GOOD	MEDIUM	HIGH	MEDIUM	T	MT
Rubis Red	MT	YES	N	HIGH LINO	GOOD	GOOD	V HIGH	low	MEDIUM	MS	NA
STI 1201	STI	YES	STP	HIGH OLEIC	GOOD	GOOD	M HIGH	GOOD	MEDIUM	MT	NA
STI 1401	STI	YES	STP	HIGH OLEIC	GOOD	GOOD	M HIGH	HIGH	MEDIUM	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

The best sermons are lived, not preached.

Irrigated Safflower Variety Trial - NDSU **MSU-EARC, Sidney, MT, 2022**

Variety/Line	Plant Height (in)	Days to Flower (DAP)	Oil (%)	Test Weight (lb/bu)	Yield 2022 (lb/ac)	2 Yr. Avg§ (lb/ac)
Cardinal	28.9	70	37.9	40.1	2373.7	2692
Chickadee	25.9	71	40.3	37.5	2417.5	3297
Hybrid 1601	28.9	71	40.4	33.8	2664.0	-
Hybrid 200	26.6	70	32.0	38.3	2419.1	3414
Hybrid 446	25.7	70	31.6	39.9	2360.2	3393
MonDak	26.4	71	35.9	36.3	2205.1	3463
Montola 2003	23.5	71	37.2	36.6	2250.7	3180
Morlin	25.7	71	40.3	35.9	1971.0	-
NutraSaff	27.7	70	50.4	35.5	2111.5	2765
Rubis Red	27.6	69	30.6	39.3	1962.2	2726
STI 1201	23.8	70	43.4	34.3	2063.8	2928
STI 1401	28.0	71	49.2	34.9	2479.1	2906
STI 2020	28.3	71	40.3	35.8	2403.5	-
Mean	26.5	71	39.3	36.0	2035.2	-
CV %	5.2	0.7	2.1	2.4	11.3	-
LSD 0.05	2.3	0.9	1.3	1.4	381.5	-
LSD 0.1	1.9	0.7	1.1	1.2	317.4	-

Location: Sidney, MT
Previous Crop: Sugarbeet
Planted: 05/17/2022
Harvested: 10/10/2022
Available Soil: N=19 lb/ac; P2O5 = 16.8 ppm.
Applied fertilizers: N=80 lb/ac; P2O5=30/ac.
Applied herbicides: Sonalan HFP 32 oz/ac on 5/18/2022; Priaxor 4.8 oz/ac on 07/25/2022.
Irrigation: 4.93 in; Precipitation = 15.26 in.

Note: Moderate to severe grasshopper damage affected the yield, test weight and oil contents.
*DAP=Days after planting; §Average of 2020 and 2021.

A farmer is a magician who produces money from the mud.

Dryland Sunflower Variety Trial - NDSU **WREC, Williston, ND 2022**

Company/Brand	Variety/Line	Hybrid Type[1]	Oil Type[2]	Plant Height	Days to Flowering	Days to Maturity	Test Weight	Seed Oil	Yield 2022	Yield 2-Yr. Avg.	Yield 3-Yr. Avg.
				(in)	(DAP*)	(DAP)	(lb/bu)	(%)	(lb/ac)	(bu/ac)	(bu/ac)
SunOpta	4415 HO/DM/CLP	CP	HO	55.9	67	100	30.6	37.4	852.6	987.3	987.3
SunOpta	4425 CL	CL	MO	55.1	65	105	31.2	34.3	1199.2	1328.4	-
Crop Land	CP432E	EX	NS	51.1	62	105	33.1	38.1	1074.9	1165.4	-
Crop Land	CP455E	EX	HO	53.1	66	113	31.4	40.5	1039.1	1223.7	1486.4
NUSEED	FALCON	EX	NS	50.3	67	105	32.8	41.3	947.7	1106.8	1122.3
SunOpta	GP25 CL	CL	MO	55.9	66	104	30.2	35.1	1182.5	-	-
DYNAGROW	H42HO18CL	CL	HO	45.6	65	96	31.3	39.0	905.7	985.3	1098.5
DYNAGROW	H45HO10EX	EX	HO	52.2	65	103	29.4	38.7	1134.4	1180.6	1262.4
DYNAGROW	H45NS16CL	CL	NS	50.3	65	100	31.8	40.8	955.3	1289.2	1258.1
DYNAGROW	H47HO11EX	EX	HO	54.8	67	114	33.8	40.8	872.8	975.3	-
DYNAGROW	H49HO19CL	CL	HO	49.6	70	104	28.7	38.2	894.1	-	-
DYNAGROW	H49NS14CL	CL	NS	48.9	69	103	30.0	39.3	998.0	-	-
DYNAGROW	H50HO20CP	CP	HO	51.1	68	115	32.5	41.7	895.9	-	-
NUSEED	N4H302 E	EX	HO	54.1	65	99	29.3	38.8	921.3	1170.9	1218.0
NUSEED	N4H422 CL	CP	HO	53.8	67	111	31.9	38.7	988.8	1312.4	1270.2
NUSEED	N4H470 CLP	CP	HO	50.0	68	114	32.7	41.8	929.1	1038.5	1034.0
SunOpta	SS90	CONV	CONF	54.1	61	99	26.6	30.0	1382.8	1273.5	-
SunOpta	SS91	CONV	CONF	54.7	67	111	28.3	26.4	1236.6	1039.5	-
Mean				52.3	66	105	30.9	37.8	1022.8	-	-
CV %				4.7	1.2	3.4	2.8	2.8	17.2	-	-
LSD 0.05				3.5	1.1	5.0	1.2	1.5	250.3	-	-
LSD 0.1				2.9	0.9	4.2	1.0	1.3	208.9	-	-

Location: WREC; Latitude: 48.126325; Longitude: -103.738798 Altitude: 2105 ft. Previous crop: oat. Soil type: Williams-Bowbells Loam.
Planted: 6/13/2022; Harvested: 10/19/2022. Soil test (0-6 in): P= 28 ppm; K=350 ppm; pH= 6.0; and OM= 2.3%.
Soil test (0-24 in): NO3N= 41 lb/ac. Applied chemicals: Spartan Charge Herbicide 3.5 fl. oz/ac (5/6/2022); Tombstone Helios 2 fl.oz/ac (06/22/2022).

[1]Hybrid type provided by the companies: CP=Clearfield plus, CL=Clearfield, EX=Express; CONV=Conventional.

[2]Oil type provided by the companies: HO=High oleic, MO=Mid-oleic, NS=NuSun, NF=Confectionary type. *DAP=Days after planting.

Irrigated Sunflower Variety Trial - NDSU **WREC, Nesson Valley, ND 2022**

Variety	Brand / Company	Oil Type[¥]	Hybrid Type	Harvested Population (Plants/A)	Days to Flower (DAP+)	Oil[†] 2022 (%)	Oil[†] 2-Yr Avg (%)	Oil[†] 3-Yr Avg (%)	Test Weight (lb/bu)	Yield 2022 (lb/a)	Yield 2-Yr Avg (lb/a)	Yield 3-Yr Avg (lb/a)
N4H302 E	Nuseed	HO	Express	24651	67	45.2	39.2	39.6	32.3	3768	2971	3006
Falcon	Nuseed	NS	Express	23859	70	44.0	37.8	39.2	36.1	3423	3025	2790
H42HO18CL	Dynagro	HO	Clearfield	28314	67	45.6	38.7	39.7	35.5	2972	2619	2656
H45HO10EX	Dynagro	HO	Express	17523	67	43.9	39.2	40.3	33.2	2686	2526	2635
4425 CL	SunOpta	MO	Clearfield	25344	68	41.7	35.9	-	32.6	3640	3410	-
N4H470 CLP	Nuseed	HO	Clearfield Plus	27027	71	49.2	42.1	-	32.9	3287	3211	-
4415 HO/DM/CLP	SunOpta	HO	Clearfield Plus	26334	68	42.4	37.4	-	32.6	3662	3126	-
H47HO11EX	Dynagro	HO	Express	19107	70	42.5	36.2	-	35.9	3011	2739	-
H49HO19CL	Dynagro	HO	Clearfield	23958	71	46.2	-	-	34.2	3898	-	-
H50HO20CP	Dynagro	HO	Clearfield Plus	26730	71	47.2	-	-	33.8	3319	-	-
SS91	SunOpta	Confectionary	Conventional	19899	68	28.1	-	-	27.8	3218	-	-
SS90	SunOpta	Confectionary	Conventional	19800	64	31.3	-	-	27.1	2853	-	-
MEAN				23545.5	68.5	42.27	38.32	39.73	32.84	3311.4	2953.3	2771.6
C.V. (%)				10.9	-	5.03	-	-	7.45	11.7	-	-
LSD (5%)				4334.7	-	3.60	-	-	4.15	655.8	-	-
LSD (10%)				3589.1	-	2.98	-	-	3.44	543.0	-	-

¥ HO=high oleic, NS=NuSun, MO=mid oleic + Days after Planting † Oil content adjusted to 10% moisture

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W
Soil Test (0-6 in.): P=20 ppm; K=170 ppm; pH=7.6; OM=2.0%
(0-24 in.): NO3-N=62 lb/a
Yield goal: 2,500 lb/a
Planting population: 26,500 seeds/a (30" row spacing)
Applied fertilizer: 195 lb/a of Urea (46-0-0)
Herbicides applied: Prowl (2pt/a) [6/3]
Fungicides applied: Priaxor (8oz/a) [7/21]

Elevation: 1902 ft
Previous crop: Dry Bean
Planted: 6/1/2022
Harvested: 11/3/2022
Soil type: Lihen Loamy Fine Sand
Plot size: 220 ft^2
Rainfall: 15.5 inches (4/1 - 11/3)
Irrigation: 18.0 inches (5/24 - 11/3)

Forgive your enemies; it messes up their heads.

Dryland Canola LL Variety Trial - NDSU **WREC, Williston, ND 2022**

Company/ Brand	Variety/Line	Type[1]	Plant Height	Days to Flowering	Days to Maturity	Oil	Test Weight	Yield 2022	Yield 2-Yr-Avg.
			(in)	(DAP[2])	(DAP)	(%)	(lb/bu)	(lb/ac)	(lb/ac)
Croplan	CP7130LL	LL	33.8	43	79	38.3	52.2	203.6	485.5
Croplan	CP7144LL	LL	33.5	42	79	39.5	51.4	236.9	479.5
Canterra Seeds	CS4000 LL	LL	33.5	45	82	38.2	51.7	199.1	455.9
DeKalb	DKTFLL21SC	LLTF	30.8	46	81	38.9	52.4	385.0	-
BASF Corp	L233P	LL	33.1	43	80	39.6	52.4	472.2	565.3
BASF Corp	L340PC	LL	35.1	42	79	38.9	52.8	543.8	660.6
BASF Corp	L343PC	LL	33.4	43	83	39.2	51.7	489.8	-
BASF Corp	L345PC	LL	33.5	43	84	38.9	52.4	539.4	647.4
BASF Corp	LR344PC	LL/RR	33.9	43	85	38.3	51.8	469.3	578.8
Mean			33.4	43.3	81.3	38.9	52.1	393.2	-
CV %			7.7	10.9	1.8	1.6	0.7	14.0	-
LSD 0.05			3.8	6.9	2.2	0.9	0.5	80.6	-
LSD 0.1			3.1	5.7	1.8	0.7	0.4	66.8	-

Location: WREC Latitude: 48.132460 Longitude: -103.746934.
Previous crop: Soybean Soil type: Williams-Bowbells Loam. Altitude: 2105 ft.
Planted: 5/24/2022 Harvested: 8/26/2022
Soil test (0-6 in): P= 21 ppm; K=265 ppm; pH= 6.1; and OM= 2%.
Soil test (0-24 in): NO_3N= 29 lb/ac.
Applied fertilizers (lb/ac): N=51; P=23.5; K=0.
Applied chemicals: Tombstone Helios 2 fl.oz/ac (06/22/2022)
[1]LL = .LibertyLink; RR = Roundup Ready; and TF = TrueFlex.
[2]DAP = Days after planting.

Kaleb Cornell presenting at NDSU-WREC Field Days in July.

Irrigated Canola Variety Trial - NDSU **WREC, Nesson Valley, ND 2022**

Variety	Brand / Company	Plant Height (in)	Days to Flower (DAP+)	Flower Duration (Days)	Days to Maturity (DAP+)	Lodging (0 - 9*)	Oil† 2022 (%)	Oil† 2-Yr Avg (%)	Oil† 3-Yr Avg (%)	Test Weight (lb/bu)	Yield 2022 (lb/a)	Yield 2-Yr Avg (lb/a)	Yield 3-Yr Avg (lb/a)
Roundup Ready													
CP9978TF	Croplan	32	42	14	91	2	40.2	39.7	39.7	53.1	2411	2770	2717
StarFlex	Star	36	43	15	91	3	41.4	40.6	40.5	52.8	2969	2653	2538
BY 6211TF	BrettYoung	35	42	15	89	1	40.4	39.4	-	53.1	3105	3180	-
NC527CR TF	NuSeed	34	42	14	90	1	40.7	39.0	-	52.8	2441	2573	-
NC471 TF	NuSeed	34	42	16	90	3	37.4	37.4	-	53.0	1530	2123	-
NC155 TF	NuSeed	33	41	17	92	2	39.0	-	-	53.6	2313	-	-
Liberty Link													
CP7144LL	Croplan	34	46	10	91	2	41.6	41.9	-	52.8	2531	2703	-
CP7130LL	Croplan	33	46	10	89	2	40.3	40.4	-	52.9	2012	2613	-
L340PC	BASF-invigor	37	44	15	90	2	40.4	-	-	52.0	3133	-	-
L343PC	BASF-invigor	32	46	14	91	1	40.3	-	-	51.0	2942	-	-
L233P	BASF-invigor	31	46	11	91	2	41.1	-	-	52.6	2882	-	-
LR344PC	BASF-invigor	33	46	11	91	2	41.0	-	-	52.5	2690	-	-
MEAN		33.8	43.8	13.5	90.5	2.0	40.32	39.75	40.11	52.69	2580.0	2659.4	2627.9
C.V. (%)		-	-	-	-	-	1.83	-	-	0.59	9.1	-	-
LSD (5%)		-	-	-	-	-	1.25	-	-	0.53	398.2	-	-
LSD (10%)		-	-	-	-	-	1.03	-	-	0.44	329.7	-	-

+ Days after planting   * 0: no lodging - 9: plants lying flat on the ground   † Oil content adjusted to 8.5% moisture

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W
Soil Test (0-6 in.): P=16 ppm; K=275 ppm; pH=7.6; OM=2.2%
(0-24 in.): NO3-N=37 lb/a
Yield goal: 2,500 lb/a
Planting population: 520,000 seeds/a
Applied fertilizer: 260 lb/a of Urea (46-0-0) and 125 lb/a of AMS (21-0-0-24S)
Herbicides applied: (**Roundup Ready**) Cornerstone 5 Plus (24oz/a) and Class Act (1qt/100gal) [6/22]
(**Liberty Link**) Liberty (22oz/a), Section 3 (3oz/a), and Class Act (1qt/100gal) [6/22]
Fungicides applied: Priaxor (8 oz/a) [7/21]

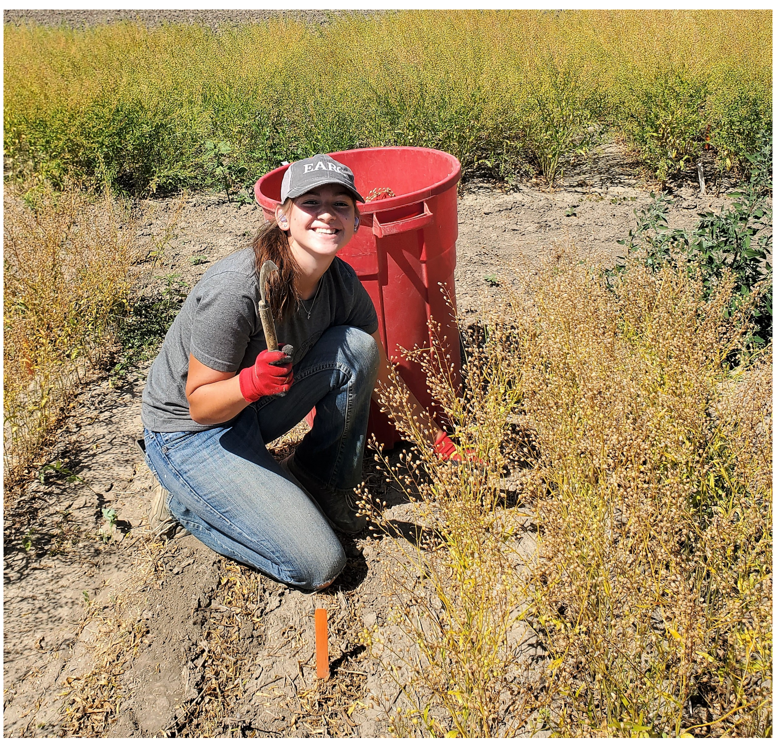
Elevation: 1902 ft
Previous crop: Dry Bean
Planted: 5/23/2022
Harvested: 9/7/2022
Soil type: Lihen Loamy Fine Sand
Plot size: 70 ft^2
Rainfall: 13.2 inches (4/1 - 9/7)
Irrigation: 15.0 inches (5/23 - 9/7)

Statewide Canola Variety Trial EARC, Sidney, MT 2022

Variety	Plant Height (cm)	Days to Flowering (Julian*)	Test Weight (lb/bu)	Oil (%)	Grain Yield† (lb/ac)
BY5125CL	41.5	173	54.2	44.9	1990.1
BY6211TF	38.5	173	53.2	45.2	1691.7
BY6217TF	43.6	174	50.9	45.6	1287.7
CP7130LL	40.0	173	54.0	43.6	1814.7
CP7144LL	44.5	173	50.7	44.4	1854.9
CP930RR	39.4	171	53.5	47.5	2054.9
CP9919RR	35.8	171	53.5	43.6	1486.2
CP9978TF	40.8	173	53.5	44.8	1816.3
DKTF91SC	36.6	172	53.7	45.9	1920.4
DKTF99SC	44.2	173	53.4	44.6	2316.1
DKTFLL21SC	36.0	172	54.1	45.3	1900.0
InVigorL233P	39.1	173	52.7	45.9	1791.8
InVigorL340PC	38.2	173	53.4	43.5	2067.9
InVigorLR344PC	39.3	173	51.2	47.5	1754.7
NCC101S	33.2	172	54.7	40.4	1734.5
NCC1825/8-S	39.2	171	55.7	42.3	2412.7
Mean	39.4	172	53.3	44.7	1877.6
P-Value	0.0008	<.0001	<.0001	<.0001	0.0007
CV (%)	8.4	0.3	1.9	2.4	15.2
LSD (0.05)	4.7	0.8	1.4	1.6	407.0

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N Available (lb/ac): 33.3
N added (lb/ac): 50
P2O5 Available (ppm): 13.3
P2O5 added (lb/ac): 19
Herbicide Applied: Sonalan 10G @ 8lbs/ac on 10/18/21
Pesticide Applied: Mustang Maxx @ 4.3 oz/ac on 5/28/22 & 4 oz/ac on 6/10/22

Planted: 5/3/22
Harvested: 8/1/22
Previous crop: sugarbeet
Soil Type: Savage Silty Clay
Crop Year Precipitation: 15.26 inch
Irrigation (sprinkler): 1.14 inch
Plot Width: 5 ft



Lakayla hand-harvesting camelina at MSU-EARC.

Regional Canola Variety Trial EARC, Sidney, MT 2022

Variety	Plant Height (in)	Days to Flowering (Julian*)	Test Weight (lb/bu)	Oil (%)	Grain Yield† (lb/ac)
16.SC.104.2	34.9	173	55.5	43.5	1264.1
16.SC.182.10	34.9	173	55.1	39.1	1173.0
16.SC.182.6	38.0	174	54.8	41.1	1492.2
16.SC.24.5	34.3	173	51.5	47.2	1409.2
16.SC.24.9	37.9	173	55.2	43.3	1392.3
Empire	29.9	172	55.7	42.9	1222.9
Mean	35.0	173	54.6	42.8	1325.6
P-Value	0.0176	0.0001	0.139	0.01	0.2685
CV (%)	8.5	0.3	4.1	5.9	15.6
LSD (0.05)	4.5	0.7	3.3	3.8	312.0

(Julian*) is a continuous count of days since January 1
† Grain yield adjusted to 12.0% moisture
N Available (lb/ac): 33.3
N added (lb/ac): 50
P2O5 Available (ppm): 13.3
P2O5 added (lb/ac): 19
Herbicide Applied: Sonalan 10G @ 8lbs/ac on 10/18/21
Pesticide Applied: Mustang Maxx @ 4.3 oz/ac on 5/28/22 & 4 oz/ac on 6/10/22

Planted: 5/3/22
Harvested: 8/1/22
Previous crop: sugarbeet
Soil Type: Savage Silty Clay
Crop Year Precipitation: 15.26 inch
Irrigation (sprinkler): 1.14 inch
Plot Width: 5 ft

Ron planting sugarbeet trials at MSU-EARC.

Dryland Soybean Roundup Read Variety Trial - NDSU

WREC, Williston, ND 2022

Company/Brand	Variety/Line	Maturity Group	Plant Height (in)	Days to Maturity (DAP)	Test Weight (lb/bu)	Seed Oil (%)	Seed Protein (%)	Yield 2022 (bu/ac)	Yield 2 Yr. Avg. (bu/ac)	Yield 3 Yr. Avg. (bu/ac)
LG SEEDS	LGS00838XF	00.8	20.4	107	53.2	21.5	40.9	9.7	11.6	-
LG SEEDS	LGS0111RX	0.1	20.9	106	53.8	20.9	40.7	13.5	14.1	13.2
NDSU	ND17009GT	00.9	22.5	109	55.4	20.3	42.2	9.0	12.2	11.2
REA	R0112XF	0.1	23.5	108	54.1	21.7	40.3	10.3	13.9	-
REA	R0422XF	0.4	17.3	114	53.6	21.2	40.7	8.6	-	-
REA	RX00912	00.9	19.4	106	53.7	21.0	40.6	9.5	-	-
Xitavo	XO 0101E	0.1	16.0	110	52.8	20.4	41.5	8.1	-	-
Xitavo	XO 0213E	0.2	18.1	114	53.6	21.1	40.1	9.7	-	-
Xitavo	XO 0311E	0.3	19.3	111	52.9	19.8	41.3	8.8	-	-
Xitavo	XO 0573E	0.5	17.5	116	54.5	21.7	39.9	8.2	-	-
Xitavo	XO 0602E	0.6	15.5	117	53.9	18.9	41.6	7.5	-	-
Xitavo	XO 0731E	0.7	17.3	121	53.6	20.2	40.4	6.6	-	-
Mean			19.0	112	53.8	20.7	40.8	9.1	-	-
CV %			10.4	1.8	1.7	1.9	0.9	15.0	-	-
LSD 0.05			2.8	2.9	1.3	0.6	0.5	2.0	-	-
LSD 0.1			2.4	2.4	1.1	0.5	0.4	1.6	-	-

Location: WREC; Latitude: 48.126325; Longitude: -103.73879

Previous crop: oat; Soil type: Williams-Bowbells Loam. Altitude: 2105 ft.

Planted: 5/24/2022; Harvested: 10/19/2022.

Soil test (0-6 in): P= 28 ppm; K=350 ppm; pH= 6.0; and OM= 2.3%.

Soil test (0-24 in): NO_3N= 41 lb/ac.

Applied fertilizers (lb/ac): None

Applied chemicals: Spartan Charge Herbicide 3.5 fl. oz/ac (5/6/2022)
Tombstone Helios 2 fl.oz/ac (06/22/2022)

Data includes only released varieties. Experimental lines are not included. Statistics reflect the entire trial.

Dryland Soybean Roundup Ready Variety Trial - NDSU **WREC, Williston, ND 2022**

Variety/Line	Plant Height	Days to Maturity	Test Weight	Seed Oil	Seed Protein	Yield
						2022
	(in)	(DAP)	(lb/bu)	(%)	(%)	(bu/ac)
AG005X8	17.1	100	49.0	21.5	39.7	10.1
AG0333	18.5	113	52.0	20.5	41.1	11.0
ND2108GT20	21.0	101	50.7	20.5	40.3	11.6
ND2108GT73	16.7	116	52.5	21.3	38.6	11.9
Mean	19.4	109	51.5	21.1	40.0	9.9
CV %	10.5	1.5	1.9	2.0	1.4	19.7
LSD 0.05	2.9	2.4	1.3	0.6	0.8	2.7
LSD 0.1	2.4	2.0	1.1	0.5	0.6	2.3

Location: WREC; Latitude: 48.126325; Longitude: -103.73879
Previous crop: oat; Soil type: Williams-Bowbells Loam.
Planted: 5/24/2022; Harvested: 10/19/2022. Altitude: 2105 ft.
Soil test (0-6 in): P= 28 ppm; K=350 ppm; pH= 6.0; and OM= 2.3%.
Soil test (0-24 in): NO_3N= 41 lb/ac.
Applied fertilizers (lb/ac): None
Applied chemicals: Spartan Charge Herbicide 3.5 fl. oz/ac (5/6/2022)
Tombstone Helios 2 fl.oz/ac (06/22/2022)

Data includes only released varieties. Experimental lines are not included. Statistics reflect the entire trial.

Kaleb Cornell, David Weltikol, Kyle Dragseth and Jerry Bergman, of NDSU-WREC, holding the NCAA Division I FCS National Championship Football trophy on 2022 Field Day.

Irrigated Conventional Soybean Variety Trial - NDSU | **WREC, Nesson Valley, ND 2022**

Variety	Brand / Company	Maturity Group	Plant Height (in)	Days to Maturity (DAP+)	Lodging (0 - 9*)	Protein† 2022 (%)	Protein† 2-Yr Avg (%)	Protein† 3-Yr Avg‡ (%)	Test Weight (lb/bu)	Yield 2022 (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg‡ (bu/a)
ND Rolette	NDSU	00.9	28	120	0	37.1	35.9	36.0	56.5	66.3	59.3	54.5
ND Benson	NDSU	0.4	29	128	0	37.4	36.8	36.4	57.0	56.6	55.6	53.5
ND Dickey	NDSU	0.7	30	131	0	37.9	36.2	-	57.4	60.9	58.7	-
MEAN			29.5	129.3	0.2	37.05	36.21	35.92	57.03	62.00	58.20	54.00
C.V. (%)			-	-	-	3.48	-	-	0.34	8.37	-	-
LSD (5%)			-	-	-	NS	-	-	0.33	8.88	-	-
LSD (10%)			-	-	-	NS	-	-	0.26	7.05	-	-

+ Days after Planting * 0: no lodging - 9: plants lying flat on the ground † Protein content adjusted to 13% moisture ‡ 3-Yr average from 2019, 2021, and 2022

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W
Soil Test (0-6 in.): P=20 ppm; K=170 ppm; pH=7.6; OM=2.0%
(0-24 in.): NO3-N=62 lb/a
Yield goal: 50 bu/a
Planting population: 200,000 seeds/a
Applied fertilizer: none applied, seed inoculated
Herbicides applied: Valor (3oz/a) [10/28/2021], Prowl H2O (2pt/a) [6/1]
Section 3EC (5.33oz/a) Destiny HC (1qt/a) [6/22], Raptor (4oz/a), Basagran (0.5pt/a), 28-0-0 (1pt/a), and Destiny (1qt/100gal) [6/22]
Fungicides applied: Priaxor (8oz/a) [7/21] and Proline (5.7oz/a) [8/3]

Elevation: 1902 ft
Previous crop: Dry Bean
Planted: 5/19/2022
Harvested: 10/19/2022
Soil type: Lihen Loamy Fine Sand
Plot size: 50 ft^2
Rainfall: 14.3 inches (4/1 - 10/19)
Irrigation: 18.0 inches (5/19 - 10/19)

Tyler Tjelde presenting at NDSU-WREC Field Days in July.

Irrigated Roundup Ready Soybean Variety Trial - NDSU **WREC, Nesson Valley, ND 2022**

Variety	Company / Brand	Maturity Group	Plant Height (in)	Days to Maturity (DAP+)	Lodging (0 - 9*)	Protein† 2022 (%)	Protein† 2-Yr Avg (%)	Protein† 3-Yr Avg (%)	Test Weight (lb/bu)	Yield 2022 (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
ND21008GT20	NDSU	00.8	30	118	2	37.3	35.5	35.7	56.2	69.9	60.2	52.7
ND17009GT	NDSU	00.9	29	115	1	39.8	37.9	37.9	56.9	70.5	59.5	49.6
RX00912	REA Hybrids	00.9	28	119	1	36.3	33.9	-	55.9	67.1	58.5	-
S009XF33	Dyna-Gro	00.9	26	116	0	36.5	-	-	55.6	81.3	-	-
GH00982XF	Golden harvest	00.9	28	121	0	37.0	-	-	55.6	78.0	-	-
S009XT68	Dyna-Gro	00.9	33	117	1	37.9	-	-	56.5	67.6	-	-
R0112XF	REA Hybrids	0.1	38	119	1	38.1	36.0	-	56.1	77.2	66.0	-
S01XF43	Dyna-Gro	0.1	31	116	1	30.4	-	-	55.7	85.2	-	-
XO 0101E	Xitavo	0.1	27	126	1	39.2	-	-	55.6	53.4	-	-
GH0272XF	Golden harvest	0.2	29	121	0	36.6	-	-	56.1	78.1	-	-
XO 0213E	Xitavo	0.2	28	128	1	37.8	-	-	55.9	69.6	-	-
70212	Integra	0.2	35	119	1	38.4	-	-	56.0	68.7	-	-
40300N	Integra	0.3	32	126	0	38.1	35.1	-	56.0	74.0	67.0	-
XO 0311E	Xitavo	0.3	28	123	1	38.4	-	-	55.6	80.2	-	-
50309 R2X	Integra	0.3	30	127	1	38.4	-	-	56.9	69.2	-	-
R0422XF	REA Hybrids	0.4	31	126	1	38.6	-	-	56.3	71.1	-	-
XO 0593E	Xitavo	0.5	26	130	1	39.1	-	-	56.9	63.5	-	-
XO 0602E	Xitavo	0.6	28	130	0	38.0	-	-	57.5	72.4	-	-
XO 0731E	Xitavo	0.7	29	131	1	38.8	-	-	57.2	76.6	-	-
ND2108GT73	NDSU	0.8	30	130	1	37.7	35.7	-	57.4	81.7	72.3	-
MEAN			29.9	123.0	0.8	37.62	35.69	36.79	56.28	72.77	63.93	51.15
C.V. (%)			-	-	-	1.58	-	-	0.84	10.39	-	-
LSD (5%)			-	-	-	0.98	-	-	0.78	12.50	-	-
LSD (10%)			-	-	-	0.82	-	-	0.65	10.41	-	-

+ Days after planting * 0: no lodging - 9: plants lying flat on the ground † Protein content adjusted to 13% moisture

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W
Soil Test (0-6 in.): P=20 ppm; K=170 ppm; pH=7.6; OM=2.0%
(0-24 in.): NO3-N=62 lb/a
Yield goal: 50 bu/a
Planting population: 200,000 seeds/a
Applied fertilizer: none applied, seed inoculated
Herbicides applied: Valor (3oz/a) [10/28/21], Prowl H2O (2pt/a) [5/23], Cornerstone 5 Plus (24oz/a) and Class Act (1qt/100gal) [6/22]
Fungicides applied: Proline (5.7oz/a) [8/3]

Elevation: 1902 ft
Previous crop: Dry Bean
Planted: 5/19/2022
Harvested: 10/19/2022
Soil type: Lihen Loamy Fine Sand
Plot size: 50 ft^2
Rainfall: 14.3 inches (4/1 - 10/19)
Irrigation: 18.0 inches (5/19 - 10/19)

Irrigated Soybean Variety Trial - NDSU **WREC, Trenton Off-Station, ND 2022**

Variety	Company / Brand	Maturity Group	Protein† 2022 (%)	Protein† 2-Yr Avg (%)	Oil† (%)	Test Weight (lb/bu)	Yield 2022 (bu/a)	Yield 2-Yr Avg (bu/a)
RX00912	REA Hybrids	00.9	34.7	33.9	19.9	55.5	69.3	59.3
S009XF33	Dyna-Gro	00.9	35.0	-	20.3	55.9	66.8	-
S009XF68	Dyna-Gro	00.9	35.2	-	19.3	55.2	63.0	-
GH00982XF	Golden Harvest	00.9	34.7	-	19.6	56.2	51.2	-
R0112XF	REA Hybrids	0.1	35.7	35.3	19.9	55.4	67.3	61.9
S01XF43	Dyna-Gro	0.1	35.8	-	19.8	54.4	67.3	-
XO 0101E	Xitavo	0.1	35.5	-	19.4	55.1	55.9	-
70212XF	Integra	0.2	34.9	35.0	20.0	55.7	55.3	54.6
GH0272XF	Golden Harvest	0.2	34.4	-	19.9	55.0	58.0	-
XO 0213E	Xitavo	0.2	35.4	-	19.4	55.2	56.6	-
50309 R2X	Integra	0.3	35.4	-	19.8	55.8	62.0	-
XO 0311E	Xitavo	0.3	34.9	-	19.5	55.4	55.2	-
40300N	Integra	0.3	36.2	35.3	19.7	54.6	59.1	58.4
R0422XF	REA Hybrids	0.4	36.1	-	20.0	54.8	54.9	-
XO 0593E	Xitavo	0.5	34.4	-	19.2	55.8	40.3	-
XO 0602E	Xitavo	0.6	34.6	-	18.6	56.4	48.3	-
XO 0731E	Xitavo	0.7	34.8	-	18.9	56.1	50.1	-
MEAN			35.17	34.87	19.60	55.44	57.68	58.54
C.V. (%)			2.07	-	2.98	1.19	9.62	-
LSD (5%)			1.21	-	0.97	1.10	9.40	-
LSD (10%)			1.01	-	0.81	0.92	7.82	-

† Protein and Oil content adjusted to 13% moisture

Yield goal: 50 bu/a
Planting population: 200,000 seeds/a
Applied fertilizer: none applied, seed inoculated
Herbicides applied: Cornerstone 5 Plus (24oz/a) and Class Act (1qt/100gal) [7/1]
Fungicides applied: none applied

Elevation: 1900 ft
Previous crop: Sugarbeet
Planted: 5/27/2022
Harvested: 10/21/2022
Soil type: Lohler Silty Clay
Plot size: 56 ft2
Rainfall: 10.0 inches (4/1 - 10/21)

Irrigated Corn Variety Trial - NDSU **WREC, Nesson Valley, ND 2022**

Variety	Company / Brand	Relative Maturity	Days to Head (DAP+)	Test Weight (lb/bu)	Yield 2022 (bu/a)	Yield 2-Yr Avg (bu/a)	Yield 3-Yr Avg (bu/a)
2B851	REA Hybrids	85	65	54.3	145.5	164.7	170.4
3537 VT2P RIB	Integra	85	67	55.1	150.4	168.0	163.2
3282 VT2P RIB	Integra	82	67	56.9	148.6	161.5	153.5
1B771	REA Hybrids	77	64	54.6	160.5	176.9	-
3009 VT2P RIB	Integra	80	63	56.2	150.7	159.0	-
83B33	REA Hybrids	83	66	54.3	158.3	-	-
MEAN			65.3	55.21	152.31	166.02	162.36
C.V. (%)			-	0.95	15.48	-	-
LSD (5%)			-	0.79	NS	-	-
LSD (10%)			-	0.65	NS	-	-

+ Days after planting

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W — Elevation: 1902 ft
Soil Test (0-6 in.): P=20 ppm; K=170 ppm; pH=7.6; OM=2.0% — Previous crop: Dry Bean
(0-24 in.): NO3-N=62 lb/a — Planted: 5/24/2022
Yield goal: 190 bu/a — Harvested: 11/1/2022
Planting population: 38,000 seeds/a (30" row spacing) — Soil type: Lihen Loamy Fine Sand
Applied fertilizer: 415 lb/a of Urea (46-0-0) — Plot size: 110 ft^2
Herbicides applied: Cornerstone 5 Plus (24oz/a) and Class Act (1qt/100gal) [6/22] — Rainfall: 15.5 inches (4/1 - 11/1)
Fungicides applied: none applied — Irrigation: 18.0 inches (5/24 - 11/1)

Your fences need to be horse-high,pig-tight and bull-strong.

Irrigated Corn Variety Trial - NDSU **WREC, Trenton Off-Station, ND 2022**

Variety	Brand / Company	Relative Maturity	Test Weight (lb/bu)	Yield 2022 (bu/a)	Yield 2-Yr Avg (bu/a)
2B851	REA Hybrids	85	54.4	152.6	157.0
1B771	REA Hybrids	77	56.0	147.5	145.7
3282 VT2P RIB	Integra	82	55.3	166.3	144.3
3009 VT2P RIB	Integra	80	54.7	144.4	133.5
83B33	REA Hybrids	83	53.9	170.1	-
3537 VT2P RIB	Integra	85	53.6	158.1	-
MEAN			54.09	157.50	133.46
C.V. (%)			0.87	7.45	-
LSD (5%)			0.86	21.20	-
LSD (10%)			0.70	17.24	-

Location: Latitude 47 58'N; Longitude 103 54'W — Elevation: 1900 ft

Yield goal: 190 bu/a — Previous crop: Sugarbeet

Planting population: 36,000 seeds/a (22" row spacing) — Planted: 5/27/2022

Applied fertilizer: 300 lb/a of Urea (46-0-0) — Harvested: 10/21/2022

80 lb/a of Starter (12-40-0-10S) — Soil type: Lohler Silty Clay

Average Population: 35,700 plants/a

Herbicides applied: Cornerstone 5 Plus (24oz/a) and Class Act (1qt/100gal) [7/1]

Fungicides applied: none applied — Rainfall: 10.0 inches (4/1 - 10/21)

We have neglected the truth that a good farmer is
a craftsman of the highest order, a kind of artist.

Lentil Variety Descriptions

Variety	Origin[1]	Seed Color	Relative Maturity	Relative Height	Seed Size	Resistance To[2] Ascochyta	Resistance To[2] 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.

MSU-EARC dryland farm - drone photo courtesy of Red Lovec.

Dryland Lentil Variety Evaluation - MSU **Richland, MT 2022**

Variety	Plant Height (in)	Test Weight (lb/bu)	1000 Seed Weight (g)	Adjusted Grain Yield (lb/a)
Avondale	15.9	62.8	50.3	1638
CDC Greenstar	15.1	60.6	75.7	1261
CDC Impala CL	15.6	65.6	34.0	1505
CDC Impress CL	16.3	63.0	52.7	1771
CDC Imvincible CL	14.3	64.6	35.0	1543
CDC Kermit	15.0	65.4	35.3	1815
CDC Maxim CL	14.4	64.4	38.7	1667
CDC Richlea	15.6	62.1	54.3	1683
CDC Viceroy	16.7	65.2	36.7	1526
LC14600088R	16.1	62.5	56.3	1998
NDL090204R	15.0	63.3	56.3	1616
NDL120599R	17.1	61.3	55.7	1733
Sage	14.3	64.7	37.3	2076
Mean	15.5	63.5	47.6	1679
P-Value	0.1770	<0.0001	<0.0001	0.0086
LSD (0.05)	NS	0.5	3.5	354.6
CV (%)	8.1	0.5	4.4	12.6

Location: Richland, MT
Previous crop: Durum
Planted: 4-29-2022
Harvested: 8-11-2022
Applied fertilizers in lb/a: None
Soil type: Farnuf Loam
Yield adjusted to 13% moisture content

Maral,Thomas and Amy at work during the sugarbeet harvest at MSU-EARC.

Irrigated Lentil Variety Evaluation - MSU **Sidney, MT 2022**

Variety	Days to Flower (DAP)[1]	Plant Height (in)	Test Weight (lb/bu)	1000 Seed Weight (g)	Adjusted Grain Yield (lb/a)
Avondale	54	14.1	62.5	54.0	2037
CDC Greenstar	57	13.7	59.8	76.1	2203
CDC Impala CL	56	15.2	65.4	34.6	2135
CDC Impress CL	55	13.9	62.1	58.6	2050
CDC Imvincible CL	55	13.8	64.7	38.2	2376
CDC Kermit	56	13.8	65.1	37.4	2361
CDC Maxim CL	54	12.8	63.5	43.0	2046
CDC Richlea	55	14.6	61.4	56.4	2167
CDC Viceroy	55	14.1	64.8	39.1	2412
LC14600088R	54	15.3	61.6	63.1	2308
NDL090204R	55	14.3	63.0	58.8	2662
NDL120599R	51	14.6	60.1	59.9	1687
Sage	51	12.5	64.1	40.9	1543
Mean	54.4	14.0	62.9	50.7	2150
P-Value	<0.0001	0.0146	<0.0001	<0.0001	0.0004
LSD (0.05)	1.3	1.4	0.4	1.6	430.7
CV (%)	1.6	7.1	0.4	2.2	14.0

Location: EARC; Sidney, MT
Previous crop: Sugarbeet
Planted: 5-5-2022
Harvested: 8-23-2022
Applied fertilizers in lb/a: None
Soil type: Savage Silty Clay Loam
Yield adjusted to 13% moisture content
DAP[1] = Days after planting
Herbicide: PowerMax at 24 oz/a and Outlook at 12 oz/a preemergence

Yi and Shreya performing remote sensing for the measurement of camelina canopy NDVI.

FIELD PEA VARIETY DESCRIPTIONS

VARIETY	ORIGIN	VINE HABIT[1]	GROWTH HABIT	VINE LENGTH	RELATIVE MATURITY	SEED SIZE	RESISTANCE TO POWDERY MILDEW
YELLOW COTYLEDON							
AAC CHROME	CANADA	SL	NA	MEDIUM	MEDIUM	M LARGE	R
AAC JULIUS	CANADA	NA	NA	MEDIUM	MEDIUM	SMALL	R
AC AGASSIZ	CANADA	SL[1]	SD[2]	TALL	MEDIUM	MEDIUM	R
CDC AMARILLO	CDC	SL	SD	MEDIUM	MEDIUM	MEDIUM	R
CDC INCA	MERIDIAN	NA	NA	NA	MEDIUM	MEDIUM	R
CDC SPECTRUM	UOS CDC	SL	NA	TALL	MEDIUM	M LARGE	R
DS ADMIRAL	DANISCO SEED	SL	SD	TALL	MEDIUM	LARGE	R
HYLINE	GREAT NORTHERN AG	SL	NA	MEDIUM	MEDIUM	MEDIUM	R
ND DAWN	NDSU	SL	SD	MEDIUM	MEDIUM	LARGE	NA
SALAMANCA	GREAT NORTHERN AG	SL	SD	MEDIUM	EARLY	MEDIUM	MS
GREEN COTYLEDON							
ARAGORN	PROGENE	SL	SD	M SHORT	M EARLY	M LARGE	NA
ARCADIA	PULSE USA	SL	SD	MEDIUM	EARLY	SMALL	MS
CDC STRIKER	UOS CDC	SL	SD	MEDIUM	MEDIUM	M LARGE	S
SHAMROCK	GREAT NORTHERN AG	SL	NA	NA	LATE	NA	S

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

MSU-EARC irrigated fields - drone photo courtesy of Red Lovec.

Dryland Pea Variety Trial - NDSU **WREC, Williston, ND 2022**

Variety/Line	Canopy Height	Days to Flowering	Days to Maturity	Protein	Test Weight	Yield	
						2022	3 yr. Avg.
	(in)	(DAP)	(DAP)	(%)	(lb/bu)	(bu/ac)	
Yellow Cotyledon Type							
AAC Chrome	20.1	54	80	21.4	59.9	43.6	27.2
AAC Julius	22.3	54	77	24.4	60.8	41.3	-
Agassiz	21.8	52	78	22.6	60.0	36.7	25.2
CDC Amarillo	24.5	55	78	22.6	60.8	40.6	25.8
CDC Inca	23.9	54	79	22.8	61.1	41.7	25.6
CDC Spectrum	22.0	55	78	22.8	60.7	42.3	26.9
CP5222Y	21.3	50	77	23.4	61.1	42.2	-
CP5244Y	21.4	49	78	22.4	61.7	39.3	-
DL Apollo	22.4	52	77	23.7	62.1	35.1	21.2
DS Admiral	24.0	54	77	23.1	61.3	43.5	26.2
Hyline	22.0	52	77	21.5	60.9	40.6	-
LG Stunner	22.5	50	77	26.2	60.8	35.6	-
MS GrowPro	24.2	51	78	26.0	59.5	41.6	-
ND Dawn	22.0	53	77	21.1	60.4	40.4	22.9
Salamanca	22.3	52	78	23.4	60.6	39.3	24.3
Green Cotyledon Type							
Aragorn	19.2	49	76	21.7	60.5	39.1	22.3
Arcadia	19.0	51	77	21.7	60.6	35.1	24.2
CDC Striker	19.5	53	78	23.7	60.9	34.6	23.5
ND Victory	26.7	56	86	23.0	60.7	36.3	-
Shamrock	22.7	54	77	23.3	61.7	39.6	23.1
Mean	22.1	53	78	23.3	60.8	38.2	-
CV %	8.4	1.3	1.3	3.2	0.7	11.9	-
LSD 0.05	2.6	0.9	1.4	1.0	0.6	6.4	-
LSD 0.1	2.2	0.8	1.2	0.9	0.5	5.3	-

Location: WREC; Latitude: 48.126325; Longitude: -103.738798.
Previous crop: Oat; Soil type: Williams-Bowbells Loam. Altitude: 2105 ft.
Planted: 5/7/2022; Harvested: 8/3/2022.
Soil test (0-6 in): P= 28 ppm; K=350 ppm; pH= 6.0; and OM= 2.3%.
Soil test (0-24 in): NO_3N= 41 lb/ac.
Applied fertilizers (lb/ac): None.
Applied chemicals: Spartan Charge Herbicide 3.5 fl. oz/ac (5/6/2022)
Tombstone Helios 2 fl.oz/ac (06/22/2022)

Data includes only released varieties. Experimental lines are not included. Statistics reflect the entire trial.

Dryland Green Dry Pea Variety Evaluation - MSU **Richland, MT 2022**

Variety	Plant Height	Test Weight	1000 Seed Weight	Protein	Adjusted Grain Yield
	(in)	(lb/bu)	(g)	(%)	(lb/a)
Aragorn	22.2	63.6	185.2	25.4	2538
Ginny 2	22.4	63.0	194.7	25.2	2556
Hampton	22.8	62.9	197.4	27.3	2666
MS-20G1	25.0	64.2	214.3	25.7	2242
MS-20GP5	24.9	62.9	209.3	26.5	2626
NDP150412G	24.1	65.2	167.0	27.1	2637
PS0877MT457	21.4	62.8	202.9	27.5	2480
SG-L-8318z	25.8	64.2	200.5	24.7	2355
Mean	23.6	63.6	196.4	26.2	2512
P-Value	0.1	<0.0001	<0.0001	0.0001	0.0304
LSD (0.05)	NS	0.6	8.0	1.2	261
CV (%)	9.0	0.6	2.8	3.1	7.1

Dryland Yellow Dry Pea Variety Evaluation - MSU **Richland, MT 2022**

Variety	Plant Height	Test Weight	1000 Seed Weight	Protein	Adjusted Grain Yield
	(in)	(lb/bu)	(g)	(%)	(lb/a)
AAC Asher	21.9	64.2	219.7	24.1	2647
AAC Carver	23.7	63.8	200.3	23.4	2729
AAC Chrome	21.5	62.6	197.0	24.8	2790
AAC Julius	23.0	63.9	172.7	26.3	2795
AAC Profit	25.5	63.4	195.4	26.1	2797
CDC Spectrum	23.2	63.7	207.1	25.7	2571
CP5222Y	22.3	63.9	229.0	25.5	2836
CP5244Y	23.9	64.2	192.7	26.1	2667
DL Apollo	22.7	64.6	194.6	26.5	2493
DS-Admiral	25.2	63.1	205.7	24.4	2451
Goldenwood	21.7	64.9	170.1	25.9	2507
Korando	24.2	64.3	234.2	24.6	2612
LG Stunner	25.7	63.9	188.4	26.2	2514
MS GrowPro	24.4	63.1	257.1	26.7	2429
MS-20Y1	23.9	62.9	211.7	26.4	2672
MS-20Y3	25.0	62.9	222.7	26.6	2648
MS-20YP4	26.1	64.3	200.4	26.3	2420
MS-22YP6	24.1	63.5	176.4	26.3	2623
ND Dawn	22.5	63.6	208.4	23.9	2738
NDP150231Y	24.6	64.3	177.4	27.3	2196
Orchestra	24.0	63.1	231.3	27.4	2520
Pizzazz	21.0	64.2	235.2	25.4	2809
Pro 143-6220	23.9	63.0	193.3	26.6	2262
Pro 143-6230	22.0	63.2	186.8	26.3	2381
Pro 173-7406	22.3	63.4	201.7	24.3	2646
PS0877MT632	21.9	63.3	180.8	27.6	2284
PS17100008	20.5	64.0	232.1	25.1	2736
PS17100022	24.6	64.3	228.4	26.2	2569
Salamanca	24.3	62.9	227.0	25.6	2738
Mean	23.4	63.7	206.1	25.8	2589
P-Value	0.0034	<0.0001	<0.0001	<0.0001	0.0331
LSD (0.05)	2.8	0.6	8.6	1.0	375
CV (%)	8.5	0.6	3.0	2.8	10.3

Location: Richland, MT — Previous crop: Durum
Planted: 4-28-2022 — Harvested: 8-4-2022
Applied fertilizers in lb/a: None — Soil type: Farnuf Loam
Yield adjusted to 13% moisture content
Protein presented on a dry matter basis

Irrigated Green Dry Pea Variety Evaluation - MSU **Sidney, MT 2022**

Variety	Days to Flower	Plant Height	Test Weight	1000 Seed Weight	Protein	Adjusted Grain Yield
	(DAP)[1]	(in)	(lb/bu)	(g)	(%)	(lb/a)
Aragorn	51.0	22.8	63.2	197.7	24.2	3352
Hampton	57.0	21.4	63.2	220.6	27.2	1816
PS0877MT457	51.0	25.0	63.4	227.5	27.2	3093
Mean	53.0	23.1	63.2	215.3	26.1	2754
P-Value	N/A	0.1844	0.5962	0.0002	<0.0001	0.3246
LSD (0.05)	N/A	NS	NS	9.7	0.6	NS
CV (%)	N/A	11.1	0.7	2.8	1.5	52.8

Irrigated Yellow Dry Pea Variety Evaluation - MSU **Sidney, MT 2022**

Variety	Days to Flower	Plant Height	Test Weight	1000 Seed Weight	Protein	Adjusted Grain Yield
	(DAP)[1]	(in)	(lb/bu)	(g)	(%)	(lb/a)
AAC Carver	54.0	27.5	64.3	225.0	21.9	5285
AAC Profit	57.0	29.0	64.1	224.8	24.7	4846
DS-Admiral	54.0	25.1	64.6	227.8	23.1	3874
ND Dawn	54.0	25.1	64.1	222.8	23.0	4170
Orchestra	53.0	27.3	65.1	281.6	27.8	4530
PS0877MT632	51.0	26.0	63.6	215.3	25.6	1572
Mean	53.8	26.7	64.3	232.9	24.4	4046
P-Value	<0.0001	0.1247	0.0060	<0.0001	<0.0001	<0.0001
LSD (0.05)	1.2	NS	0.7	5.7	0.5	970.4
CV (%)	1.5	8.2	0.7	1.7	1.4	16.1

Location: EARC; Sidney, MT
Previous crop: Sugarbeet
Planted: 5-5-2022
Harvested: 8-3-2022
Applied fertilizers in lb/a: None
Soil type: Savage Silty Clay Loam
Yield adjusted to 13% moisture content
DAP[1] = Days after planting
Protein presented on a dry matter basis
Herbicide: PowerMax at 24 oz/a and Outlook at 12 oz/a preemergence

Farming isn't a battle against nature, but a partnership with it.
It is respecting the basics of nature in action and ensuring that they continue.

Variety	Days to Maturity (DAP+)	Hundred Seed Weight (g)	Seeds / Pound	Test Weight (lb/bu)	2022 (lb/a)	2-Yr Avg‡ (lb/a)	3-Yr Avg¥ (lb/a)
PINTO BEAN							
Monterrey	105	33	1382	59.7	2929	3254	2737
Lariat	106	33	1379	61.3	2509	3154	2734
LaPaz	105	33	1385	62.1	2448	3353	2711
ND-Falcon	104	32	1439	59.8	2736	2999	2512
Torreon	105	31	1492	61.7	2406	2737	2388
Stampede	105	33	1369	60.9	2539	2623	2373
ND-Palomino	107	32	1418	59.2	2012	2709	2360
Windbreaker	104	34	1349	59.4	2099	2110	2054
Vibrant	104	29	1562	59.8	1989	2137	1947
Cowboy	102	31	1464	60.9	2467	-	-
NAVY BEAN							
ND-Polar	106	17	2688	64.0	2069	2301	1968
T9905	106	18	2578	64.5	1699	2013	1749
Blizzard	108	15	2966	64.0	1501	1474	-
HMS Medalist	105	14	3279	64.9	1735	-	-
Armada	105	18	2503	63.1	1403	-	-
BLACK BEAN							
Black Tails	100	16	2830	65.4	1324	2015	1939
Eclipse	104	15	3077	64.0	1630	1842	1742
Zorro	105	15	3117	64.3	1092	1258	-
ND-Twilight	104	17	2732	66.2	1472	-	-
GREAT NORTHERN							
ND-Pegasus	106	30	1494	61.5	3117	3475	2917
SMALL RED							
Viper	102	24	1912	63.9	2617	3193	2708
Merlot	101	29	1602	62.1	1907	2097	2058
PINK							
Rosetta	107	28	1634	63.2	1902	1703	-
MEAN	104.4	25.1	2028.2	62.43	2069.7	2444.6	2306.1
C.V. (%)	-	4.9	4.4	1.02	13.5	-	-
LSD (5%)	-	2.0	147.3	1.05	459.1	-	-
LSD (10%)	-	1.7	122.8	0.88	382.8	-	-

+ Days after planting ‡ 2-Yr average from 2020 and 2022 ¥ 3-Yr average from 2019, 2020, and 2022

Location: Latitude 48 9.9222'N; Longitude 103 6.132'W — Elevation: 1902 ft
Soil Test (0-6 in.): P=20 ppm; K=170 ppm; pH=7.6; OM=2.0% — Planted: 5/25/2022
(0-24 in.): NO3-N=62 lb/a — Harvested: 9/21/2022
Yield goal: 2,500 lb/a — Soil type: Lihen Loamy Fine Sand
Planting population: 125,000 seeds/a — Plot size: 49 ft^2
Applied fertilizer: 304 lb/a of Urea (46-0-0) — Rainfall: 13.2 inches (4/1 - 9/21)
Herbicides applied: Valor (3oz/a) [10/28/2021], Prowl H2O (2pt/a) [6/1] — Irrigation: 18.0 inches (5/25 - 9/21)
Section 3EC (5.33oz/a) Destiny HC (1qt/a) [6/22], Raptor (4oz/a), Basagran (0.5pt/a), 28-0-0 (1pt/a), and Destiny (1qt/100gal) [6/22]
Fungicides applied: Priaxor (8oz/a) [7/21] and Proline (5.7oz/a) [8/3]

Dryland Chickpea Variety Trial - NDSU | **WREC, Williston, ND 2022**

Variety/Line	Plant Height (in)	Days to Flowering (DAP[2])	Days to Maturity (DAP)	1000 Grain Weight (g)	Seed Size >22/64"	Test Weight (lb/bu)	Yield 2022 (lb/ac)	Yield 3 Yrs. Avg.
CDC Frontier	12.7	47	86	330.2	22.0	57.1	1650.0	1340.2
CDC Orion	11.6	43	85	377.9	51.8	56.4	1527.8	1283.0
CDC Palmer	11.4	44	85	385.8	49.4	56.7	1317.1	1119.8
Kashin	16.8	50	88	269.4	1.8	58.1	1265.5	-
ND Crown	12.9	47	84	369.5	52.3	57.4	1407.9	1167.0
New Hope	15.1	49	87	375.8	52.0	56.8	1073.6	-
Royal	12.1	53	91	417.2	59.1	56.2	999.1	652.7
Sawyer	11.7	47	87	363.8	35.0	57.4	1056.2	776.0
Sierra	12.3	50	88	403.5	57.8	56.9	958.2	566.9
Mean	13.0	48	87	365.9	42.3	57.0	1250.6	
CV %	7.1	2.4	2.7	2.8	10.2	1.4	17.8	
LSD 0.05	1.4	1.7	3.4	15.1	6.3	1.2	324.1	
LSD 0.1	1.1	1.4	2.9	12.6	5.2	1.0	268.7	

Location: WREC   Latitude: 48.12918;   Longitude: -103.74848.

Previous crop: Soybean   Soil type: Williams-Bowbells Loam.

Planted: 5/17/2022   Harvested: 8/6/2022

Soil test (0-6 in): P= 21 ppm; K=265 ppm; pH= 6.1; and OM= 2%.

Soil test (0-24 in): NO_3N= 29 lb/ac.

Applied fertilizers (lb/ac): None.

Applied chemicals: Spartan Charge Herbicide 3.5 lb/ac (05/06/2022);
Tombstone Helios 2 fl.oz/ac (06/22/2022 and 08/03/2022).

[2]DAP = Days after planting.

Begonias - photo from NDSU-WREC

Dryland Chickpea Variety Evaluation - MSU — **Richland, MT 2022**

Variety	Plant Height	Test Weight	Seed sizes greater than 22/64 inches	Adjusted Grain Yield
	(in)	(lb/bu)	(%)	(lb/a)
2510-2	16.7	63.7	3.9	859
Anna	16.6	64.2	0.0	1607
CDC Consul	16.8	64.4	1.7	1230
CDC Cory	16.6	61.9	1.9	1227
CDC Frontier	16.5	63.8	13.6	1298
CDC Leader	15.0	62.8	35.9	1148
CDC Orion	16.7	61.0	48.4	579
CDC Palmer	16.8	62.3	37.4	1606
Kasin	20.7	64.9	0.4	1217
Myles	16.6	60.8	0.0	1773
Nash	14.8	N/A	72.2	123
ND Crown	16.5	62.8	51.8	1172
NDC160236	18.4	62.5	41.1	1027
New Hope	15.0	N/A	74.8	110
Royal	16.8	N/A	50.3	143
Sawyer	17.3	63.0	33.5	598
Sierra	15.5	N/A	49.9	126
Mean	16.7	63.1	30.4	932
P-Value	0.0222	<0.0001	<0.0001	<0.0001
LSD (0.05)	2.7	0.6	10.4	505
CV (%)	11.4	0.7	24.0	38.2

Location: Richland, MT — Previous crop: Durum
Planted: 4-29-2022 — Harvested: 8-22-2022
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

A bumble bee is considerably faster than a John Deere tractor.

Irrigated Chickpea Variety Evaluation - MSU — **Sidney, MT 2022**

Variety	Days to Flower	Plant Height	Test Weight	Seed sizes greater than 22/64 in	Adjusted
	(DAP)[1]	(in)	(lb/bu)	(%)	(lb/a)
2510-2	56	23.5	64.9	3.2	4448
Anna	50	23.6	65.5	0.0	4172
CDC Consul	55	23.4	65.6	2.0	4559
CDC Cory	56	23.4	63.4	0.7	4311
CDC Frontier	55	23.1	63.4	21.1	4612
CDC Leader	54	19.8	62.6	33.5	4610
CDC Orion	50	22.4	61.9	55.0	4483
Myles	50	22.7	62.1	0.0	3833
Nash	56	24.1	60.5	79.2	3787
ND Crown	54	25.4	62.6	68.1	4228
NDC160236	56	23.9	63.3	42.2	4787
Royal	56	22.8	61.9	75.5	4109
Sawyer	50	21.4	62.2	25.8	3940
Sierra	53.5	23.3	60.4	81.2	3995
Mean	53.6	23.1	62.9	34.8	4277
P-Value	<0.0001	0.0251	<0.0001	<0.0001	<0.0001
LSD (0.05)	0.8	2.5	0.7	6.9	380
CV (%)	1.0	7.6	0.8	13.8	6.2

Location: EARC; Sidney, MT — Previous crop: Sugarbeet
Planted: 5-6-2022 — Harvested: 9-6-2022
Applied fertilizers in lb/a: None — Soil type: Savage Silty Clay Loam
Herbicide: PowerMax at 24 oz/a and Outlook at 12 oz/a preemergence — DAP[1] = Days after planting
Fungicide: Miravis Neo at 13.7 oz/a and Miravis Top at 14 oz/a (two applications each) — eld adjusted to 13% moisture content

Life is simpler when you plow around the stump.

Dryland Crop Performance Comparisons – Williston, ND 2022

Gautam Pradhan

Crop	Type	Variety	Yield 3 Year Avg* (bu/a)	Market Price† ($/bu)	Gross Return ($/a)	+ or - spring wheat ($/a)
HR Spring Wheat		ND VitPro	24.8	8.74	216.46	0.00
HR Winter Wheat**		Jerry	41.3	7.63	315.27	98.80
Durum Wheat		ND Riveland	27.5	9.50	261.25	44.79
Barley	(Feed)	ND Genesis	32.4	5.00	162.02	-54.44
Oats		Jury	48.3	3.00	144.97	-71.49
Soybeans	(Roundup Ready)	ND 17009GT	11.2	14.14	157.70	-58.77
Field Peas	(Green)	Arcadia	24.2	8.50	205.49	-10.97
	(Yellow)	Agassiz	25.2	8.50	214.26	-2.20
			lb/a	**(¢/lb)**		
Chickpeas	(Large Kabuli)	CDC Frontier	1340.8	35.00	469.28	252.82
Sunflower	(Oil)	H45NS16CL	1258.1	22.50	283.08	66.61

*The average yield of a crop/variety was based on a three-year average yield (2020, 2021, 2022) from dryland varietal trials.

**The average yield of a crop/variety was based on a three-year average yield (2019, 2020, and 2022) from dryland varietal trials.

†The market price was obtained in the fourth week of December 2022 from grain elevators in and around Williston.

You're never too old for the corn maze.

Variety Selection and Fungicide Application for Durum Disease Management

Audrey Kalil, Eric Eriksmoen, John Teixeira, Edson Ncube, Destiney Haug, Lauren Holman, Austin Kraklau, Jayden Hansen, Dean Schoenberg, Dave Teigen, Brian Bendickson and Wes Doepke

Funding provided by the ND Wheat Commission

Introduction

Foliar and head diseases can reduce durum yield and grain quality. Fusarium Head Blight (FHB), or scab, is a disease of durum caused by the fungal pathogen *Fusarium graminearum*. This pathogen produces a toxin, Deoxynivalenol (DON), which contaminates wheat grain. Both foliar fungal diseases and head scab are managed by selecting varieties with increased disease tolerance and the application of fungicides. The goal of this project was to assess DON levels in the harvested grain of durum varieties grown at several locations in western and central North Dakota to identify the varieties that consistently accumulate the least DON, and determine the impact of fungicide application on reducing DON and controlling foliar fungal disease.

Methods

Data is presented from variety trials were conducted at 5 locations. Trials were set up in a randomized complete block design, with 5 x 30 ft. plots and three replicated plots per variety. Prosaro fungicide (8 oz/ac) applied at flowering (Feekes 10.5.1) for the management of scab and foliar fungal disease was applied as a split plot treatment in Minot, to evaluate integration of both fungicide and variety disease tolerance). No other locations were treated with fungicides. Varieties in Minot were assessed for foliar disease on August 1 at the milk (Feekes 11.1) growth stage. Grain from each plot was analyzed for DON using the Reveal Q+ mycotoxin extraction kit and AccuScan II GOLD reader (Neogen). Results presented are an average of data from three replications per variety.

Results and Discussion

	Garrison		Minot	Mohall	Rugby		Wilton	
AAC Spitfire	0.63	b	1	2.43	0.67	ab	1.23	bc
Joppa	0.57	b	1.17	2.03	0.67	ab	1.07	bc
ND Riveland	0.6	b	0.53	2	0.47	b	0.8	c
CDC Defy	0.67	b	0.7	2.83	0.8	ab	0.73	c
Divide	0.8	ab	0.7	2.4	0.5	b	1	bc
Alkabo	0.93	ab	0.62	2.7	0.7	ab	0.63	c
ND Stanley	1	ab	0.93	2.57	0.67	ab	1.63	bc
Tioga	1.13	ab	1.13	3.43	0.67	ab	2.03	b
Carpio	1.2	ab	0.67	2.07	0.53	b	1.23	bc
ND Grano	1.23	ab	1	3.1	0.7	ab	1.63	bc
AAC Stronghold	1.27	ab	1	3.17	1.1	a	2	b
CDC Vantta	1.8	a	1.2	2.37	1	ab	4.27	a
ANOVA ($\alpha < 0.05$)	0.0179		NS	NS	0.0131		<0.0001	

Table 1. DON in durum varieties across sites in 2022. Means from Minot are from non-fungicide treated plots. Means followed by non-overlapping letters within columns (sites) indicate significant differences as determined by Tukey's HSD. Orange, yellow and green color coding is intended to help visually discriminate the treatments that differ according to statistical analysis. Detection threshold was 0.3 ppm. NS = non-significant.

Varieties did not perform similarly in terms of relative scab tolerance across locations. At Minot and Mohall there was no difference among durum varieties in measurable DON in the grain (Table 1). Where there were statistical differences among varieties (Garrison, Rugby and Wilton), ND Riveland tended to have the lowest DON and CDC Vantta has the highest DON. CDC Defy exhibited similar levels of tolerance to ND Riveland.

Fungicide	Test Weight (lb/bu)	Protein (%)	Yield (bu/ac)	DON (ppm)	Foliar Disease Severity (%)	Foliar Disease Incidence (%)
No	63.5	12.4	66.6	0.9	3.0	84.9
Yes	64.0	12.6	66.3	0.7	1.4	52.7
T-test	NS	NS	NS	0.0024	<0.0001	<0.0001

Table 2. Effect of fungicide treatment (8 oz/A Prosaro applied at flowering) on grain quality, yield and foliar disease. Foliar disease assessments were based on the percent of leaves exhibiting fungal leaf spotting diseases such as Tan Spot, Septoria Blotch, and Stagnospora leaf blotch (incidence) and the amount of the flag leaf tissue affected (severity) on 30 plants per plot.

At the Minot location, fungicide application reduced foliar disease incidence and severity, as well as DON (Table 2).

Variety	Test Weight (lb/bu)		Protein (%)		Yield (bu/ac)		DON (ppm)		Foliar Disease Severity (%)	Foliar Disease Incidence (%)	
AAC Spitfire	62.8	e	13.1	ab	65.5	a	1.0	a	3.0	85.0	a
AAC Stronghold	63.5	cde	12.6	bc	68.9	a	0.9	ab	3.0	79.4	ab
Alkabo	64.6	ab	12.1	bc	68.8	a	0.4	b	2.8	77.2	abc
Carpio	64.7	ab	12.2	bc	69.1	a	0.5	ab	2.0	68.9	abc
CDC Defy	64.4	abc	12.4	bc	70.2	a	0.9	ab	2.7	83.3	a
CDC Vantta	59.6	f	13.8	a	48.3	b	1.1	a	1.3	43.3	d
Divide	63.3	de	11.9	c	64.2	a	0.6	ab	2.1	65.6	abcd
Joppa	63.8	bcd	12.7	bc	66.6	a	0.8	ab	1.8	68.9	abc
ND Grano	64.9	a	12.4	bc	70.8	a	0.9	ab	2.5	80.6	ab
ND Riveland	64.2	abc	12.0	bc	69.3	a	0.6	ab	1.6	56.7	bcd
ND Stanley	64.9	a	12.4	bc	68.3	a	0.8	ab	1.8	63.9	abcd
Tioga	64.1	abcd	12.4	bc	68.0	a	0.9	ab	1.7	52.8	cd
ANOVA (α<0.05)	<0.0001		<0.0001		<0.0001		0.0047		NS	0.0291	

Table 3. Effect of variety on grain quality, yield and foliar disease.

CDC Vantta had the lowest foliar disease incidence, but yield and test weight were also the lowest among the varieties tested (Table 3). Foliar disease incidence for ND Riveland and Tioga were not significantly different from CDC Vantta, and was lower than the other varieties tested. These varieties had higher yield and test weight compared to CDC Vantta. Alkabo had the lowest DON among the varieties tested at this location, but was only significantly lower than AAC Spitfire and CDC Vantta.

Conclusions

Management of head scab in durum requires an integrated approach. Selection of a variety with improved scab resistance such as ND Riveland or CDC Defy, along with timely application of fungicides, will provide the best control. These data show that application of fungicide at flowering for control of head scab provides a benefit for foliar disease management as well, reducing disease incidence and severity on the flag leaf. While there was no effect on yield under these conditions, under heavy foliar disease pressure this practice along with selection of a variety with improved foliar disease resistance will maximize yield.

Crop Rotation for Management of Lentil Root Rot

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Destiney Haug, Matt Obergfell, and Marguerite Wheeler

This study was funded by the ND Department of Ag Specialty Crop Block Grant Program

Introduction

Root rot of lentil is a significant constraint to yield and can be caused by several soil-borne pathogens. The oomycete or water mold pathogen *Aphanomyces euteiches* is extremely aggressive and can cause complete plant death. The fungal genus *Fusarium*, of which several species can be pathogenic on lentil, can also cause yield loss and may occur together with Aphanomyces. Both Aphanomyces root rot and Fusarium root rot occur in the lentil production regions of North Dakota. Late planting into warm soils, combined with wet soil conditions will increase potential yield loss to root rot. There are no varieties available today that provide root rot resistance and seed treatments are largely ineffective. The primary means by which root rot is controlled is by increasing the rotation length between the planting of host crops which are susceptible to Aphanomyces root rot (peas, lentils, dry beans, and alfalfa). Some growers have also adopted the practice of intercropping (growing two crops in the field at the same time) to minimize the financial risk of yield loss to root rot, as the secondary crop will grow in areas of the field where disease is severe. Whether this practice also reduces the severity of lentil root rot has yet to be determined. The goal of this study was determine the rotation length needed to reduce root rot severity and yield loss in lentil, and evaluate the practice of intercropping lentil with mustard.

Methods

The trial was set up in a randomized complete block design, with 30 x 40 ft. plots and four replicates. The field site selected is in long term no-till (> 10 years) and has a history of root rot from when peas were planted in 2016. The study area was planted to safflower in 2017 and the crop rotation treatments were initiated in 2018. Treatments are listed below:

- Lentil/Durum (L/D)
- Lentil + Mustard/Durum (L+M/D)
- Lentil/Durum/Barley (L/B/D)
- Lentil/Durum/Barley/Durum (L/D/B/D)
- Lentil/Durum/Canola/Durum (L/D/C/D)

In 2022, lentils (var. Avondale) were planted on 5/25/22 at a seeding rate of 70 lb/ac. No seed treatment was applied. The intercrop plots were planted on the same day at the full rate of lentils, plus a half rate of yellow mustard (var. Tilney) at 2.5 lb/ac. Durum (var. ND Riveland at 100 lb/ac), barley (var. ND Genesis at 100 lb/ac) and canola (InVigor L233P at 5 lb/ac) were seeded on 5/18, 5/15 and 5/25 respectively. With the exception of the canola, no seed treatments were applied.

Root rot was assessed on 30 plants per plot (5 plants x 6 locations in the plot) at early flowering. Root rot was rated on a 0 to 5 severity scale where 0 = no disease/white root and 5 = completely black root/dead plant. The lentil and lentil-mustard intercrop were desiccated pre-harvest and harvested on August 15th. Durum, barley and canola were harvested on August 26th.

Results and Discussion

There was no difference in root rot incidence (percent of plants with root rot symptoms) in the two, three and four year rotations (**Figure 1**). Intercropping mustard with lentil within a two year rotation with durum (L+M/D) did not reduce root rot incidence compared with the monocropped lentil in the two year rotation (L/D. The four year rotation with barley (L/D/B/D) resulted in reduced root rot incidence compared to the four year rotation with canola (L/D/C/D) (**Figure 1**).

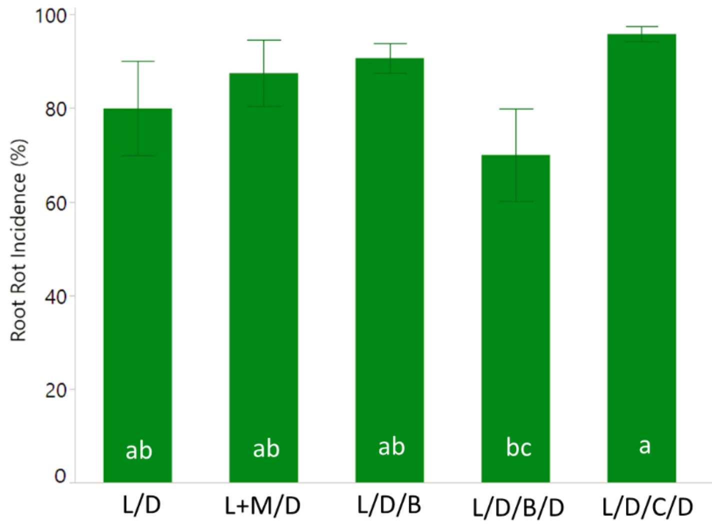

Figure 1. Root Rot incidence in crop rotation treatments. Root rot incidence was determined by dividing the total number of plants with root rot by the number of plants evaluated (30) and multiplying by 100. Levels not connected by the same letter are significantly different as determined by Student's t multiple comparison of means ($\alpha < 0.05$)

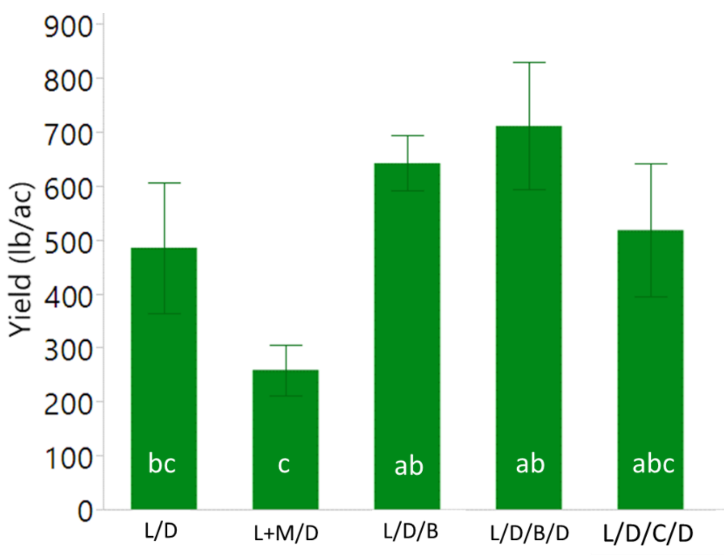

Figure 2. Lentil yield across crop rotation treatments. Levels not connected by the same letter are significantly different as determined by Student's t multiple comparison of means ($\alpha < 0.05$)

Lentil yield decreased with increasing levels of root rot ($R^2 = 0.31$, $p = 0.0049$). Yield was lowest in the lentil-mustard intercrop treatment, although not significantly different from the two year rotation with monocropped lentils or the four year rotation with canola (**Figure 2**). The intercrop treatment also yielded 150 lb/ac of mustard.

Conclusions

Late planting led to high levels of root rot in this study and in grower lentil fields. To reduce root rot and increase lentil yield it will be necessary to increase rotations out further than four years apart. There may also be a crop sequence effect on root rot (**Figure 1**), but further studies are needed to confirm these results.

Intercropping with mustard decreased lentil yield, however, high market prices for mustard ($0.75/lb) resulted in higher revenue for this treatment ($196/ac) compared to lentil alone in a two year rotation ($155/ac) based on a market price of $0.32 lb/ac for lentil. The added cost of fertilizer and potential for weed management issues should be taken into account when seeking to adopt this practice as a root rot management tool.

Effect of Seed Treatments on Nodulation and Yield in Chickpea

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This study was funded by the USDA-NIFA Pulse Crop Health Initiative.

Introduction

Chickpea is highly susceptible to soil-borne seed rotting and seedling blight pathogens including the oomycetes in the *Pythium* genus as well as fungal pathogens *Rhizoctonia solani* and species of *Fusarium*. These pathogens reduce stand counts and can cause plant death shortly after emergence. Seed treatments that include the active ingredient metalaxyl, mefenoxam or ethaboxam are effective for management of *Pythium* and are 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.

Methods

The trial was set up in a randomized complete block design, with 5 x 25 ft. plots and five replicates. The field sites selected had no history of chickpea production and have 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, non-fungicide treated plots (treatment 1) received rhizobial inoculum. In 2021, a liquid inoculum was used (Primo, Verdesian), which was applied directly to the seed immediately prior to planting. In 2022, granular inoculum (Primo GX2, Verdesian) was applied at planting with the seed in-furrow. In 2021, the trial was planted April 22nd when soil temperature was 48°F. In 2022, the trial was plated on May 5th when the soil temperature was 57°F. Plant population was assessed 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 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. The trials were desiccated pre-harvest and harvested on August 17th in 2021 and August 19th in 2022.

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 and Discussion

In both study years, stand count was lowest in the no fungicide and Mertect 340F treatments (Table 2). Mertect does not include an active ingredient for control of Pythium seed rot so this suggests that *Pythium* was causing disease in this trial. Stand counts were also lower in the Intego Solo treatment, compared to the other products tested (Table 2). There was no effect of seed treatment on root rot.

There was no effect of seed treatment on nodulation in either study year whether a liquid or granular inoculant formulation was used. In 2021, nodulation was very low. Drought conditions likely impacted this result as the seed was planted into dry soil, and a significant rainfall event did not occur until 16 days after planting. Rhizobial survival under these conditions were likely impacted, resulting in reduced nodulation. Despite a lack of field history of chickpea, the non-inoculated plots had an average of 50 nodules/plant in 2022. Precautions were taken to avoid cross contamination by seeding the un-inoculated plots first, so either those precautions were in sufficient or the study area had populations of rhizobia already present that were capable of nodulating chickpeas.

In 2021, yield was greatly reduced where no seed treatment was used, but not significantly different among the different seed treatment products. Yield data in 2022 showed a similar numerical trend, but in this case there was no significant difference among any of the treatments. Stand count was significantly correlated with yield in both study years ($p < 0.002$) and overall stand counts were higher in 2022. *Pythium* is generally less problematic in warmer soils, thus the difference in soil temperatures at seeding may explain the lack of statistical separation among the treatments in 2022.

Treatment	Stand Count (Plants/ft^2)				Root Rot (0-5)		Nodule #		Yield (lb/ac)		
	2021		2022		2021	2022	2021	2022	2021		2022
No fungicides, non-inoculated	0.2	e	3.0	d	2.36	2.0	0.96	50.3	157	b	1822
No fungicides, inoculated	0.3	e	3.4	d	2.48	1.8	0.10	64.7	270	b	1788
Mertect 340F	1.0	de	3.6	cd	1.90	1.5	0.68	67.2	849	a	2023
Intego Solo	1.9	cd	3.8	bcd	1.72	1.6	2.02	70.2	867	a	2019
Rancona CTS	3.0	abc	4.8	a	1.78	1.6	2.64	65.8	944	a	2152
Obvius	1.8	cd	4.8	ab	1.86	1.7	2.10	74.0	964	a	2342
Allegiance	2.3	bcd	4.6	abc	2.32	1.7	0.14	69.9	989	a	2007
Cruiser Maxx Vibrance Pulses	3.3	ab	4.5	abc	2.28	1.8	0.74	63.1	1079	a	2111
Vibrance Maxx	3.6	ab	5.1	a	1.96	1.7	0.74	73.8	1099	a	2074
Vibrance Maxx Pulses	3.7	a	4.8	ab	2.06	1.5	1.08	75.2	1113	a	2225
Apron Maxx RTA	2.6	abc	5.0	a	1.94	1.8	1.06	67.5	1152	a	2063
ANOVA ($\alpha <$ 0.05)	< 0.0001		< 0.0001		NS	NS	NS	NS	< 0.0001		0.0597

Table 2. Results of 2021 and 2022 chickpea seed treatment trial. Inoculation refers to rhizobial inoculation. Statistical significance determined by ANOVA ($\alpha < 0.05$). Means followed by a common letter are not significantly different as determined by Tukey's HSD ($\alpha < 0.05$).

Fungicide Tank Mixes for Ascochyta Blight Management in Chickpea

Audrey Kalil, Michael Wunsch, John Teixeira, Edson Ncube, Marguerite Wheeler, Destiney Haug, Lauren Holman, Tyler Tjelde, Justin Jacobs, and Andrina Turnquist

Funding Provided by the ND Department of Agriculture Specialty Crop Block Grant Program

Introduction

A study was initiated at the WREC Nesson Valley Irrigated Research site to evaluate fungicides for control of Ascochyta Blight in chickpea. Previous research has found that tank mixing Proline® with Bravo Weather Stik® (active ingredient chlorothalonil) improves Ascochyta blight suppression. This study compared tank mixing Proline at different rates with Bravo Weather Stik®, as well as the generic versions of chlorothalonil, Praiz® and Equus® 720 to confirm these findings.

Study Description

The study was a randomized complete block design with 5 ft x 22 ft plots, 6 replicates per treatment. The trial was planted May 10th (var. Orion). Border plots were inocluated June 20th with one handful each of overwintered chickpea residue. Study treatments are listed in Table 1. Foliar fungicide applications were made on the following dates (40 PSI, 15 gal/ac water, NIS @ 0.25% v/v): June 24th at the R1 growth stage, July 8th at the R3 growth stage, July 21st at the R5 growth stage and August 5th at the R6 growth stage. Ascochyta disease assessments were made July 1st, July 6th, July 22nd, August 3rd and August 16th by determining the percent of the crop canopy exhibiting disease at three locations per plot (front, middle and back).

Study Treatments

Table 1. Foliar fungicide treatments

Treatments	Description	Active Ingredients
1	Non-treated	Chlorothalonil (M5)
2	Bravo WS 1.38 pt/ac	Chlorothalonil (M5)
3	Bravo WS 2 pt/ac	Chlorothalonil (M5)
4	Proline 5 fl oz/ac	Prothioconazole (3)
5	Proline 5.7 fl oz/ac	Prothioconazole (3)
6	Bravo WS 1.38 pt/ac + Proline 5 fl oz/ac	Chlorothalonil (M5) + Prothioconazole (3)
7	Bravo WS 1.38 pt/ac + Proline 5.7 fl oz/ac	Chlorothalonil (M5) + Prothioconazole (3)
8	Bravo WS 2 pt/ac + Proline 5 fl oz/ac	Chlorothalonil (M5) + Prothioconazole (3)
9	Bravo WS 2 pt/ac + Proline 5.7 fl oz/ac	Chlorothalonil (M5) + Prothioconazole (3)
10	Praiz 1.38 pt/ac + Proline 5.7 fl oz/ac	Chlorothalonil (M5) + Prothioconazole (3)
11	Equus 720 1.38 pt/ac + Proline 5.7 fl oz/ac	Chlorothalonil (M5) + Prothioconazole (3)

Results

Disease pressure was extremely high in the study. In the non-treated plots, 91% of the canopy was affected by Ascochyta blight symptoms by August 16th (Table 2). The tank mixes all performed better than either Bravo WS or Proline alone and neither of these products alone were sufficient to control disease under such intense disease pressure (Figure 1, Table 2).

Under moderate to severe Ascochyta blight pressure, tank mixing proline with chlorothalonil provided vastly superior control compared to proline alone. This was regardless of whether Bravo Weather Stik, Praiz or Equus 720 was the tank mix partner (Table 2). In a tank mix, there did not appear to be a reduction in disease control with the rate of proline was reduced from 5.7 to 5 fl oz/ac. There was also no benefit to increasing the rate of Bravo WS from 1.38 to 2 pt/ac. While disease was reduced by the tank mix, it was not eliminated entirely, as Ascochyta severity was still above 50% in the tank mix treatments (Table 2: August 16th).

Untreated | Proline 5.7 fl/oz | Bravo WS 1.38 pt/ac + Proline 5.7 fl/oz

Figure 1. Plot photos taken July 21st, 2022

Table 1. Ascochyta blight severity and yield data. Differences among treatments are indicated by different letters as determined by Tukey s HSD multiple comparison of means 0.0 .

Trt	Description	Ascochyta Severity (%) 7/8	Ascochyta Severity (%) 7/22	Ascochyta Severity (%) 8/3	Ascochyta Severity (%) 8/16	Yield (lb/ac)
1	Non-treated	16.1 a	65.3 a	70.8 a	91.2 a	58 c
2	Bravo WS 1.38 pt/ac	10.6 ab	32.0 c	62.8 ab	82.8 ab	202 c
3	Bravo WS 2 pt/ac	9.7 b	28.3 c	55.8 b	81.7 ab	302 c
4	Proline 5 fl oz/ac	11.4 ab	43.1 b	64.5 ab	75.9 bc	224 c
5	Proline 5.7 fl oz/ac	10.8 ab	41.4 b	67.5 ab	77.5 b	238 c
6	Bravo WS 1.38 pt/ac + Proline 5 fl oz/ac	7.2 b	16.7 d	39.2 c	59.5 de	1320 ab
7	Bravo WS 1.38 pt/ac + Proline 5.7 fl oz/ac	7.0 b	16.7 d	37.8 c	61.4 de	1374 ab
8	Bravo WS 2 pt/ac + Proline 5 fl oz/ac	6.4 b	16.4 d	37.5 c	58.9 de	1676 ab
9	Bravo WS 2 pt/ac + Proline 5.7 fl oz/ac	7.5 b	14.2 d	37.0 c	55.3 de	1940 a
10	Praiz 1.38 pt/ac + Proline 5.7 fl oz/ac	6.1 b	18.3 d	42.8 c	66.1 cd	1168 b
11	Equus 720 1.38 pt/ac + Proline 5.7 fl oz/ac	7.0 b	17.0 d	38.0 c	54.2 e	1493 ab
	ANOVA or Wilcoxon test (α< 0.05) p -value	0.0012	< 0.0001	< 0.0001	< 0.0001	< 0.0001

Conclusions

Frequent rainfall events in July and August increase risk of severe Ascochyta blight risk. Adoption of this tank mix under such conditions will improve Ascochyta blight management. Growers should combine the use of this tank mix with other management approaches including crop rotation (3-4 years), avoiding planting chickpeas near last season’s chickpea stubble and rotating fungicide active ingredients. Ascochyta blight is a very aggressive disease, and requires an integrated pest management (IPM) approach.

Intercropping Demonstration Update: Crosby, ND

Justin Jacobs, NDSU – Williston Research Extension Center

INTRODUCTION

Intercropping is an agricultural concept that is gaining more interest and acceptance in recent years. The primary push behind intercropping is the search for agricultural practices that are more soil health focused. Intercropping is not a new concept and its origin can be traced to ancient Roman and Native American cultures. Modern examples of intercropping include the use of two crops grown together as a hay or forage crop. However, the use of intercropping for grain production is a concept that is relatively new. Researchers at the Carrington Research and Extension Center experimented with combinations such as flax and wheat, and lentil and wheat, for grain production during the 1990s. Neither of these combinations showed an advantage above monocropping, so the idea lost interest. However recently, multiple North Dakota Research and Extension Centers have been working with intercrop combinations such as pea and canola, chickpea and flax, and lentil and mustard and, unlike the 1990 combinations, these projects have yielded favorable data and promising outlooks, however there are still questions to be answered about intercropping. What crops can be successfully intercropped together and what are the benefits and advantages for the producer.

	Legume Yield	Oilseed Yield	Combined Yield	Legume LER	Oilseed LER	Combined LER
	------------------(bu/a)--------------------			---------------------(%)----------------------		
4 lb Canola	-	36.6†	36.6	-	1.000	1.00
30 lb Flax	-	20.0†	20.0	-	1.000	1.00
8 lb Mustard	-	17.0†	17.0	-	-	1.00
90 lb Lentil	20.4†	-	20.4	1.000	-	1.00
45 lb Lentil & 3 lb Canola	25.2	15.4	40.6	1.236	0.421	1.66
45 lb Lentil & 2 lb Canola	18.0	17.4	35.4	0.885	0.476	1.36
60 lb Lentil & 2 lb Canola	20.3	14.4	34.7	0.997	0.393	1.39
60 lb Lentil & 3 lb Canola	11.4	16.7	28.1	0.557	0.457	1.01
60 lb Lentil & 7.5 lb Flax	20.7	14.0	34.6	1.014	0.699	1.71
45 lb Lentil & 7.5 lb Flax	23.8	9.0	32.9	1.170	0.452	1.62
60 lb Lentil & 15 lb Flax	9.5	10.8	20.3	0.466	0.540	1.01
45 lb Lentil & 15 lb Flax	5.6	8.8	14.4	0.273	0.442	0.72
45 lb Lentil & 5 lb Mustard	20.1	10.3	30.4	0.985	0.608	1.59
60 lb Lentil & 4 lb Mustard	19.1	3.7	22.8	0.938	0.216	1.15
45 lb Lentil & 4 lb Mustard	15.5	6.2	21.7	0.761	0.365	1.13

† Average Yields were obtained from NDSU Extension publication EC1657, Projected 2022 Crop Budgets: North West North Dakota.

Table 1. Lentil yields with canola, flax, and mustard combinations.

	Legume Yield	Oilseed Yield	Combined Yield	Legume LER	Oilseed LER	Combined LER
	------------------(bu/a)--------------------			---------------------(%)----------------------		
4 lb Canola	-	36.6†	36.6	-	1.000	1.00
30 lb Flax	-	20.0†	20.0	-	1.000	1.00
8 lb Mustard	-	17.0†	17.0	-	-	0.00
180 lb Dry Pea	33.0†	-	33.0	1.000	-	1.00
90 lb Dry Pea & 3 lb Canola	22.0	17.3	39.3	0.667	0.471	1.14
90 lb Dry Pea & 2 lb Canola	20.6	15.8	36.3	0.623	0.430	1.05
120 lb Dry Pea & 2 lb Canola	13.2	19.9	33.1	0.400	0.543	0.94
120 lb Dry Pea & 3 lb Canola	16.9	9.1	26.1	0.513	0.249	0.76
120 lb Dry Pea & 7.5 lb Flax	32.2	6.2	38.4	0.977	0.311	1.29
90 lb Dry Pea & 15 lb Flax	15.0	20.6	35.6	0.455	1.031	1.49
90 lb Dry Pea & 7.5 lb Flax	24.6	10.0	34.6	0.745	0.500	1.24
120 lb Dry Pea & 15 lb Flax	18.6	-	18.6	0.563	-	0.56
120 lb Dry Pea & 4 lb Mustard	22.6	23.0	45.6	0.686	1.351	2.04
90 lb Dry Pea & 4 lb Mustard	23.0	15.3	38.3	0.697	0.898	1.60
90 lb Dry Pea & 5 lb Mustard	26.0	11.3	37.3	0.788	0.663	1.45
120 lb Dry Pea & 5 lb Mustard	22.1	14.1	36.2	0.670	0.828	1.50

† Average Yields were obtained from NDSU Extension publication EC1657, Projected 2022 Crop Budgets: North West North Dakota.

Table 2. Dry Pea yields with canola, flax, and mustard combinations.

MATERIALS AND METHODS

In 2022, a demonstration trial was planted in Crosby, North Dakota with the partnership of the Divide County Soil Conservation District. The intent of this trial was to evaluate multiple planting combinations of legume and oilseed crops. A total of 48 intercrop combinations were tested, along with 7 monocrops. The four legume crops grown were: dry yellow pea, green lentil, chickpea, and soybean, and three oilseed crops: canola, flax, and mustard. Within all intercropping combinations, each component crop was tested at two different seeding rates, resulting in four different seeding rate combinations for each pairing. These non-replicated strip trial plots measured 5 feet wide by 100 feet long. In intercropping, it is important to choose a primary and secondary crop in order to assist in decision making for in-season management. In this trial, the legume crops were the primary crops and the oilseed crops the secondary crops. In a mixed-grain intercropping system it is important to pair crops that can be planted at the same time, managed similarly during the growing season, harvested at the same time, and capable of being separated post-harvest. The trial in Crosby was planted on June 2 using a no-till research plot seeder. The trial was planted into the standing wheat stubble. The plot area was sprayed with Roundup® prior to planting. No fertilizers or in-season herbicides were applied to the trial. Emergence notes were taken on the plots and photos taken at two different growth stages of the trial. Root samples were taken and examined at two different dates and observations were made on the nodulation of the legume crops and the interaction of root systems within each intercrop combination. The trial was harvested September 27 using a plot combine, and the harvested samples were separated and yields were taken on each crop.

Crop	Economic Value
Dry Pea	$9 per bushel
Lentil	$0.22 per pound
Canola	$0.25 per pound
Flax	$13.7 per bushel
Mustard	$0.45 per pound

Table 3. Estimated economic return values based on crop

RESULTS

In the 2022 trial, the soybean and chickpea had poor emergence which allowed kochia to take over the plots thus, pairings involving either of those crops were abandoned. Also, as a result of the kochia presence in the trial, all monocropped plots displayed low yields compared to the intercropped plots. When assessing metrics such as Land Efficiency Ratio (LER) and Gross Return, the monocrop yields used in the data set were obtained from NDSU Extension Publication EC1657, Projected 2022 Crop Budgets: North West North Dakota. All yields in the intercrop scenarios were calculated after separation of the two crops from the harvested sample. LER is a measure used in an intercropping system to measure the overall efficiency of two crops grown together on one field. A monocrop grown by itself has a value of 1.00 or 100% efficient. The LER value of an intercrop is calculated by taking the yield of the first component crop in an intercrop and dividing it by the yield of the respective monocrop. The yield of the second component crop is also divided by the yield of its respective monocrop, and then is added to the result of the first component crop. The goal in an intercrop system is to achieve a LER value greater than 1.00. The results from trial in Crosby showed all but four of the lentil (Table 1) and dry pea (Table 2) treatments had a LER value greater than 1.00. When observed separately, a reduction in yield is seen in each of the component crops, however the yield reduction in each component crop is made up for with the yield of the second component crop. It is important to remember these numbers are based on a one-year, single environment, non-experimental design data set. When the samples were harvested in September, each component crop had reached maturity, however an exact date of maturity was not recorded. No noticeable loss was observed on the ground prior to harvest. In addition to measuring the efficiency of the intercrop treatments in the trial, the estimated gross return values for each intercrop treatment were calculated. The estimated crop return prices (Table 3) were obtained using the NDSU Extension Publication EC1657, Projected 2022 Crop Budgets: North West North Dakota. Potential gross returns values for the intercrop treatments were calculated based on yield and the previously mentioned economic values. This is an estimated gross value and does not consider the cost of production. It is difficult to calculate a net return on an

	Legume Gross Return	Oilseed Gross Return	Combined Gross Return
	---------------------$/a------------------------		
4 lb Canola	-	457.50	457.50
30 lb Flax	-	274.00	274.00
8 lb Mustard	-	382.50	382.50
90 lb Lentil	268.95	-	268.95
45 lb Lentil & 3 lb Canola	332.47	192.73	525.20
45 lb Lentil & 2 lb Canola	238.00	217.69	455.69
60 lb Lentil & 2 lb Canola	268.10	179.76	447.86
60 lb Lentil & 3 lb Canola	149.82	209.30	359.12
60 lb Lentil & 7.5 lb Flax	272.83	191.42	464.25
45 lb Lentil & 7.5 lb Flax	314.68	123.73	438.41
60 lb Lentil & 15 lb Flax	125.21	147.98	273.20
45 lb Lentil & 15 lb Flax	73.48	121.11	194.58
45 lb Lentil & 5 lb Mustard	264.79	232.54	497.33
60 lb Lentil & 4 lb Mustard	252.16	82.68	334.85
45 lb Lentil & 4 lb Mustard	204.69	139.68	344.37

Table 4. Gross Return values for lentil

	Legume Gross Return	Oilseed Gross Return	Combined Gross Return
	---------------------$/a------------------------		
4 lb Canola	-	457.50	457.50
30 lb Flax	-	274.00	274.00
8 lb Mustard	-	382.50	382.50
180 lb Dry Pea	297.00	-	297.00
90 lb Dry Pea & 3 lb Canola	198.10	215.65	413.75
90 lb Dry Pea & 2 lb Canola	185.16	196.91	382.07
120 lb Dry Pea & 2 lb Canola	118.86	248.47	367.33
120 lb Dry Pea & 3 lb Canola	152.45	114.00	266.45
120 lb Dry Pea & 7.5 lb Flax	290.05	85.23	375.29
90 lb Dry Pea & 15 lb Flax	135.05	282.44	417.48
90 lb Dry Pea & 7.5 lb Flax	221.39	136.88	358.27
120 lb Dry Pea & 15 lb Flax	167.22	-	167.22
120 lb Dry Pea & 4 lb Mustard	203.72	516.60	720.32
90 lb Dry Pea & 4 lb Mustard	207.08	343.45	550.53
90 lb Dry Pea & 5 lb Mustard	234.11	253.75	487.87
120 lb Dry Pea & 5 lb Mustard	198.97	316.59	515.56

Table 5. Gross Return values for dry pea

intercrop because of many factors. It should be noted that the cost of producing an intercrop has multiple input costs that can be reduced. One example is in the production of canola when intercropped with dry pea; research has shown that an acceptable canola crop can be produced with a lower rate of fertilizer and reduced seeding rate when grown with dry pea. To read more about the previous study see “Improving Efficiency Using Intercropping”, pages 98 & 99, *in* NDSU WREC / MSU EARC 2019 Agricultural Research Update. In order to understand the potential for increased returns in an intercrop system, it is easiest to compare growing one acre of each of the two crops monocropped compared to growing two acres of these two crops intercropped. These comparisons can be seen in Tables 6 and 7. The returns listed in these tables can be correlated to the yields seen in Tables 1 and 2. Tables 4 and 5 separates the estimated gross returns into the projected return from the legume crop and projected return from the oilseed crop. When observing the data set, and using the projected economic values from 2022, it was more profitable to grow two acres of an intercrop opposed to growing one acre each of the component monocrops. Based on the economics for the 2022 season, the oilseed crops were more profitable than the leguminous crop in the intercrop scenarios. Therefore, in the case of this current season, it was favorable to grow combinations with a greater oilseed population.

As was mentioned, root samples were taken and observed on two dates throughout the growing season. Several interesting phenomena were observed. One was the lentil and dry pea samples had greater nodulation than the soybean and chickpea samples. Another was the overall root mass of the intercropped treatments was greater than in the monocropped treatments. Also, a large number of earthworms were seen in multiple samples. One sample of lentil and mustard had observable fungal hyphae growing between the two root systems.

CONCLUSION

Image 1. Dry Pea at 90 pounds per acre with 4 pounds per acre of mustard

What will it take to make intercropping a regular practice in agriculture, there are still many unanswered questions and one of the more prominent questions tends to be, which crops can be intercropped. This demonstration trial sought to begin to answer this question. While results may vary year to year and from environment to environment, there have been some good observations made on the compatibility of intercropping a legume and oilseed crop. The goal is to repeat this trial in the future to have useable data from chickpea and soybean. One of the drawbacks in an intercrop system is the lack of herbicide options when growing two crops together. This makes a successful pre-emergent herbicide all the more important. When considering intercropping soybean, it may be an advantage to pair the herbicide traits of both crops in order to improve the weed control in the intercrop system. Other studies have revealed advantages to intercropping that were not observed in this trial. For example, previous research has shown that intercropping chickpea and flax together has shown an observable decrease in ascochyta blight on chickpea. Read more about this study in “Chickpea and Flax Intercropping”, pages 17 & 18 *in* 2019 NDSU Carrington Research Extension Annual Report. It is unknown what other observations may be made with combinations of other oilseeds with chickpea. As the interest and implementation of intercropping increases, so will our understanding of how to make this an implementable practice. As we investigate further into intercropping, more avenues in adoption of intercropping become visible.

Image 2. Root system of intercropped dry pea with canola.

	Acre 1	Acre 2	Acre 1 + Acre 2	Difference
Lentil Mono + Canola Mono	$ 268.95	$ 457.50	$ 726.45	$ -
45 lb Lentil & 3 lb Canola	$ 525.20	$ 525.20	$ 1,050.41	$ 323.96
45 lb Lentil & 2 lb Canola	$ 455.69	$ 455.69	$ 911.38	$ 184.93
60 lb Lentil & 2 lb Canola	$ 447.86	$ 447.86	$ 895.72	$ 169.27
60 lb Lentil & 3 lb Canola	$ 359.12	$ 359.12	$ 718.25	$ (8.20)
Lentil Mono + Flax Mono	$ 268.95	$ 274.00	$ 542.95	$ -
60 lb Lentil & 7.5 lb Flax	$ 464.25	$ 464.25	$ 928.51	$ 385.56
45 lb Lentil & 7.5 lb Flax	$ 438.41	$ 438.41	$ 876.82	$ 333.87
60 lb Lentil & 15 lb Flax	$ 273.20	$ 273.20	$ 546.39	$ 3.44
45 lb Lentil & 15 lb Flax	$ 194.58	$ 194.58	$ 389.17	$ (153.78)
Lentil Mono + Mustard Mono	$ 268.95	$ 382.50	$ 651.45	$ -
45 lb Lentil & 5 lb Mustard	$ 497.33	$ 497.33	$ 994.66	$ 343.21
45 lb Lentil & 4 lb Mustard	$ 344.37	$ 344.37	$ 688.74	$ 37.29
60 lb Lentil & 4 lb Mustard	$ 334.85	$ 334.85	$ 669.69	$ 18.24

Table 6. Economic analysis of Gross Return on lentil

	Acre 1	Acre 2	Acre 1 + Acre 2	Difference
Pea Mono + Canola Mono	$ 297.00	$ 457.50	$ 754.50	$ -
90 lb Dry Pea & 3 lb Canola	$ 413.75	$ 413.75	$ 827.51	$ 73.01
90 lb Dry Pea & 2 lb Canola	$ 382.07	$ 382.07	$ 764.14	$ 9.64
120 lb Dry Pea & 2 lb Canola	$ 367.33	$ 367.33	$ 734.65	$ (19.85)
120 lb Dry Pea & 3 lb Canola	$ 266.45	$ 266.45	$ 532.90	$ (221.60)
Pea Mono + Flax Mono	$ 297.00	$ 274.00	$ 571.00	$ -
90 lb Dry Pea & 15 lb Flax	$ 417.48	$ 417.48	$ 834.97	$ 263.97
120 lb Dry Pea & 7.5 lb Flax	$ 375.29	$ 375.29	$ 750.57	$ 179.57
90 lb Dry Pea & 7.5 lb Flax	$ 358.27	$ 358.27	$ 716.54	$ 145.54
120 lb Dry Pea & 15 lb Flax	$ 167.22	$ 167.22	$ 334.43	$ (236.57)
Pea Mono + Mustard Mono	$ 297.00	$ 382.50	$ 679.50	$ -
120 lb Dry Pea & 4 lb Mustard	$ 720.32	$ 720.32	$ 1,440.64	$ 761.14
90 lb Dry Pea & 4 lb Mustard	$ 550.53	$ 550.53	$ 1,101.07	$ 421.57
120 lb Dry Pea & 5 lb Mustard	$ 515.56	$ 515.56	$ 1,031.12	$ 351.62
90 lb Dry Pea & 5 lb Mustard	$ 487.87	$ 487.87	$ 975.73	$ 296.23

Table 7. Economic analysis of Gross Return on dry pea

Soybean Irrigation Trial under Semi-Arid Western ND

(Funding source: North Dakota Soybean Council)

Gautam Pradhan, PI
Tyler Tjelde, Co-PI
James Staricka, Co-PI

Background

In irrigated agriculture, the amount and the timing of irrigation play a crucial role in obtaining a sustainable higher yield with minimum adverse effects on the environment. Insufficient irrigation on critical growth stages results in lesser crop yield than the genetic potentiality of a given variety; and excess irrigation leads to higher pumping cost, quick depletion of water resources, leaching of nutrients, and environmental pollution. Soybean is the second largest irrigated crop in ND, however, there is a lack of information on the optimum amount and timing of irrigation of this crop for western ND.

Objectives

- The main objective of this project is to determine the optimum amount and timing of irrigation for enhanced soybean yield, quality, and water productivity.
- The secondary objectives are to assess the effect of irrigation treatments on the
    - soil health manifested by changes in soil physical and chemical properties, and
    - manifestation of soybean diseases including but not limited to white mold

Materials and Methods

- A glyphosate-tolerant soybean variety ND 17009GT was seeded at the Williston Research Extension Center, Nesson Valley Irrigation Site, Ray, ND (Longitude: -103.1069, Latitude: 48.1630) on May 27, 2022, under randomized complete block design with four replications. The seeding rate was 195,000 PLS/ac with Row to Row distance of 30 in and a gross plot size of 59’ X 50’.
- There were 12 irrigation treatments:

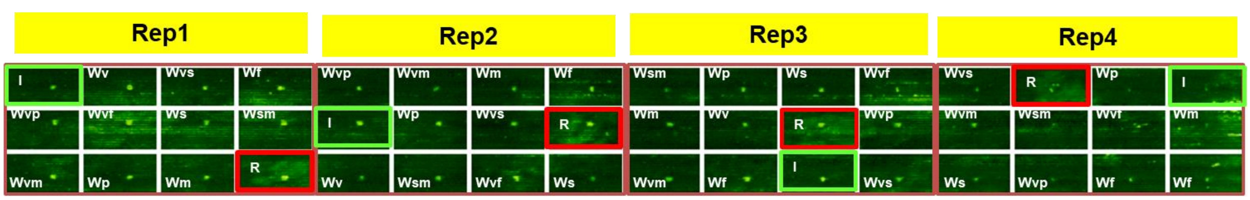
  I = Full irrigation; Wv = Deficit irrigation during vegetative [(VE – V(n)] stage; Wf = Deficit irrigation during flowering [R1-R2] stage; Wp= Deficit irrigation during pod development [R3-R4] stage; Ws = Deficit irrigation during seed filling [R5-R6] stage; Wm = Deficit irrigation during maturity [R7-R8] stage; Wvf = Deficit Irrigation during vegetative + flowering stages; Wvp = Deficit irrigation during vegetative + pod development stages; Wvs = Deficit irrigation during vegetative + seed filling stages; Wvm = Deficit irrigation during vegetative + maturity stages; Wsm = Deficit irrigation during seed filling + maturity stages; and R = rainfed.
- Soil water contents at six different depths (from 6” to 36”) were recorded 15 times from June 22 to September 6, 2022.
- Unmanned aircraft systems equipped with multispectral, thermal, or RGB cameras were flown over the experimental field at different dates to assess canopy temperature (CT), normalized difference vegetation index (NDVI), and normalized difference Red Edge (NDRE).
- At maturity, plant height was measured, biomass was collected, and the crop was harvested using a plot combine.

Preliminary results

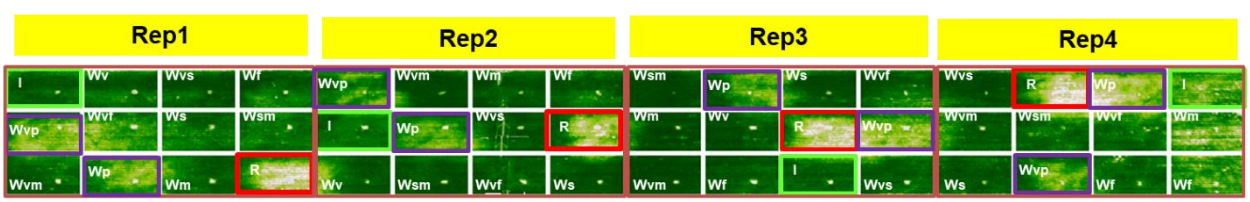
- The preliminary results from 2022 showed a significant difference among irrigation treatments for the NDVI of soybean.
- The NDVI imageries from August 19, 2022, showed a slight decrease in greenness in rainfed (R) plots compared to others (Figure 1A).
- The NDVI image collected on September 1, 2022, showed a marked decline in greenness in rainfed (R) plots and plots that had deficit irrigation during pod filling (Wp) and vegetative + pod filling (Wvp) stages (Figure 1B).
- The NDVI image collected on September 15, 2022, showed a marked decline in greenness in all the plots manifesting senescence of the soybean under all the treatments (Figure 1C). However, it is clear from the figure that the senescence occurred at a higher pace in rainfed (R) plots and plots that had deficit irrigation during pod filling (Wp) and vegetative + pod filling (Wvp) stages compared to others.
- This year, during the soybean vegetative stage, there were frequent and heavy rains. Therefore, although irrigation was not applied, soybean did not experience any drought at the vegetative stage, which is apparent from Fig.1A and B. For example, there was no difference for NDVI between Wf and Wvf, Wp and Wvp, Ws and Wvs, Wm and Wvm, and I and Wv.

Figure 1. NDVI of soybean under different irrigation treatments and dates.

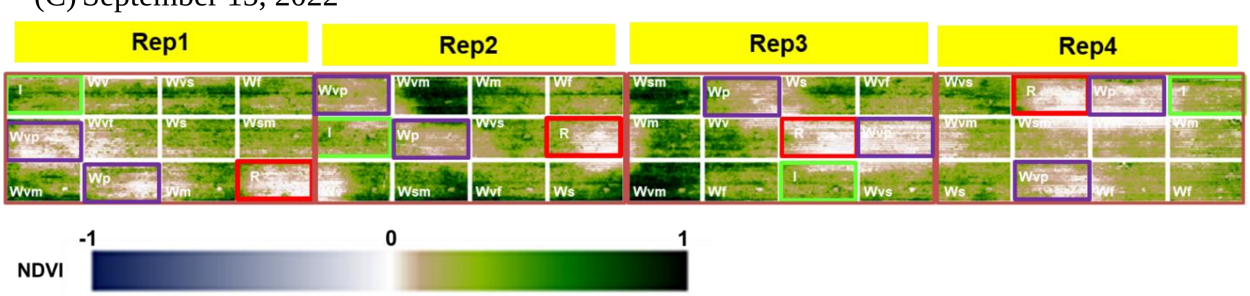
(A) August 19, 2022



(B) September 1, 2022

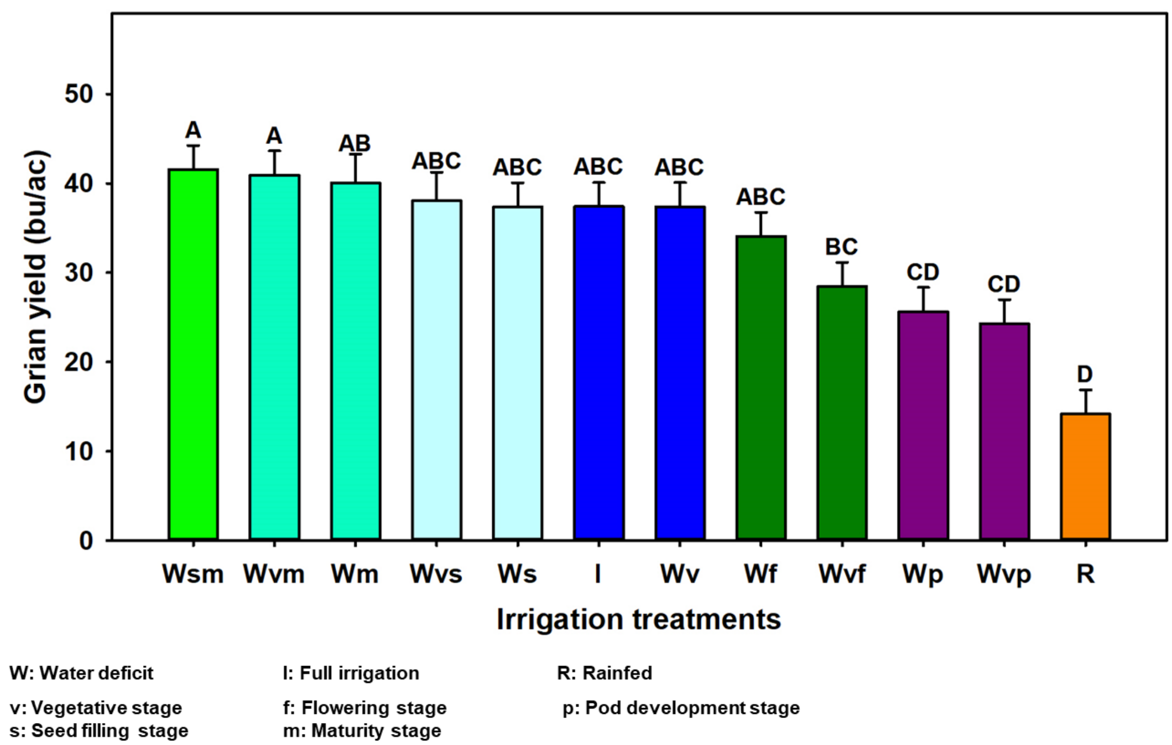


(C) September 15, 2022



- There was a significant effect of irrigation treatments on soybean grain yield. As clear from Figures 1B and C, Rep 4 showed a marked decline in greenness in all plots compared to plots under Rep 1 to 3 because of gopher damage. Therefore, we excluded yield data from Rep 4 in the statistical analysis.
- As mentioned for NDVI, because of frequent and heavy rains during the vegetative stage, there was no difference between Wm and Wvm, Wvs and Ws, I and Wv, Wf and Wvf, and Wp and Wvp for grain yield as well (Figure 2).
- The treatment Wsm produced the highest grain yield, which was statistically on par with other treatments: Wvm, Wm, Wvs, Ws, I, Wv, and Wf.
- A marked decline in yield occurred for treatments Wvf, Wp, Wvp, and R compared to Wsm and Wvm.

Figure 2. Soybean grain yield under different irrigation treatments.



Summary

- The preliminary data showed a possibility of saving irrigation water without any decrease in soybean grain yield, provided that the deficit irrigation does not occur at the flowering and pod development stages.

Irrigation Research at Nesson Valley 2022

Justin Jacobs, NDSU – Williston Research Extension Center

Weather Summary - Nesson Valley, ND+

	Precipitation		Temperature		
Month	2022	Avg‡	2022	Avg‡	Days above 89º
	---inches---		-------degrees Fº-------		
Oct-Dec. 2021	1.60	1.25			
April	1.15	0.73	32.9	40.2	0
May	6.94	2.36	52.9	53.5	0
June	2.50	2.92	62.8	63.6	1
July	2.43	2.13	70.0	69.7	7
August	0.16	1.37	70.2	67.5	10
September	0.42	1.97	60.9	58.0	4
April-July	13.02	8.14	54.6	56.8	8
April-Sept	13.60	11.49	58.3	58.8	22
Total- (Oct 2021 - September 2022)	15.21				

Last spring frost = May 2, 2022 (29.1°)

First fall frost = October 6, 2022 (26.2°)

+ NDAWN Hofflund site
‡ Average since January 1, 2006

After having experienced two dry years back to back in 2020 and 2021, we were hopeful that the script would be different for 2022. The beginning of 2022 started off with a bang and began by dumping somewhere close to 20 inches of snow and ice on us in April. And we all remember the damage it caused, and Nesson was no exception to that story. The highline poles along the county road were broken like simple toothpicks. And on top of the damage caused to infrastructure, the excess moisture created a problem for any hope of getting into the field early. As a result of these multiple delays, field work did not start until the first week of May. Despite, these early challenges, 2022 turned out to be a good year for trials at Nesson Valley.

As a result of the late start to field prep, including a war on kochia, the first trials (spring wheat and durum) did not get planted until May 17, and similar to 2021 the final trial (sunflower) was planted on June 1. A total of 19 trials were planted this year with 6 of them being breeding nurseries and 1 being an agronomic trial. Thirteen total crops were tested this year, including new trials with Lupin and Chickpea. Additionally, the malt barley trial was transitioned into a forage/feed barley trial. Compared to the year prior, there was an excellent increase in overall yields. We received more rainfall at the beginning of the season than we had in 2020 and 2021. However, it became dry towards the end of July and persisted through August and into a portion of September. While our first irrigation did not happen until June 27, we ran water until September 19. The rainfall amounted to roughly 13.5 inches during the growing season, which was a nice change compared to prior seasons. On top of the natural precipitation, an additional 15 inches of irrigation was applied across the farm. The early season crops received between 11 and 15 inches of irrigation, while the later maturing crops received nearly 18 inches of irrigation. Last year, 2021, was the first year that an off-station trial was hosted in the Trenton-Buford River Bottoms. That trial was once again planted in 2022, and the results from the corn and soybeans can be found in this publication.

Crop (# of varieties)	**2022 Average**	**Crop**	**2022 Average**
Spring Wheat (57)	**83 bu/a**	Dry Bean (23)	**2,070 lb/a**
Durum Wheat (24)	**84 bu/a**	Canola (12)	**2,580 lb/a**
Barley (24)	**91 bu/a**	Sunflower (15)	**3,311 lb/a**
Oat (7)	**167 bu/a**	Herbicide Tolerant Soybean (42)	**73 bu/a**
Corn (6)	**152 bu/a**	Conventional Soybean (30)	**62 bu/a**

Twenty twenty-two started as a difficult year, but resulted in some greater than expected yields for several of the trials. At the end of the year, 4 fall-seeded trials were planted. As always, if there are any research ideas that you think need to be looked at, please let us know.

Performance of Black Gram under No-till Rainfed Conditions of the Northern Great Plains

Gautam Prasad Pradhan, Saurabha Koirala, Mukhlesur Rahman, and Jerald Bergman

(Funding Agency: USDA-AMS/ND DoA)

Background

U.S.A. has been experiencing huge fluctuations in the acreage of lentils and peas. There is a need to diversify legume production for agricultural sustainability. Black gram is a specialty legume crop that has high nutritional, agricultural, and economic values.

Table 1. Nutritional, agricultural, and economic benefits of black gram.

Benefits	**Black gram (*Vigna mungo* L. Hepper)**
Human health	1. Improves Digestion. 2. Protects Heart. 3. Boosts Energy. 4. Improves Bone Health. 5. Strengthens Nervous System. 6. Helps Manage Diabetes. 7. Good for Skin and Hair.
Agricultural	1. Fixes nitrogen from the air into the soil. 2. Can be successfully grown under low moisture conditions. 3. Has a deeper root structure and greater foliage than peas and lentils, which successfully reduces soil erosion and effectively suppresses weeds.
Economic	USA is the 6th largest importer of Vigna beans ($62 million in 2020) in the world. Global market may increase from 6 billion lbs. in 2017 to 8 billion lbs. by 2023.

Black gram plant

Black gram grains

Objectives

- To evaluate the feasibility of growing and cultivating black gram in ND.
- To identify genotypes best adapted to the semiarid conditions of ND.

Materials and Methods

Twenty-one black gram accessions were seeded at the NDSU Williston Research Extension Center dryland research site (Latitude 48.12632; Longitude -103.738798) using a GPS based autosteered seven rows no-till plot seeder that maintained a row to row distance of 7”. The experimental design was alpha lattice with four replications. The experimental field was kept weed free by spraying Spartan Charge Herbicide @ 3.5 fl. oz/ac on 5/6/2022 and hand weeding whenever needed. 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, collected biomass, and hand harvested the crops. The harvested crops were air dried and processed using a laboratory thrasher. The data were analyzed using PROC GLIMMIX in SAS 9.4. The accessions were tested as fixed effects and Replication, Replication (Block) were treated as random effects. The LSMeans were separated at 0.5% level.

Table 2. Black gram accessions used in the experiment.

Accession #	Name	Accession #	Name	Accession #	Name
1	ND164441BG22	8	ND374134BG22	15	ND377396BG22
2	ND164727BG22	9	ND374135BG22	16	ND377397BG22
3	ND183462BG22	10	ND376871BG22	17	ND377406BG22
4	ND288602BG22	11	ND377387BG22	18	ND383310BG22
5	ND298910BG22	12	ND377390BG22	19	ND425187BG22
6	ND308573BG22	13	ND377391BG22	20	ND425189BG22
7	ND360949BG22	14	ND377394BG22	21	ND425190BG22

Preliminary results

The black gram accession showed significant differences in plant height, days to flowering, relative leaf chlorophyll content, cluster number, and grain yield. The plant height ranged from 13 to 28 cm. Accessions 2, 5, and 7 were the tallest plants, and accessions 14, 16, and 17 were the shortest ones (Fig. 1). Accessions 7 and 17 flowered in 49 days, whereas accessions 4 and 21 required 65 days to flower (Fig. 2). The relative chlorophyll content measured with an atLEAF chlorophyll meter, on August 16, 2022, showed that 17 out of 21 accessions had the statistically similar chlorophyll content, 47-53 atLEAF units; and the accession 3 had the lowest chlorophyll content, 29 atLEAF units (Fig. 3). The cluster number per plant varied from about nine for accessions 1, 3, 5, 11, 13, 20, and 21 to twenty for accession 19 (Fig. 4). The accessions 4 and 20 produced the lowest grain yield, <1 g per plant and the accession 14, 16, and 18 produced the highest grain yield, >4 g per plant (Fig. 5.).

Fig.1. Plant heights of black gram accessions under dryland no-till conditions.

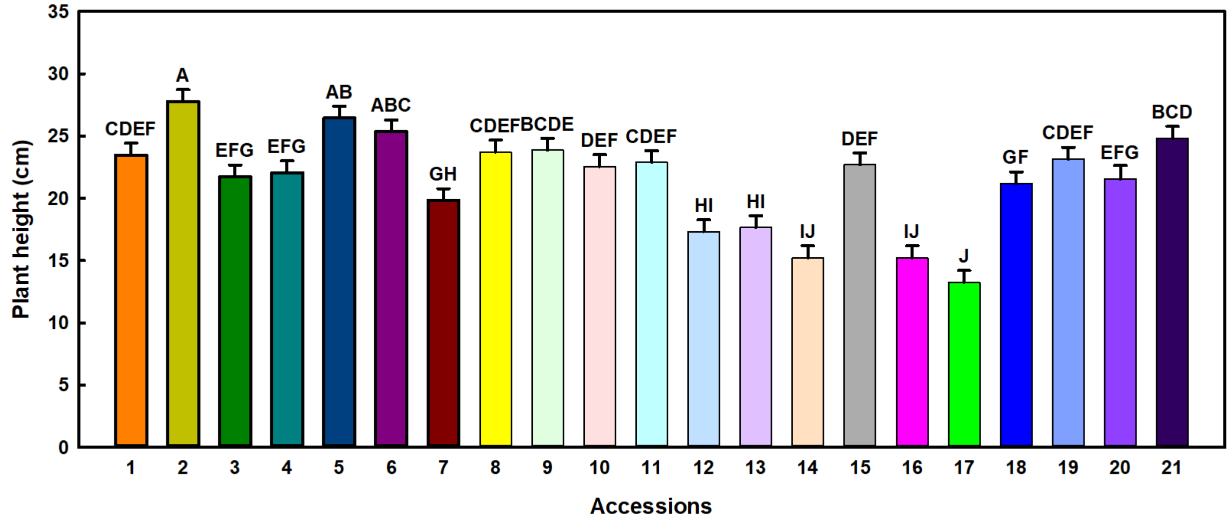


Fig. 2. Days to flowering of black gram accessions under dryland no-till conditions.

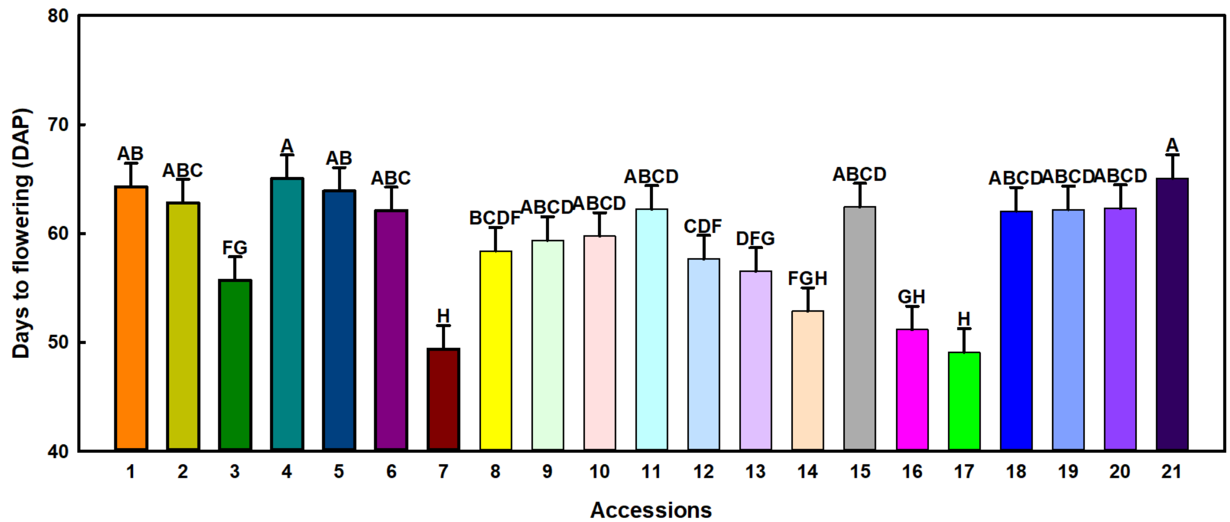


Fig. 3. Relative chlorophyll content of black gram accessions under dryland no-till conditions.

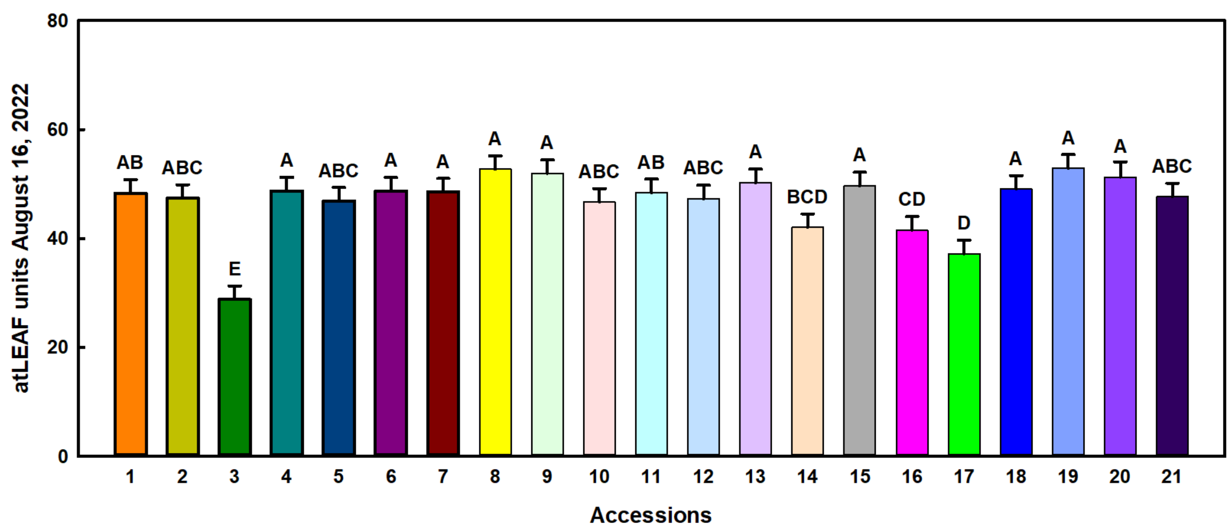


Fig. 4. Cluster number of black gram accessions under dryland no-till conditions.

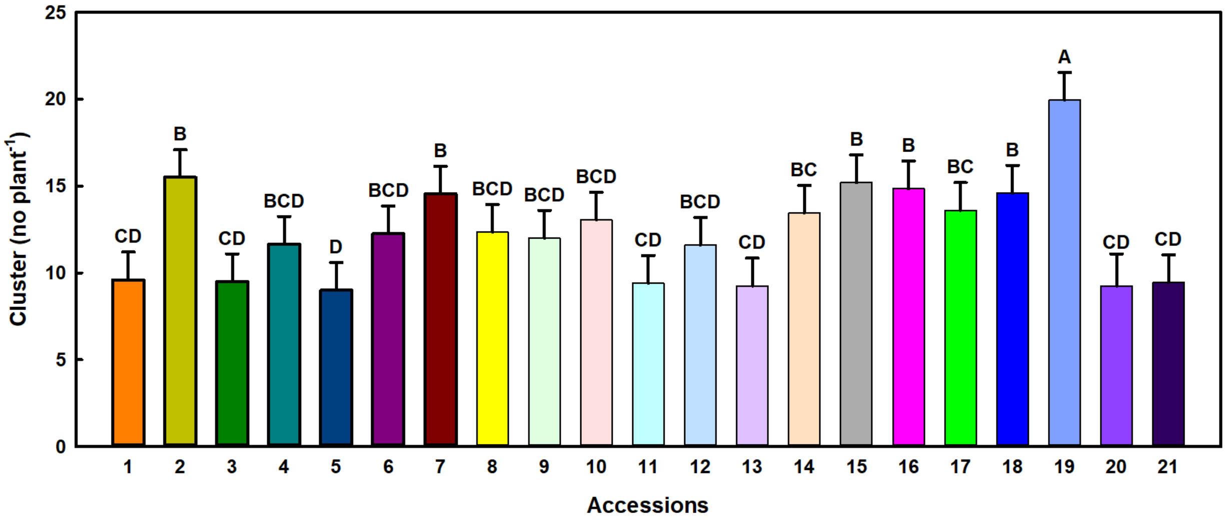
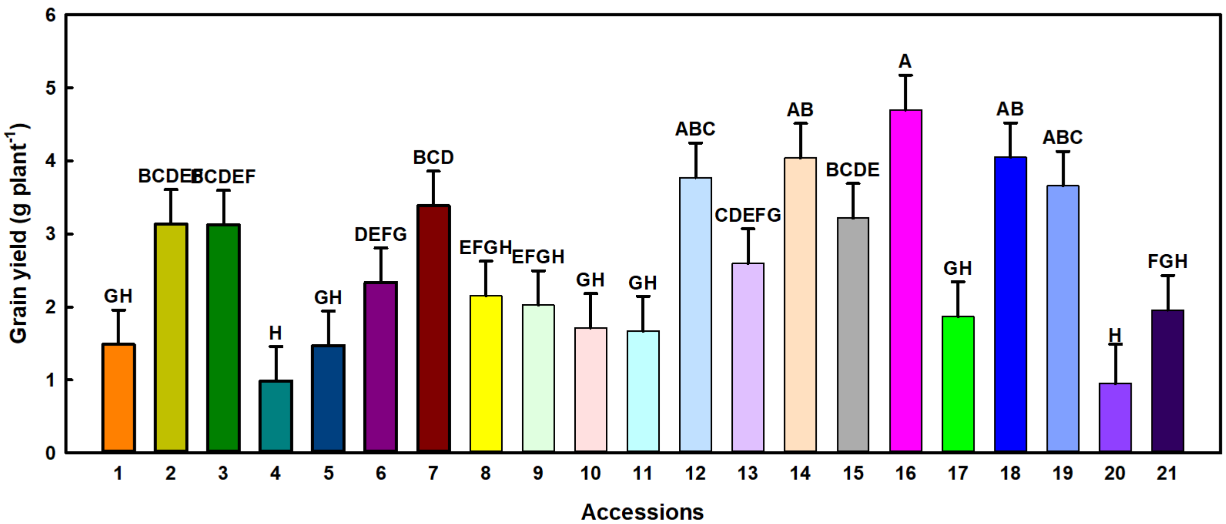


Fig. 5. Grain yield of black gram accessions under dryland no-till conditions.



Summaries

The preliminary findings demonstrated that there is a large genotypic variability for growth, physiology, yield characteristics, and grain yield among black gram accessions grown under no-till, dryland conditions. The experiment indicated that the black gram may be grown in the Northern Great Plains of the United States under no-till, dryland conditions.

Please Scan Me!

Horticulture Program at Williston Research Extension Center

Rojee Chipalu Pradhan

"The glory of gardening: hands in the dirt, head in the sun, heart with nature. To nurture a garden is to feed not just the body, but the soul." – ***Alfred Austin***

Horticulture team left to right: Rojee Chipalu Pradhan, Lauren Holmen (Agronomy Technician), Gabriel Hobbs and Kayla Griego

2022 is an exciting year for me. This is my sixth year at Williston Research Extension Center by experiences, whereas it is my first year as a Horticulture Research Specialist. We implemented the horticulture program in dryland as well as in irrigated areas. This year I have a wonderful team to fulfill my project goals. Despite all challenges, we were able to maintain the WREC horticulture garden and landscapes at their absolute best. The total seasonal rainfall from January 1 to November 20, 2022 was 14.27 inches. The last spring frost occurred on April 27, 2022, and the first fall-killing frost on October 7, 2022. As a result, the growing season was 163 days long, which is comparatively longer than previous year. (Source https://ndawn.ndsu.nodak.edu)

All-America Selection Display Garden

The Williston Research Extension Center garden has been an All-America Selection (AAS) public display garden for more than a decade. All-America Selection is a national, non-profit plant trialing organization in North America founded in 1932. The AAS Mission Statement is "to promote new garden varieties with superior performance judged in impartial trials in North America" (https://allamericaselections.org/about). The display garden project was started with stem cuttings of Begonia, and different varieties of Geranium from the beginning of November 2021. AAS flower and vegetable seeds were seeded in the Horticulture lab under the light shelves (Photos1-3) from the beginning of March to the first week of May 2022. The seeding date was based on the growing requirements of a variety given in a seed packet. Some varieties required at least ten weeks before they were suitable for transplanting outside. The list of AAS winners' flowers and vegetables grown in the garden are given in Tables 1 and 2. In addition to the All-America Selection varieties, other annual flowers and vegetables were also planted in the display garden. The vegetable and flower seedlings were transplanted in the garden from the end of May until middle of June. Whereas some seeds were sown directly in the third week of May such as peas, lettuce, corn, bean, and cucumber, etc. The AAS winners produced around 700 lbs. of fresh vegetables and small fruits (123 lbs. pumpkin, 81 lbs. winter squash, 340 lbs. tomatoes, 79 lbs. pepper and 48 lbs. strawberry). We received flower and vegetable seeds from All-America Selections around September/October 2021 and live plants (flower) in April 2022. AAS sent us vegetable and flower varieties that won national or regional competitions in recent and previous years. People interested in gardening can visit their website (https://allamericaselections.org) for cultivar information, gardening tips, the latest winners as well as recipes, and landscape ideas.

1.Vinca seeds growing under light shelves using heating mat. 2. Tomato seedlings transplanted in six cubes. 3. Vegetable and flower seedling under light shelves from seeding to 4 to 6 weeks old. 4. AAS Display Garden. 5. All America Selections: Marigold Big Duck Orange, MBD Gold, Canna. 6. All America Selections: Petunia Bee’s Knees. Photo by Rojee Chipalu Pradhan.

Table 1. List of AAS winners' flowers planted in display garden in 2022

2022 Winners	**2018 Winners**
Begonia Viking™ Explorer Rose on Green	Canna South Pacific Orange
Celosia Flamma Orange	Marigold Super Hero Spry
Petunia Bee's Knees	Ornamental Pepper Onyx Red
Verbena Beats™ Purple+White	**2017 Winners**
Verbena Vanity	Celosia Asian Garden
2021 Winners	Dianthus Interspecific Supra Pink
Zinnia Profusion Red Yellow Bicolor	Geranium Calliope® Medium Dark Red
2020 Winners	Penstemon Twizzle Purple
Rudbeckia Amarillo Gold	Petunia Evening Scentsation
2019 Winners	Vinca Mega Bloom Orchid Halo
Begonia VikingTM XL Red on Chocolate	Vinca Mega Bloom Pink Halo
Marigold Big Duck Gold	Zinnia Profusion Red
Marigold Big Duck Orange	**2016 Winner**
Marigold Big Duck Yellow	Geranium Brocade Fire
Marigold Garuda Deep Gold	**2013 Winner**
Petunia Wave® Carmine Velour	Geranium Pinto Premium White to Rose
Vinca Mega Bloom Polka Dot	
Zinnia Holi Scarlet	

Table: 2. List of AAS winners' vegetables planted in display garden in 2022

2022 Winners	**2017 Winners**
Eggplant Icicle	Bean, Pole Seychelles
Lettuce Bauer	Okra Candle Fire
Pepper Dragonfly	Pepper Chili Pie
Tomato Pink Delicious	Pepper Sweetie Pie
Tomato Purple Zebra	Squash Honeybaby
2021 Winners	Tomato Midnight Snack
Squash Goldilocks	Tomato Patio Choice Yellow
2020 Winners	**2016 Winners**
Cucumber Green Light	Pepper Cornito Giallo
Pea Snack Hero	Pepper Escamillo
Pumpkin Blue Prince	Pepper Flaming Jade
Tomato Apple Yellow	Pumpkin Pepitas
Tomato Celano	Strawberry Delizz
Tomato Chef's Choice Bicolor	**2015 Winner**
Tomato Early Resilience	Squash Bossa Nova
2019 Winners	Basil Dolce Fresca
Pepper Just Sweet	Basil Persian
Tomato Fire Fly	**2014 Winner**
Tomato Mountain Rouge	Tomato Fantastico
Tomato Red Torch	
Tomato Sparkly XSL	
2018 Winners	
Corn, Sweet American Dream	
Pak Choi Asian Delight	
Pepper, Cayenne Red Ember	
Tomato, Cocktail Red Racer	
Tomato Valentine	

Historic Daylily Collection

Daylily collection. Photo by Rojee Chipalu Pradhan

The World Collection of Daylilies was established in the Williston Research Extension Center dryland station 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. All the Daylilies from the old bed were completely relocated to the new bed in 2020. The Daylily collection area has been maintained by watering once a week, regular hand weeding, and fertilization. There are around 124 different cultivars of Daylily in our collection.

Master Gardener Certified Pollinator Garden

The certified pollinator garden was established in 2016. The objectives of Master Gardener Certified Pollinator Garden are to provide Master Gardeners with volunteering opportunities, to build a habitat that will nourish pollinators, and to 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. Different pollinator-friendly annual flowers were planted in the pollinator garden in 2022. This garden was maintained by regular watering, and hand weeding.

Landscape Management

One of the major tasks of 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. In addition to the existing all the perennial plants, different cultivars of annual flowers were planted in the landscape to enhance the embellishment of the periphery of the office building. These landscape and lawn area were regularly maintained by running sprinklers and mowing lawn on weekly basis. Some glimpses of landscapes can be seen in pictures.

Perennial and annual flowers around The Ernie French Center building. Photo by Rojee

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 13, 2022. Three speakers gave presentations about gardening and landscapes: Would you plant a Bee lawn by Esther Mc Ginnis, Summer lawn and garden tips by Tom Kalb, and All Americas Selections-Flowers and Vegetables by Rojee Chipalu Pradhan. After presentation we gave a garden tour to all the participants.

Horticulture Field day presentation. Photo by Kayla Griego

Horticulture garden tour. Photo by Kayla Griego

- **Garden Tour**: Williston Research Extension Center Garden is a public display garden; hence individuals and groups are welcomed to take a garden tour. In 2022, we gave a tour to leadership Williston, Western Cooperative Credit Union, Leonardite company representatives, and students of Trenton summer school.

Trenton summer school students receives token of Love from WREC after taking garden tour. Photo by Kayla Griego

- **Presentation:** I gave presentation on Williston Research Extension Center, horticulture program to Leadership Williston, Williston state college students, Western Cooperative Credit Union participants.

- **Spring Tree and Garden Workshop:** This workshop was organized by NDSU Williams County. I gave a presentation as well as hands on training on propagation of house plants.

2022 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 shelter belt trees of the Williston Research Extension Center. There were five different traps on five trees (different tree species such as Ash, Pine, Spruce, Oak etc.). Five traps were installed on May 19, 2022, and removed on September 7, 2022. Lures were replaced according to scheduled instructions. Every two weeks, I collected insects and shipped to the ND Department of Agriculture.

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

Community service:

This year, around 68 pounds of fresh vegetables (tomato, pepper, squash) and strawberry 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, Red Torch, Celano, Purple Zebra), and squash (Honeybaby). Photo by Rojee Chipalu Pradhan

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

Increasing the Competitiveness of Local Fruit Production with Tunnel Grown Strawberry in North Dakota.

Rojee Chipalu Pradhan, Jerald Bergman, Tyler Tjelde, James Staricka

Strawberry (*Fragaria x ananassa*) plant belongs to the Rosaceae family and is native to the temperate regions of the Northern Hemisphere. Strawberry is an herbaceous perennial plant with a fibrous root system. They are high in soluble fiber, vitamin C, folate, potassium, and antioxidants. This study will increase consumer knowledge about adapted strawberry cultivars and demonstrate the benefits of using tunnels for berry 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 USDA-AMS Specialty Crop Block Grant Program.

Materials and Methods

This is a two-year project.

2021: The experiment was conducted at the WREC Nesson Valley Research and Development site to examine the production of strawberries under open field, low tunnel and high tunnel. Six different ever bearing strawberry cultivars (Table 1) were planted in June 2021 in randomized block design with four replications. Each treatment plot had five plants. Some strawberries plant did not survive for different reasons. So, we replanted strawberry plant in October 2021.

Table 1. Strawberry cultivars and descriptions.

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

2022:

Most of the strawberry plant could not overwinter; nearly two percent of plants survived. Hence, we reordered strawberry plants in May 2022. Bare root strawberry plants, immediately on arrival, were planted in three inches pots and raised under light shelves. These plants were transplanted in ground on June 23, 2022 (Photo 1). Each planting hole was fertilized with one fourth cup of starter fertilizer (N:P:K:S:Z =12:40:0:10:1) before planting. Fortnightly, Miracle Gro All Purpose Plant Food was applied at the rate of one tablespoon in a gallon of water until beginning of October. Some of strawberry plants (around 30 percent) could not survive. The survival rates of San Andreas and Fort Laramie was around 40 percent whereas the survival rates of Evie II, Portola and Seascapes was more than 70 percent. Therefore, we re-transplanted all the cultivars in September 2022 except Seascape.

Temperature data loggers were installed in high tunnel and open field (Photo 2 and 4). Every week, growth parameters (no of runners, growth stage) were measured and ripe berries were harvested. The runners were removed fortnightly. The harvesting/yield parameters include number of fruits and the weight of marketable and unmarketable fruits. The criteria for unmarketable fruits are mainly fruit weight (<7 gram), deform shape, and damaged fruit (eaten by bird, goffer, mice, flies etc.). Strawberries were harvested and weighed from each plant separately. Brix and pH were measured from berries (each plant) from open field and low tunnel on two Julian days of the year (244 and 270), whereas berries from high tunnel were measured for Brix and pH on three Julian days of the year (244, 270, and 291). Julian is a continuous count of days since January 1. The micro climate inside the high tunnel allowed the third measurement. Brix percentage was quantified using a Veegee Refractometer and pH by Checker Portable pH Meter.

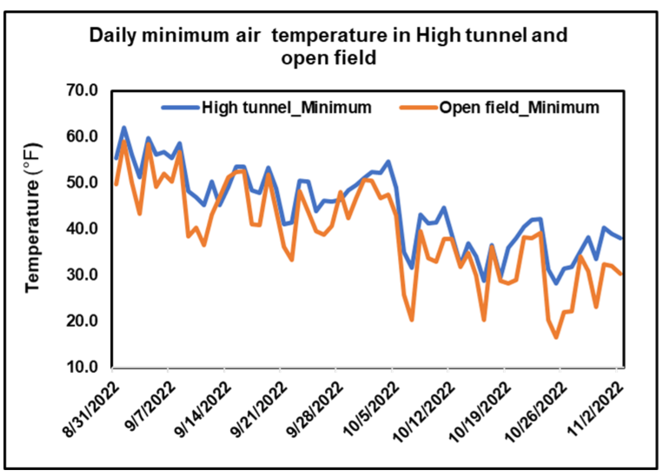
Photo 1. Strawberry planted under open field and low tunnel, Photo 2 and 4 temperature data loggers installed in open field and high tunnel, Photo 3. strawberry in low tunnel. Photo by Rojee.

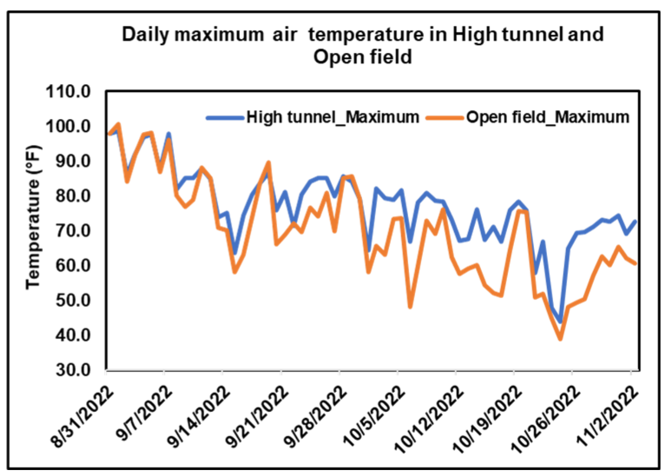
Brix and pH value recorded using Veegee refractometer and Checker portable pH. Photo by Rojee.

Aerial images: High tunnel, Low tunnel (uncovered), open field. Drone image by Dr. Gautam Pradhan.

Results and Discussions

Temperature: Daily recorded temperatures are given in two different figures, 1 and 2. There was in an average five degrees difference between open field and high tunnel for minimum temperature; whereas around 8 degrees difference for maximum temperature. Figure 3 shows the first occurrence of minimum temperature in high tunnel and open field along with long-term NDAWN and Williams county averages. The minimum temperature (40°F) in high tunnel occurred in the beginning of October; whereas open field got that temperature in the second week of September. The minimum temperature i nside the high tunnel seems constant over the period of time compared to open field.





Figures 1 and 2. Minimum and Maximum daily temperature in high tunnel and open field.

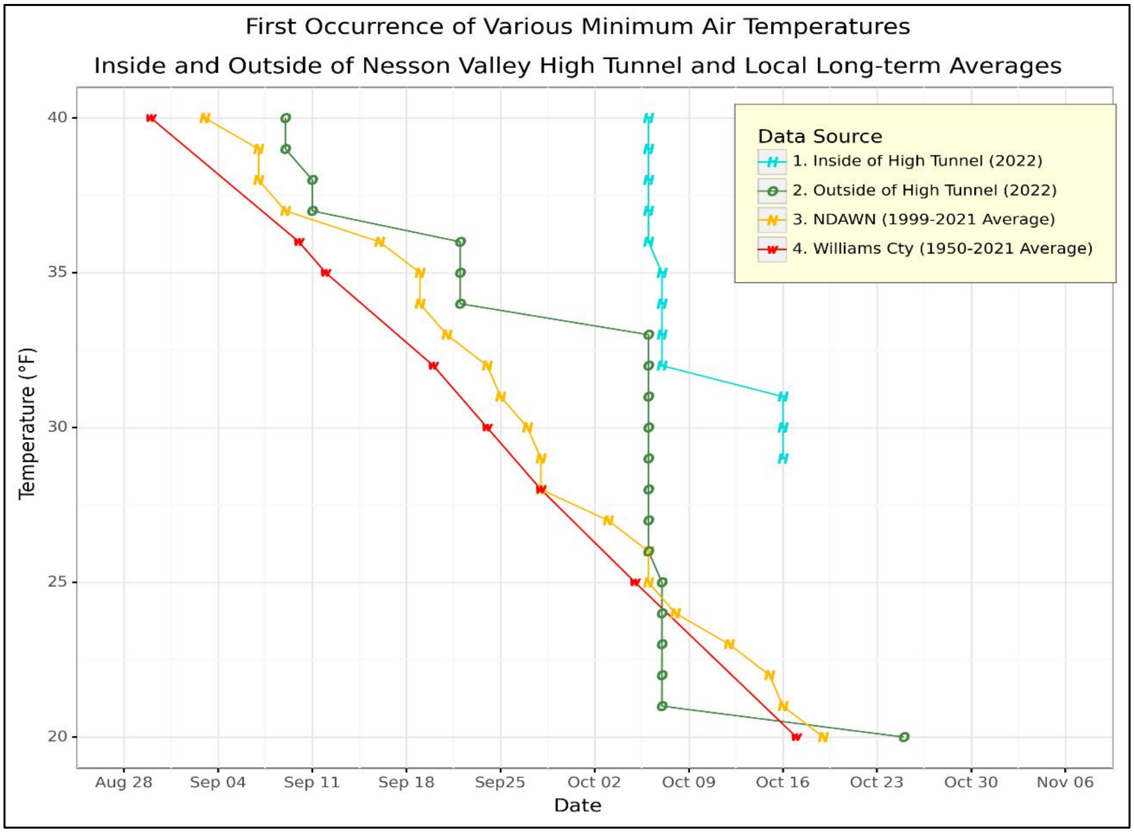


Figure 3. First occurrence of minimum temperature in high tunnel and open field and local long-term averages.

Growth, Yield and berry quality: There was a difference in plant growth, yield, and berry qualities in three different environments as well as in cultivars.

Plant stand: As I mentioned earlier, only two percent strawberry plants survived during winter. Strawberry plants started producing berries from end of July and continued until beginning of October in open field and until middle of November in High tunnel. The first fall frost (October7,2022) injured all the strawberry plants and berries in open field and low tunnel. The strawberry plants were heavily infested by grasshoppers ranging from 30 to almost 100% leaf damage, and some spider mite infestation was also observed during the summer.

Brix and pH: Brix is a unit of measurement for the sugar concentration in a fruit juice. And pH is used to determine the acidity level. The Brix and pH data are given in table 2. The Brix values were slightly less in earlier days in high tunnel compared to low tunnel. The pH values were mostly similar in all three environments and different Julian days. There was a significant difference between the cultivars in the percentage of Brix regardless of environment and Julian days (Fig 4). The Brix percentage in berries ranged from 6.24 to 8.36 (Fig 4). Fort Laramie had a higher Brix percent followed by Seascape.

Table 2. Brix and pH of strawberry cultivars under different environment and Julian days.

Parameter	Brix %							pH						
Environment	High Tunnel			Low Tunnel		Open Field		High Tunnel			Low Tunnel		Open Field	
Julian day / Cultivars	244	270	291	244	270	244	270	244	270	291	244	270	244	270
Albion	6.3	7.8	8.0	8.4	9.5	8.2	9.0	3.1	3.0	3.0	3.0	3.0	3.2	3.0
Evie II	5.4	4.9	6.7	7.4	7.3	8.1	6.8	2.8	2.8	2.9	3.0	2.8	3.1	2.9
Fort Laramie	7.1	7.2	8.7	10.2	9.0	7.5	8.0	2.8	2.9	3.0	3.1	2.9	2.7	2.9
Portola	6.2	6.3	7.6	6.4	7.2	NA	7.1	3.0	2.5	3.0	3.1	2.5	NA	3.0
San Andreas	5.5	4.9	7.3	7.0	7.9	7.2	6.3	2.9	2.9	2.6	2.9	2.9	3.1	2.9
Seascape	7.2	9.0	9.1	7.8	8.6	8.2	9.7	2.9	3.0	3.1	3.0	3.0	3.0	2.9
Average	6.3	6.7	7.9	7.9	8.2	7.8	7.8	2.9	2.9	2.9	3.0	2.9	3.0	2.9

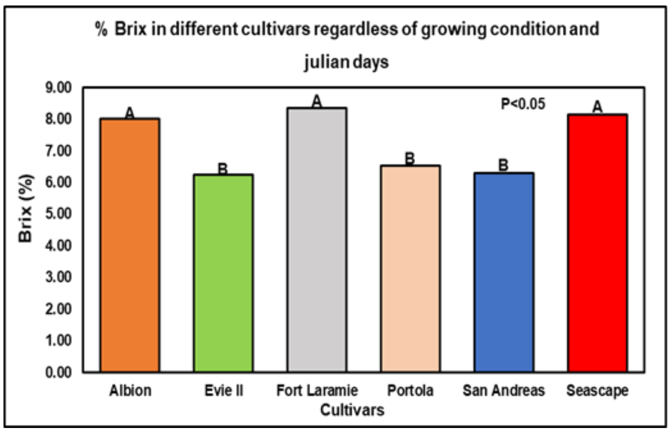


Figure 4. Percent Brix of strawberry cultivars.

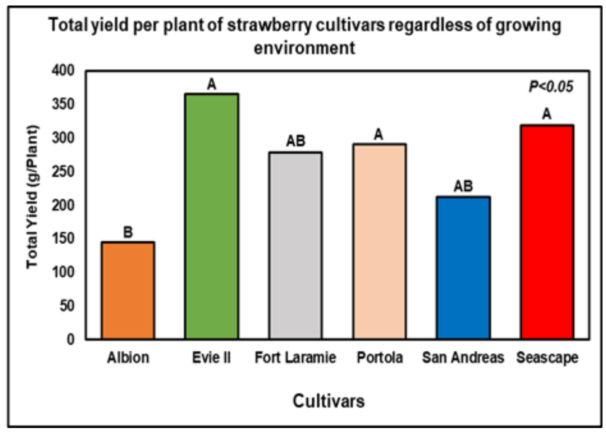


Figure 5. Total yield per plant of strawberry cultivars.

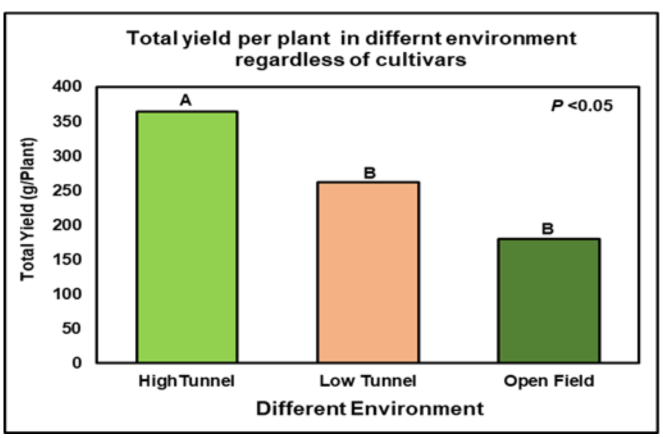


Figure 6. Total strawberry yield per plant in different growing conditions.

Table 3. Total yield per plant of strawberry cultivars grown in different environment.

Cultivars	Total Yield(g/plant)		
	High Tunnel	Low Tunnel	Open Field
Albion	175.3	173.8	87.0
Evie II	490.8	346.8	258.4
Fort Laramie	437.2	314.0	84.8
Portola	371.6	347.9	151.1
San Andreas	280.3	160.7	196.2
Seascape	433.5	224.9	299.5
P value = 0.199			

Yield: There was no interaction effect between environment and cultivars (Table 3, *P value= 0.199*) for total berry yield per plant. Whereas there was a significant effects of cultivars and environment on total strawberry yield per plant (figure 5 and 6). The total strawberry yield per plant ranged from 145.34 to 365.33 grams(Fig.5). Strawberry cultivar Evie II produced the highest yield followed by Seascape. The strawberry grown in high tunnel produces higher yield followed by low tunnel and open field(Fig 6).

Summary:

The preliminary outcomes showed that the high tunnel may extend growing period of strawberries plants and result into higher berry yield compared to open field and low tunnel. The variety Evie II performed better than other varieties. The winter survival, yield and quality data will be measured in 2023 to validate the findings.

2023 WREC Seed Availability

Spring Wheat

ND Heron= new NDSU release

MT Dagmar= new solid stem

ND Elgin= high yielder

Durum

CDC Defy=high grain yield, good lodging tolerance, and best FHB of Canadian durum varieties.

ND Riveland=high grain yield, best FHB rating of all NDSU durum varieties, high test weight, and very good quality.

Barley

CDC Austenson= two-row feed barley with top grain yield, straw strength, test weight and kernel size.

CDC Maverick= two row forage barley with smooth awns and high forage yield.

Oats

CDC Haymaker=forage oat, high tonnage potential, very large flag leaf and plump seed size.

ND Paul=Tall, late maturing, naked oat with excellent forage and feed quality.

Soybeans

ND 17009GT=glyphosate tolerant, high yield potential, early maturing 00.9 and moderate resistance to I.D.C.

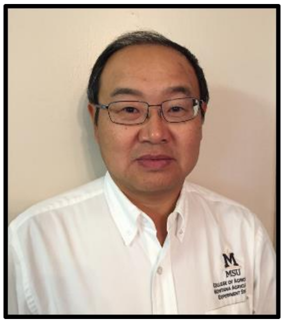
Flax

CDC Rowland=high yield potential, stands well, dark seed color and above average test weight.

For seed availability call Kyle Dragseth at 701-770-1652

NOTES

MSU-EARC FACULTY & STAFF—2022



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