

PROGRESS REPORT ON GRASS SEED PRODUCTION RESEARCH

prepared by

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Grass-Legume Seed Institute Presentation

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This summary and previous annual research summaries are on the Web at:

<https://turf.umn.edu/seed-production-research-progress-reports>

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General management regime of research plots in Northern Minnesota:

Spring seeded ryegrass with wheat-BMP(best management practice)

Ryegrass seeded at 5-7#/acre with spring wheat
Sterling Blue(dicamba)+ 2,4-D amine 4 (0.75 + 0.75 pint) applied in late September
Fertilize 30-50-50 after small grain harvest
Spike tooth harrow after fall fertilizer application to spread straw
Fertilize 110-0-0-20s(15#ESN) applied early May, 300 - 600 GDD
Sterling Blue+ 2,4-D amine 4 (0.75+0.75 pint) applied late May, 700 - 900 GDD
Tacoma or Assure II (8-10 oz) applied early June, 800 - 1,000 GDD
Apogee (6-8 oz) applied early heading, 1,100 - 1,300 GDD
Priaxor 6oz.or Quilt Xcel 12oz. applied full heading, 1,700 - 1,900 GDD or as needed

Fall seeded ryegrass in wheat stubble

Pre-harvest glyphosate application to wheat , or
glyphosate applied to wheat stubble prior to seeding ryegrass, if needed.
Drill ryegrass at 5-7#/acre after wheat harvest into existing stubble
Fertilize 30-50-50 at planting
If planting into summer fallow, apply 11-50-50.

Intermediate Wheatgrass/Kernza

Establishment=Seed at 10#/acre in late August in 6"-8" rows.
120-40-40-10s applied in late October.
.75pt. 2,4-D a + .75pt. Sterling Blue late September or May if needed.
Field burn in early September after harvest.

Kentucky bluegrass

Establishment=Seed at 4#/acre in late August to early September.
120-40-40-10s applied in late September.
.75pt. 2,4-D a + .75pt. Sterling Blue late September.
Field burn in August.

General seed harvest procedure for small research plot

Note: Years sited on the summary tables are generally the year the trial was planted or initiaed.
Measured areas are hand cut and bagged for each individual plot.
These samples are then brought to the U of M St.Paul campus
where they are dried, threshed, cleaned and weighed.
Seed yields, quality and other data are statistically analyzed and results summarized.

On-farm small plot research trials

General crop management is done by the grower/cooperator.
Application of treatment variables, agronomic notes and harvest performed by U of Mn personnel.
Effort is made to remove research samples prior to grower harvest.
Cooperators are asked to avoid management applications of treatments involved in the study to the research plot area.

On-farm large plot trial research protocol

These experiments are conducted in fields with growers implementing all of the general field management.
Treatment variables are field scale and are applied either by the grower or University personnel.
University agronomists and grower cooperators work together to insure treatment variables are properly applied.
Plant samples, crop development observations and other applicable notes
are recorded as needed throughout the growing season usually by University personnel.
At harvest, University agronomists will assist the growers in collecting quality samples and recording harvest data.
Experimental design usually consists of 2 or 3 treatment variables and 3 replicates/treatment.

2024 Research Locations

MagPlots=University of Minnesota-Magnusson Research Farm 2 miles north and 4.5 miles west of Roseau,Mn
Northern Resources=West Plant-Roseau Kevin Johnson farm
MagFarms=Magnusson Farms- NW of Roseau Mark Melby farm
Casey Pearson=NW of Roseau Tony Wensloff farm
Rice Farms= NW of Roseau
Estling Farm=North of Roosevelt
Stanley Farms=Grygla area

Table 1.

Monthly and Year End Precipitation Totals*
Roseau,Mn 1967-2024.

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Yearly Total(in.)	Yearly Deviation	Mean(F ^o) Temperature
1967	1.13	0.39	0.59	2.89	0.89	2.23	4.95	1.69	0.83	1.11	0.70	1.76	19.16	-3.52	35.8
1968	0.62	T	1.25	0.63	1.46	6.47	6.13	8.49	2.35	1.26	1.06	0.21	29.93	7.25	37.3
1969	3.07	0.11	0.05	1.27	3.31	2.29	3.70	4.28	3.29	1.91	0.30	0.73	24.31	1.63	37.0
1970	0.71	0.41	1.38	2.56	5.93	4.07	3.55	0.83	2.77	1.49	1.21	0.37	25.28	2.60	35.0
1971	0.54	0.13	0.26	1.50	2.24	2.29	3.58	0.69	3.33	2.97	0.29	0.50	18.32	-4.36	36.2
1972	0.68	0.76	0.50	0.70	1.66	5.03	1.92	1.53	4.22	1.40	0.38	0.32	19.10	-3.58	34.9
1973	0.09	0.17	1.18	0.90	2.46	2.21	4.04	2.09	5.67	1.19	0.67	0.75	21.42	-1.26	M
1974	0.88	0.87	0.16	2.72	4.12	1.56	2.56	11.00	0.42	0.66	0.15	1.40	26.47	3.79	M
1975	1.10	0.29	0.64	1.40	1.52	4.96	2.26	1.75	1.79	1.49	0.20	0.65	18.05	-4.63	M
1976	1.13	0.50	1.05	0.77	0.54	5.82	1.52	3.72	0.34	0.07	T	0.37	15.83	-6.85	36.2
1977	0.14	0.62	1.02	0.27	2.43	3.71	2.28	1.74	3.83	0.87	2.27	0.26	19.44	-3.24	37.7
1978	0.36	0.26	0.17	1.00	1.97	1.92	6.25	3.25	3.44	0.23	0.98	0.79	20.62	-2.06	35.3
1979	0.50	1.01	1.06	2.77	1.89	1.91	3.70	1.59	0.45	1.40	1.02	0.16	17.46	-5.22	32.6
1980	0.55	0.82	0.35	0.00	0.24	1.75	3.35	5.19	4.12	1.66	0.94	0.18	19.15	-3.53	36.0
1981	0.27	0.16	0.66	0.56	2.79	6.85	2.63	2.41	3.63	1.75	0.90	0.99	23.60	0.92	38.3
1982	1.30	0.45	0.74	0.24	1.38	2.00	5.53	2.71	1.92	2.91	0.46	0.57	20.21	-2.47	34.2
1983	1.31	1.26	1.17	0.53	2.76	4.03	1.62	3.34	2.91	2.26	0.66	0.10	21.95	-0.73	37.7
1984	T	0.95	T	0.72	0.72	4.46	3.78	0.99	0.37	4.32	0.10	1.02	17.43	-5.25	37.3
1985	0.12	0.33	0.06	1.07	4.35	4.62	1.08	8.72	1.60	1.04	1.68	0.38	25.05	2.37	34.4
1986	0.30	0.90	0.26	2.96	1.40	2.43	3.59	2.04	2.52	0.65	1.97	0.36	19.38	-3.30	M
1987	0.47	0.30	0.10	0.59	4.37	2.25	4.80	2.22	0.82	0.92	0.73	0.35	17.92	-4.76	M
1988	0.60	0.09	1.75	0.00	1.74	1.34	5.53	1.70	2.24	0.12	0.77	1.05	16.93	-5.75	M
1989	3.27	0.32	2.86	0.10	2.82	5.46	1.60	2.56	1.24	0.41	0.62	0.45	21.71	-0.97	M
1990	0.55	0.20	1.12	1.09	0.46	3.19	2.48	0.62	0.91	0.16	0.18	0.72	11.68	-11.00	38.2
1991	0.56	0.64	0.58	2.87	3.19	5.94	3.40	1.99	7.42	1.64	1.36	0.70	30.29	7.61	M
1992	0.61	0.68	0.45	2.27	1.99	2.36	2.72	4.51	2.76	0.12	1.27	0.88	20.62	-2.06	36.5
1993	0.68	0.05	0.27	1.01	1.63	5.06	5.87	4.69	0.72	0.71	0.45	0.65	21.79	-0.89	35.5
1994	0.21	0.33	0.47	0.02	0.16	2.54	3.03	3.48	3.94	1.38	2.72	0.32	18.60	-4.08	37.7
1995	0.57	0.59	1.23	0.61	2.50	2.13	4.59	3.59	1.81	1.33	1.54	1.46	21.95	-0.73	35.8
1996	0.94	0.48	0.22	1.65	4.62	1.64	7.34	1.78	1.77	1.75	2.73	1.07	25.99	3.31	M
1997	1.06	0.14	1.02	0.84	2.02	3.36	4.02	1.31	4.01	2.45	0.19	0.25	20.67	-2.01	M
1998	0.69	1.05	0.21	0.77	4.55	5.39	3.01	2.20	0.31	4.42	1.39	0.95	24.94	2.26	M
1999	0.15	0.77	0.23	1.31	4.09	6.97	3.46	1.38	3.16	0.43	0.38	0.56	22.89	0.21	40.1
2000	0.45	0.14	0.79	0.38	1.83	7.38	1.63	6.45	2.14	2.89	3.41	0.74	28.23	5.55	38.2
2001	0.21	0.52	0.46	1.89	3.27	1.76	4.74	1.40	0.72	1.76	1.50	0.56	18.79	-3.89	39.8
2002	0.19	0.10	0.45	1.44	2.79	9.94	2.96	4.47	1.62	1.02	0.30	0.54	25.82	3.14	38.1
2003	0.80	0.77	1.60	1.75	2.95	3.56	1.92	1.78	4.55	1.32	1.52	1.95	24.47	1.79	37.6
2004	2.85	0.70	2.14	2.61	8.19	2.98	2.42	5.50	2.97	2.36	0.08	1.33	34.13	11.45	36.0
2005	2.33	0.67	0.82	0.73	3.62	7.55	3.37	3.24	1.77	3.48	2.06	1.65	31.29	8.61	39.0
2006	2.52	0.95	1.01	1.23	1.97	1.00	0.94	2.18	2.42	1.54	0.17	0.56	16.49	-6.19	41.0
2007	0.44	0.56	1.25	0.95	2.75	7.75	2.92	1.37	0.92	5.14	0.39	0.86	25.30	2.62	38.0
2008	0.25	1.29	0.46	2.17	1.56	3.93	4.33	3.63	3.06	2.37	2.00	1.47	26.52	3.84	36.0
2009	1.25	1.75	4.45	1.37	3.59	3.72	1.28	3.92	2.67	1.06	0.28	1.22	26.56	3.88	36.0
2010	0.80	0.43	0.55	1.23	6.47	2.88	3.79	1.50	6.09	2.42	1.14	0.61	27.91	5.23	40.0
2011	1.15	0.20	0.23	3.14	2.63	3.87	2.38	1.63	0.89	1.34	0.19	0.07	17.72	-4.96	39.0
2012	0.59	1.06	2.06	1.39	1.48	3.32	2.74	1.42	0.18	3.64	1.22	0.24	19.10	-3.58	41.0
2013	1.34	1.21	1.05	1.40	4.69	1.70	2.14	3.77	2.65	0.84	1.43	1.85	24.07	1.39	35.0
2014	2.32	0.54	3.31	1.71	3.74	4.23	2.21	1.62	2.68	1.14	0.75	1.49	25.74	3.06	36.0
2015	1.11	0.57	0.71	0.42	5.18	4.33	6.27	4.45	1.43	2.08	1.52	3.08	31.15	8.47	41.0
2016	0.39	0.89	1.31	1.29	3.14	5.71	3.57	1.23	3.97	0.97	0.85	0.75	24.07	1.39	42.0
2017	1.44	1.55	0.59	0.47	0.90	5.55	0.83	0.99	6.22	0.97	0.94	2.71	23.16	0.48	41.2
2018	1.04	0.99	2.76	0.02	2.71	1.89	1.75	1.36	2.05	1.68	0.62	1.28	18.15	-4.53	36.6
2019	0.90	1.65	1.66	0.27	1.42	2.99	4.09	3.42	9.95	4.18	0.80	0.74	32.07	9.39	35.2
2020	0.84	0.29	1.30	0.53	1.66	6.29	8.23	2.30	0.77	1.11	1.19	0.99	25.50	2.82	38.3
2021	0.35	0.23	0.14	1.32	1.64	1.53	1.18	3.52	1.18	3.00	2.07	1.50	17.66	-5.02	42.1
2022	0.54	1.88	0.33	3.45	5.27	2.07	3.54	5.86	1.94	0.91	0.66	1.31	27.76	5.08	36.0
2023	0.34	0.13	0.58	0.62	1.82	1.36	2.62	1.48	1.82	1.81	1.17	1.32	15.07	-7.47	39.8
2024	0.72	0.59	0.87	1.46	3.60	4.82	4.56	2.47	1.85	0.80	0.97	0.76	23.47	0.91	41.7

58 year average annual precipitation= 22.56

44 year available mean temperature= 40.1

*Precipitation amounts used are from the Magnusson Research Farm-near Roseau April-October and Minnesota Climatology Working Group nearest location for the remainder of the year.

Table 2.

2023 Perennial Ryegrass Seed Production Variety Trial*
Magnusson Research Farm-Roseau,Mn.

Variety	Company	Seed Lot#	Seed Yield	Harvest			Heading (%)				
				Ht.	Lodging ¹	Date	6/5	6/9	6/13	6/17	6/22
NK-200	check	3917	1225	34	8.0	8/6	0	4	13	27	70
Galactic Green	U of M-3999	4050	1774	26	7.3	8/6	0	5	20	43	90
Superstar GL	Mountain view seed	4125	1629	27	7.7	8/6	2	13	33	57	93
Sliders LS	Mountain view seed	4126	1560	26	6.0	8/6	5	17	40	63	95
Silversun	Pure Seed Testing	4170	1400	25	5.0	8/6	13	37	63	87	99
Gray Fox	Pure Seed Testing	4168	1563	26	7.0	8/6	2	20	37	63	92
Silver Sport	Pure Seed Testing	4169	1454	25	5.7	8/6	8	33	53	73	96
Arctic Green	U of M	4171	1655	27	7.3	8/6	T	10	23	53	93
Sideway	DLF	4158	1691	26	5.7	8/6	5	27	47	60	98
Gray Fox A2	UM / PST	4164	1400	25	6.3	8/6	2	10	27	53	90
Silver Sport A2	UM / PST	4165	1335	25	8.0	8/6	2	17	33	70	98
Silver Sun A2	UM / PST	4166	1756	25	4.7	8/6	7	27	47	80	99
LSD @5% level			347	1	2.0	0	5	9	12	14	4
CV(%)			13	3	18	0	69	30	20	13	3

Experimental design:RCB with 3 reps

Planted 8-25-23 @7#/ac into fallow with 20#/ac of spring wheat

Trial mean yield= 1537

*Because of winter injury, rep 1 was not harvested and results should be viewed with caution.

¹Lodging-1=upright ;9=flat

Table 3.

2023 Perennial Ryegrass Winter Hardiness Trial
Magnusson Research Farm Roseau,Mn & U of M- St. Paul Campus*

Variety ²	Seed lot	Winter Injury ¹	
		Roseau 5/1/24	5/16/24
Green Emperor A2	4031	6.0	4.0
Green Emperor	3976	6.5	4.5
Annual	4134	9.0	9.0
Galactic Green	4050	5.8	3.0
NK-200	3917	6.5	6.8
Hancock	4155	7.3	6.5
Arctic Green	4171	6.3	3.0
Spreader III A2	4051	7.3	5.8
Royal Green	4159	6.3	4.3
Sideways	4158	7.3	6.0
Gray Fox	4168	6.8	4.3
Gray Fox A2	4164	7.3	5.3
Silver Sport	4169	7.3	6.3
Silver Sport A2	4165	6.8	5.5
Silver Sun	4170	8.3	7.8
Silver Sun A2	4166	7.0	6.5
LSD @5% level		1.1	1.4
CV(%)		11	18

Experimental design:RCB with 4 reps

Planting date- Roseau=8/30/2023 ; St.Paul 9/22/2023

*No winter injury in St.Paul and no data included.

¹Winter injury(visual rating) 1= no injury; 10=dead.²'A2' lines are resistant to the herbicide Assure II.

Table 4.

2020 Kentucky Bluegrass Variety Trial
Magnusson Research Farm-Roseau,Mn

LINE	source	Lot#	Seed Yield (#/acre)			#/ac.	% mean	Harvest			Heading (%)			
			2022	2023	2024			2022-24	Ht.(in.)	Date	Lodging ¹	5/27	5/31	6/5
A99-3124	MN-Rutgers	3920	445	485	534	488	81	23	10-Jul	1.0	0	14	17	37
Park	check	4062	857	458	587	634	105	35	3-Jul	6.3	17	77	87	99
Minnfine	check	4063	736	565	576	626	104	35	3-Jul	7.0	33	90	96	99
318west	UM	4120	429	476	445	450	75	24	10-Jul	1.0	0	10	17	43
Dragon	check	4131	825	721	905	817	136	30	4-Jul	1.0	7	50	63	90
Exp#1	exp	4132	952	514	644	703	117	30	6-Jul	1.0	2	27	40	77
Desert Moon	PST	4135	705	485	487	559	93	23	10-Jul	1.0	1.7	22	37	70
New Moon	PST	4136	594	556	469	540	90	30	7-Jul	1.0	3.7	30	40	80
610middle*	UM	4121*	354	407	NH	NH	NA	NA	NA	NA	NA	NA	NA	NA
704east*	UM	4122*	427	482	NH	NH	NA	NA	NA	NA	NA	NA	NA	NA
LSD @5% level			100	81	100	75	NA	4	3	1.4	9	12	14	18
CV(%)			11	11	10	8	NA	7	29	33	68	18	16	14

Experimental design:RCB with 4 reps

Seeded 8/5/2020 @5#/acre

Mean trial yield by year= 632 515 581 602

*Significant off type bluegrass contamination in plots of these lines;not harvested in 2024.

¹ Lodging-9=Flat;1=Upright

5/25/2024 4oz Tilt+2oz. Grizzly for mildew and army worm control

Table 5.

2020 Intermediate Wheatgrass-Kernza Variety Trial
Magnusson Research Farm-Roseau,Mn. 2024 data and 2021-24 Seed Yield

Seed lot#	Variety	Seed Yield-#/acre ³					Harvest			% heading				1000 seed wt.(TSW) ⁴	
		2021	2022	2023	2024	2021-24	Lodging ²	Ht.(in.)	Hulled % ¹	6/13	6/17/	6/22	6/28	2022	2024
4138	TLI 701	997	1335	1064	1070	1116	2.8	63	81	1	18	63	94	6.844	6.573
4139	TLI 702	955	1141	743	823	916	1.5	67	80	5	35	78	99	6.151	6.070
4140	TLI 703	1068	1144	874	843	982	1.0	65	83	8	40	78	99	5.734	5.909
4141	TLI 704	1108	1037	861	874	970	1.0	69	80	4	33	73	98	6.282	6.523
4142	MN-1601	948	943	972	1035	975	1.8	67	81	1	13	63	96	6.689	5.662
4143	MN-1603	1012	930	790	899	908	1.5	63	83	0	7	53	89	5.171	5.486
4144	MN-1605	872	981	863	935	913	1.5	69	81	1	15	60	95	6.090	6.247
4145	MN-1607	1084	939	888	937	962	1.0	66	80	1	10	58	94	6.188	5.576
4146	TLI -C5	1001	1079	894	781	939	2.3	66	80	1	19	68	99	5.724	6.161
4147	MN-Clearwater	1001	1099	903	903	977	1.0	67	81	1	20	65	98	5.487	5.887
LSD @ 5% Level		145	140	104	168	73	1.0	3	3	3	10	10	4	NA	NA
CV(%)		10	9	8	12	5	46	3	2	87	35	11	3	NA	NA

Experimental design:RCB with 4 reps

Planted 8-20-2020 @ 10#/acre

Mean yield by year= **1005 1063 885 910** mean TSW 6.040 6.009¹ Hulled %= visual estimate of % hulled seed after processing and cleaning

A single sample that was hand picked had 90.4% carryopsis only seed(by weight) that lot was visually rated 80%

² Lodging-9=Flat;1=Upright³ Plots were burned 8/24/2023 when very dry that resulted in stand loss and stand variability.⁴ Grams/1000 seeds in harvest years 2022 & 2024.

Fertilizer application= 140-40-40-10s 10/2023

Table 6.

2022-24 Dry Pea Quality Trial*
Magnusson Research Farm.

Variety	Yield-Bu/acre ¹			
	2022	2023	2024	3-year Ave
AAC Profit	104a	120a	115a	113
CDC Amarillo	99a	104b	109a	104
CDC Dakota	91ab	105b	108a	101
Delta	80b	103b	97b	93
DS Admiral	78b	107b	97b	94

Variety	% Protein ²				Protein Yield(#/acre) ²			
	2022	2023	2024	3-year Ave	2022	2023	2024	3-year Ave
AAC Profit	25.9a	24.7a	24.8ab	25.1	1518a	1676a	1582a	1592
CDC Amarillo	22.5c	24.3ab	23.4b	23.4	1260b	1429b	1407ab	1365
CDC Dakota	24.6ab	24.2ab	25.3a	24.7	1266b	1426b	1517ac	1403
Delta	21.7c	24.4ab	25.4a	23.8	952c	1412b	1345bc	1236
DS Admiral	23.5bc	23.1b	22.9b	23.1	1021c	1381b	1234b	1212

Experimental Design: RCB w/5 reps.

Varieties with the same letters are not statistically different at the 10% level

*The Magnusson Research farm was 1 of 8 locations of this trial administrated by Samuel Koeshall at Montana State University .

¹Yield=Bushels per acre at 12% moisture

²Protein and protein yield are on a dry matter basis.

Protein yield is %protein x #/acre yield.

General Management -

Herbicide application- Seeding Rate= 350,000PLS/acre

Authority Elite 1.5pt.acre Pre-emergent

5oz. Beyond Xtra Early post emergent

Fertility application 8-50-50 Soil type- sandy loam

Previous crop- spring wheat

Planting Date- 5/28/2022, 5/16/2023, 5/13/2024

Harvest date- 9/7/2022, 8/28/2023, 8/28/2024

Table 7.

2023-24 Perennial Ryegrass Fertility Trial Magnusson Research Farm-Roseau, Mn

TRT#	Fertilizer Rate: N level ¹	Application timing	Seed Yield		Harvest			Treatment
			%mean	#/acre	Ht(in.)	Lodging ²	Stubble ³	Variable Explanation
1	0-0-0	fall12-70-20	24	344	18	1.0	1.0	No added N
2	140+0+0	30-0-0--10/20	100	1448	25	5.7	2.3	30#N late oct- STANDARD-AMS+ESN spring
3	140+0+0	30-0-0--9/20	103	1504	26	6.3	3.0	Standard-NO ESN
4	140+0+0	30-0-0--9/20	99	1445	26	6.3	3.7	Standard--NO ESN&NO AMS
5	140+0+0	30-0-0--9/20	101	1466	26	5.7	2.3	30#N 9/29- STANDARD-AMS+ESN spring
6	140+0+0	30-0-0--9/20	112	1626	27	6.0	2.3	Standard-NO AMS
7	140+0+0	No fall N	104	1507	26	6.0	3.7	Spring only N +ESN+AMS
8	100+0+0	30-0-0--9/20	81	1180	24	3.0	1.0	Standard-(low N rate-100#N)
LSD @5% level			11	170	1	2.1	1.7	
CV(%)			7	7	4	24	40	

Experimental Design:RCB w/3reps Variety=Arctic Green

Mean yield(not including 0# N)= 1454#/ac

¹-All plots received 12-70-50 on 9/12/2024 ; fertilizer listed in addition.

²-Lodging-1=upright;9=flat

³-Stubble color after harvest-1=brown;3=brown/green mix;5=green(possible indicator of residual N after harvest)

Treatment Explanations:

TRT#	Total Fertilizer	
	Added	Additional Fertilizer ¹
1	8-40-40	None
2	140+40+40	30-0-0 on 10/17/2023 ; 100-0-0 on 4/15/2024(15#ESN + 20#AMS)
3	140+40+40+20s	30-0-0 on 9/20/2023; 100-0-0-20s(20#AMS) on 4/15/2024
4	140+40+40	30-0-0 on 9/20/2023; 100-0-0 on 4/15/2024
5	140+40+40+20s*	30-0-0 on 9/20/2023; 100-0-0-20s(15#ESN + 20#AMS) on 4/15/2024
6	140+40+40*	30-0-0 on 9/20/2023; 100-0-0(15#ESN) on 4/15/2024
7	140+40+40+20s*	130-0-0-20s(15#ESN+20#AMS) on 4/15/2024
8	100+40+40+20s*	30-0-0 on 9/20/2023; 60-0-0-20s(15#ESN + 20#AMS) on 4/15/2024

8/25/2023 Soil test results

Depth	Olsen P	K	% OM	PH	NO3-N
0-6"	5 ppm	103 ppm	2.8	8.4	5#/acre
6-24"					3#/acre

Fertilizer sources=

N(Urea)-46-0-0 (100#N=217# urea/acre)

Sulfur(AMS)21-0-0-24s (20#S=83#AMS/acre)

Poly Coated N(ESN 44-0-0) (15#N=34#ESN/acre)

P & K Sources-P= 11-52-0; K=0-0-60

Table 8.

2011-24 Spring Plant Perennial Ryegrass Fertility Trial Seed Yield Summaries
Magnusson Research Farm-Roseau,Mn

Trt. #	Nitrogen Fertilizer	Late Fall Nitrogen	Overall ³ Mean	Seed Yield as % of Mean													
				2024	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
1	0	0	28	24	22	25	26	24	20	21	45	38	29	27	28	21	36
2	100+0+0	30#	98	81	91	----	91	99	103	90	104	90	----	92	96	112	108
3	140+0+0	30#	105	103	108	77	104	104	111	101	99	110	99	104	104	118	118
4	140+40+0	30#	108	----	----	106	99	96	100	107	106	109	127	120	----	----	----
5	140+0+0+20s	30#	101	101	101	117	104	95	99	101	102	----	----	110	99	----	----
6	140+0+0	30#	103	----	----	----	----	98	102	101	99	----	----	106	109	----	----
7	180+0+0	30#	109	----	----	----	----	----	----	107	92	111	----	122	111	----	----
8	140+0+0	0	102	----	96	----	106	104	99	94	91	106	----	96	104	119	115
LSD @5% level					11	15	12	10	13	11	13	12	20	11	16	11	12
CV(%)					8	9	9	8	10	8	9	9	16	8	NA	NA	NA

Experimental Design:RCB with 4 reps

Variety all years=Arctic Green

Yield Trial mean by year (exclude 0#N) 1454 1150 1525 1276 1584 1668 1631 1627 1220 1344 1244 1068 1499 1313

¹Split-30-50-50 applied fall and remainder in spring²Split-30-50-50-20s(77#AMS / acre) applied in fall+110-0-0 in early May³Treatment overall means should be viewed with caution when there are limited number of years-(ie-#6-7)

Trt. #	Explanation of fertility treatments
--------	-------------------------------------

1	No fertilizer added
2	30-40-40 applied Sept-Oct. / 70-0-0 applied early May
3	30-40-40 applied Sept.-Oct. / 110-0-0 applied early May (standard)
4	30-40-40 applied Sept-Oct. / 110-40-0 applied early May
5	30-40-40-20s(77#AMS) Sept-Oct. / 110-0-0 applied in early May
6	30-40-40 applied Sept-Oct. / 90-0-0 applied May / 7 gal. 28%UAN applied mid-June
7	30-40-40 applied Sept-Oct./ 150-0-0 applied early May
8	8-40-40 applied Sept.-Oct. / 140-0-0-20s applied early May

Table 9.

**2024 Herbicides applied to Perennial Ryegrass
Arctic Green-Magnusson Research Farm**

TRT# Trade Name	Product Rate/concentration/acre	timing	Seed Yield	Test wt.	Harvest			Stubble color ³	Foxtail barley presence ⁴
			#/acre	#/bu. ⁵	Germination ¹	Ht(in.)	Lodging ²		
1 Prowl H2O	3.5pt	30-Apr	1691	24.4	92	25	3.5	1	1.0
2 Callisto	6oz.	30-Apr	1762	24.4	92	26	3.0	1	1.0
3 Nortron	4pt	30-Apr	1655	25.5	95	26	4.5	1	0.0
4 Dual II Magnum	1pt	30-Apr	1522	22.6	88	24	2.5	3	1.0
5 Dual II Magnum	1pt	1-Jun	1740	24.3	89	26	4.0	1	0.5
6 Assure II	10oz+.25%NIS	7-Jun	1731	25.4	88	25	3.5	2	0.5
7 Tacoma	10oz	7-Jun	1727	24.9	91	26	3.5	2	0.5
8 Wolverine	1.7pt+1ptAmSol	7-Jun	1807	24.8	93	26	3.5	1	0.5
9 2,4-D+Sterling Blue Assure II	.75pt+.75pt / 10oz+.25%NIS	6/1+6/7	1566	24.1	90	26	3.5	3	0.0
10 2,4-D+Sterling Blue+Dual Assure II	.75pt+.75pt+1pt/10oz.+.25%NIS	6/1+6/7	1495	23.8	88	25	4.0	2	0.5
11 2,4-D+Sterling Blue+Callisto Assure II	3oz*+.75pt+.75pt+3oz+2.5%-28%UAN+1%COG/10oz.+.25%NIS	6/1+6/7	1771	24.0	92	26	4.5	2	0.0
12 No Treatment			1722	23.9	90	25	3.0	3	1.0
LSD @5% level			260	0.6	5	1	1.2	3.2	1.0
CV(%)			7	1	2	2	15	79	87

Experimental Design=RCB with 2 reps

Plot size=10' x 30'

¹Germination- % strong germination on 4 x 100 seed samples per treatment(standard germination test)

²Lodging-1=upright ;9=flat

³-Stubble color after harvest-1=brown;3=brown/green mix;5=green

⁴Foxtail barley presence- 0=none present ; 1=present(.5=present in 1 of 2 plots)

⁵Test weight per bushel given as a possible indicator of seed quality.

TRT# Trade Name	Common name	active ingredient #/gal	TRT#	Trade Name	Application Date
1 Prowl H2O	Pendamethalin	3.8	1	Prowl H2O	30-Apr
2 Callisto	Mesotrione	4	2	Callisto	30-Apr
3 Nortron	ethofumisate	4	3	Nortron	30-Apr
4 Dual II Magnum	metalachlor	7.64	4	Dual II Magnum	30-Apr
5 Dual II Magnum	metalachlor	7.64	5	Dual II Magnum	1-Jun
6 Assure II	quizalofop	0.88	6	Assure II	7-Jun
7 Tacoma	fenoxypop	1	7	Tacoma	7-Jun
8 Wolverine	fenoxypop .4#+pyrasulfotole .13#+Bromoxynil 1.08#		8	Wolverine	7-Jun
9 2,4-D+Sterling Blue	2,4-D amine 3.8# +dicamba 4#		9	2,4-D+Banvel /Assure II	6/1+6/7
10 2,4-D+Sterling Blue+Dual	2,4-D amine 3.8# +dicamba 4#+metalochlor 7.64#		10	2,4-D+Banvel+Dual/Assure II	6/1+6/7
11 2,4-D+Sterling Blue+Callisto	2,4-D amine 3.8# +dicamba 4#+mesotrione 4#		11	2,4-D+Banvel+Callisto/Assure II	6/1+6/7
12 No Treatment	NONE		12	No Treatment	

Additive/Rate

NIS(Non-ionic surfactant) Preference - 1Qt./100 gallons water

COC(crop oil concentrate) Prime oil-1 gallon/100 gallons water

UAN-urea ammonium nitrate-28%N-2.5gallons/100gallons water

Applications made with 10'boom bicycle sprayer at 28PSI and 12GPA

4/30/2024 TRTS 1-4 just greening up when pre emergents were applied

E 4-6mph 45F 4:00pm Soil conditions moist--.3" rain overnight of 4/30 after application

6/1/2024 TRTS 5,9,10,11 clear, 8:30am,63F, wind wsw5mph, 49%RH, ryegrass 6-8" and jointing

6/7/2024 trt# 6,7,8,9,10,11 10:30am 64F wnw 11mph

51% RH 50% cloud cover, 10%heading 12-14" g. height

Table 10.

2023-25 Hard Fescue Fertility x Establishment Trial
Magnusson Research Farm-F7SW

trt#	N Fertilizer Application ¹		Seed Yield(#/acre)				% heading 2024		
	2023	2024	Harvest date		Harvest (7/3/2024)		20-May	23-May	31-May
			3-Jul	10-Jul	Lodging ²	Height			
1	40-0-0	40-0-0	1474	1652	5.0	27	10	27	70
2	80-0-0	80-0-0	1552	1572	4.3	27	7	23	67
3	40-0-0	80-0-0	1620	1522	4.7	27	10	23	60
4	80-0-0-20s	80-0-0-20s	1572	1546	4.7	28	7	23	70
5	0	0	1326	1181	2.0	26	27	43	73
LSD @5% level			258	217	1.3	2	7	10	13
CV(%)			9	8	17.0	5	30	20	11

Experimental Design:RCB w/3reps

All plots received 14-50-70 10/13/2023 and 15-50-40-10s on 9/10/2024.

¹Added nitrogen and sulfur by year 9/19/2023 & 10/4/2024

²Lodging 1=upright ;9=flat

Soil Sample taken 8-25-2023

Location	pH	%OM	N # 0-6"	N# 6-24"	N#0-24"	P-O ppm	K ppm	Ca ppm	
F-7 SW	8.2	2.5	25	33	58	18	133	2659	
CEC meq	CCE% D1	Mg ppm	S #	Zn ppm	Salt1	Cu ppm	B ppm	Fe ppm	Mn ppm
22	0.8	987	14	0.24	0.33	0.38	0.69	9.47	1.18

Table 10a .

MNHD Hard Fescue GDD in Northern MN

The 2024 season was the first year that data was collected to predict a growing degree day (GDD) model in MNHD hard fescue seed production at the U of MN Magnusson Research Farm near Roseau, MN.

A degree of caution is needed when using these GDD numbers in MNHD hard fescue as the data set is only from one year.

Several more years data will be required to improve the confidence

in using GDD to predict the critical growth stages in MNDH hard fescue.

The accumulation of GDD's began after snow melted from the MND hard fescue field and continued through swathing.

A base temperature of 32 degrees F was used for MNHD hard fescue (T-Base = 32 F).

Formula to calculate GDD:

$$\frac{(\text{Daily High Temp} + \text{Daily Low Temp}) - 32}{2}$$

2

The following data, rounded to the nearest ten GDD's, was collected from a first-year MNHD seed production field.

This MNHD hard fescue field was seeded in May of 2023 and data collection began after snow melt in 2024.

Plans are in place to collect additional data in the 2025 growing season to strengthen the GDD data base for MNHD hard fescue grown for seed production in the environmental conditions of northern MN.

Greenup - 140	Fully headed - 1,010
Tillering - 210	Pollen shed - 1,190
Late tillering - 400	Early swath - 1,900
Jointing/row closure - 540	Late swath - 2,140
10% headed - 710	

Table 11.

2022-4 Fall Plant Cover Crop Seed Production

Magnusson Research Farm-Roseau,Mn

Trt#	Fall Planting	Variety	Seed Yield per acre		Winter injury ¹	%stand	Harvest
			2024	2023	5/1/24	5/1/24	Date
7	Australian Winter Pea	VNS	NH	NH	9.0	0	NH
8	Hairy Vetch/w triticales	vetch-VNS	1250#	NH ¹	2.3	73	8/12/2024
9	Winter Canola	Mercedes	NH	574#	9.0	0	NH
10	Winter Hybrid rye	Tayo	98 Bu.	126 Bu.	2.0	83	8/12/2024
		LSD @5% level	NA	NA	0.4	9	NA
		CV(%)	NA	NA	4	14	NA

Experimental Design=RCB w 4 reps

Seeding date=8/27/2023

¹-Winter Injury-1=no injury;9=dead

40-0-0 applied to Tayo rye 5/1/2024

Fall Planting	Variety	Seed rate #/acre	Row spacing	Planting	
				Date	
7	Australian Winter Pea	VNS	80	6"	8/27/2023
8	Hairy Vetch/w triticales	MN/+Tulus	20/45	12"	8/27/2023
9	Winter Canola	Mercedes	5	6"	8/27/2023
10	Winter Hybrid rye	Tayo	40	6"	8/27/2023

Table 12.

2023-4 Spring Plant Cover Crop Seed Production

Magnusson Research Farm-Roseau,Mn

Spring plant ¹	Variety	Seed Yield (#/Ac)		%stand	Harvest		Harvest	
		2024	2023	6/7/2024	Lodging ²	Height	Date	
1	Daikon Radish	Tapmaster	1475	392	60	6.3	59	9/4/2024
2	Yellow Mustard	VNS	1755	1718	78	2.5	54	9/4/2024
3	Berseem clover	Peaceful Valley	271	214#	15	3.5	20	10/8/2024
4	Crimson clover	VNS	NH	160#	25	NH	NH	NH
5	Buckwheat	VNS	1907(40Bu)	739#	90	5.3	63	9/4/2024
6	Flax	Omega	1555(29Bu)	20Bu.	83	1.3	27	9/4/2024
7	Rape	Dwarf Essex	NH	NH	5	NH	NH	NH
		LSD @5% level	622	204	0.9	0.9	5	
		CV(%)	29	19	9	15	7	

Experimental Design=RCB w 4 reps

Seeding date=5/13/2024

Spring plant ¹	Variety	Seed rate #/acre	Row spacing	Planting	
				Date	
1	Daikon Radish	Tapmaster	7	6"	5/13/2024
2	Yellow Mustard	VNS	9	6"	5/13/2024
3	Berseem clover	Peaceful Valley	4	6"	5/13/2024
4	Crimson clover	VNS	4	6"	5/13/2024
5	Buckwheat	VNS	50	6"	5/13/2024
6	Flax	Omega	42	6"	5/13/2024
7	Rape	Dwarf Essex	5	6"	5/13/2024

Experimental Design=RCB w 4 reps

¹-Spring plant-Rape,Crimson and Berseem clover established poorly²-Lodging 1=Erect ;9=Flat

Grizzly II @ 2oz. Applied 6/10/2024 for flea beetle control

4pm 65F wind MW 4-10

80-0-0- applied to treatments 1,2,5,7 and 40-0-0 applied to treatment 6 on 6/20/2024

Soil test 0-6" 10/2023

pH	OM	N-#/ac	P-O ppm	K ppm
7.5	2.3	56	18	123

Table 13.

2023 Cover Crop Evaluation
Magnusson Research Farm-Roseau,Mn

							Top Growth			Top Growth			Root Growth					
Wheat stubble-F4							Fresh wt.	Dry wt.	%dry	Fresh wt.	Dry wt.	%dry	Fresh wt.	Dry wt.	%dry	% stand	WI ⁴	% ground cover
Treat#	Species	Variety	Stand ¹	Vigor ²	%GC ³	Ht(in.)	#/acre	#/acre	matter	#/acre	#/acre	matter	#/acre	#/acre	matter			
1	Canola	L340PC	6.7	6.7	48	3.7	6812	1076	15.8	-----	-----	-----	-----	-----	-----	0	9	0
2	Radish	Daikon	6.0	5.7	35	3.2	3454	461	13.3	16023	2341	-----	10822	806	-----	0	9	0
3	Rape	forage	6.0	4.3	38	3.7	4701	806	17.1	-----	-----	-----	-----	-----	-----	0	9	0
4	Turnip	barkant	6.3	4.7	42	3.7	5181	643	12.4	16196	2456	-----	3915	441	-----	0	9	0
5	Pea	Australian	7.3	7.7	25	3.5	1247	240	19.2	-----	-----	-----	-----	-----	-----	0	9	0
6	Crimson clover	VNS	5.7	4.0	17	1.3	384	77	20.1	-----	-----	-----	-----	-----	-----	0	9	0
7	Red clover	Ruby	3.7	2.0	8	0.5	38	16	42.1	-----	-----	-----	-----	-----	-----	47	2.3	43
8	Hairy vetch	VNS	5.3	6.0	23	2.2	2495	403	16.2	-----	-----	-----	-----	-----	-----	85	6.3	67
9	Buckwheat*	VNS	7.0	7.3	12	5.7	413	230	55.7	-----	-----	-----	-----	-----	-----	0	9	0
10	Flax	Omega	5.7	5.7	32	3.0	1247	201	16.1	-----	-----	-----	-----	-----	-----	0	9	0
11	Triticale	Tulus	6.7	6.0	22	5.0	1823	365	20.0	-----	-----	-----	-----	-----	-----	83	4	50
12	Barley	genesis	6.7	7.3	37	7.3	3742	729	19.5	-----	-----	-----	-----	-----	-----	0	9	0
13	Wheat	Linkert	5.7	6.3	32	6.7	1631	326	20.0	-----	-----	-----	-----	-----	-----	0	9	0
14	Oats	Deon	7.7	7.3	50	8.0	4510	911	20.2	-----	-----	-----	-----	-----	-----	0	9	0
LSD @5% Level			1.9	1.1	17	2.0	2782	643	4.8	NS	NS	-----	3699	220	-----	-----	-----	-----
CV(%)			18	12	33	29	62	79	11	22	15	-----	10	9	-----	-----	-----	-----

Experimental design:RCB with 3 reps

*Frost prior to harvest reduced fresh weight

¹Stand 9/18/2023 - 9= ideal;1=no plants

²Vigor 9/18/2023 -9=best plant vigor;1=poor vigor

³GC 10/14/2023 = %ground cover

⁴WI 5/16/2024-winter injury- 1=none ;9=dead

							Top Growth			Top Growth			Root Growth					
Fallow -F4							Fresh wt.	Dry wt.	%dry	Fresh wt.	Dry wt.	%dry	Fresh wt.	Dry wt.	%dry	% stand	WI ⁴	% ground cover
Treat#	Species	Variety	Stand ¹	Vigor ²	%GC ³	Ht(in.)	#/acre	#/acre	%Dry	#/acre	#/acre	%dry	#/acre	#/acre	matter			
1	Canola	L340PC	8.0	5.0	83	6.0	35117	4460	12.7	-----	-----	-----	-----	-----	-----	0	9	0
2	Radish	Daikon	7.0	6.7	67	7.3	36843	4384	11.9	73496	9901	13	81938	4107	5	0	9	0
3	Rape	forage	7.0	4.3	50	6.0	15351	2103	13.7	-----	-----	-----	-----	-----	-----	0	9	0
4	Turnip	barkant	8.0	6.0	93	7.7	51331	6160	12.0	98826	10938	11	38379	2955	7	0	9	0
5	pea	Australian	7.0	7.0	38	1.6	2399	504	21.0	-----	-----	-----	-----	-----	-----	0	9	0
6	crimson clover	VNS	7.7	3.7	25	3.8	768	169	22.0	-----	-----	-----	-----	-----	-----	0	9	0
7	Red clover	Ruby	3.7	1.3	10	2.7	96	20	21.0	-----	-----	-----	-----	-----	-----	75	2.3	67
8	hairy vetch	VNS	5.3	5.3	28	1.1	1535	330	21.5	-----	-----	-----	-----	-----	-----	0	9	0
9	buckwheat	VNS	8.7	7.3	30	14.0	3934	1101	28.0	-----	-----	-----	-----	-----	-----	0	9	0
10	Flax	Omega	8.0	7.0	43	5.3	1919	380	19.8	-----	-----	-----	-----	-----	-----	0	9	0
11	Triticale	Tulus	7.7	7.0	47	3.1	5085	890	17.5	-----	-----	-----	-----	-----	-----	73	2.3	73
12	barley	genesis	8.0	8.0	60	9.3	18631	2702	14.5	-----	-----	-----	-----	-----	-----	0	9	0
13	wheat	Linkert	7.0	6.3	43	7.0	6524	1181	18.1	-----	-----	-----	-----	-----	-----	0	9	0
14	oats	Deon	8.3	8.0	57	9.3	18613	3071	16.5	-----	-----	-----	-----	-----	-----	0	9	0
LSD @5% Level			1.3	1	15	4.0	3820	655	3.0	11560	856	2	32560	866	2	-----	-----	-----
CV(%)			10	10	18	39	52	80	8	26	8	9	9	9	9	-----	-----	-----

Experimental design:RCB with 4 reps

3 row plots - rows 1' apart x 10'-17' long

All Planted 9/1/2022

Handed watered 5 days after planting

¹Stand 9/18/2023 - 9= ideal;1=no plants

²Vigor 9/18/2023 -9=best plant vigor;1=poor vigor

³GC 10/14/2023 = %ground cover

⁴WI 5/16/2024-winter injury- 1=none ;9=dead

	0-6"	0-6"	0-6"	6-24"	0-24"	0-6"	0-6"
Soil test 10/4/2023	pH	OM	N1 lb	N2 lb	N-(N1+N2)	P-O ppm	K ppm
Wheat stubble F6	8.3	2.6	7	9	16	6	88
Fallow F4	7.5	2.3	56	72	128	18	123

Table 14.

**2023-24 Red Clover Cover Planted Under Tayo Hybrid Rye on Different Dates
2 Locations-Magnusson Research Farm and Magnusson Farms***

Trt#	Red clover Plant date	Planting method	Vigor/growth ¹ 10/15/2024	Treatment explanation
1*	9/12/2023	in furrow	2.0	W/ rye at planting
2*	9/12/2023	broadcast	2.0	broadcast before planting
3	11/14/2023	broadcast	2.8	fall dormant
4	4/1/2024	broadcast	2.8	spring dormant
5	5/8/2024	broadcast	3.0	spring fertilizer time
6	None	-----	1.0	no red clover
LSD @5% level			1.4	
(CV)			42	

Experimental Design=RCB w 4 reps Hybrid rye planted 9/12/2023

*Magnusson Farms treatments had no red clover in any plots in the fall of 2024.

All notes are from the Magnusson Research Farm location only.

¹Vigor/stand-1= poor,no stand;9= good stand of red clover.

Magnusson Research Farm - Rep 1 had some red clover but reps 2-4 were very weak.

Magnusson Research farm -11/14/2023 rye- 2-4" tall and 90% canopy

Magnusson Farms -11-14-2023 Red clover- .5"-1.5" with 20% canopy closure

Magnusson Research farm rye plots-Established with a Hege small plot seeder

Magnusson Farms rye planting done with commercial equipment. Red clover broadcast by hand.

Seeding rate= hybrid rye-45#/acre
red clover- 12#/acre

Soil test 0-6" 10/2023

pH	OM	N-#/ac	P-O ppm	K ppm
7.5	2.3	56	18	123

Table 15.

**2023-24 Ryegrass Cover Crop Seed Production +Additional Nitrogen
Magnusson Research Farm-F2B+2023 Yield data from Casey Pearson 2023**

Treatment ¹	Seed Yield(#/acre)		Harvest		
	2023	2024	stubble ³	Ht(in.)	Lodging ²
Farmer Practice	723	1664	2.0	26	5.7
Farmer Practice+50#N	823	1676	3.0	26	8.0
LSD @5%level	NS	NS	NS	NS	NS
CV(%)	10	10	12	4	26

Experimental Design=RCB w 3 reps Harvest Date=7/30/2024

All N fertilizer applied 4/15/2024

¹-Farmer practice=140#N applied to all plots on 4/15 and 12-70-50 applied 9/12/2023(+50N= 190-70-50)
Casey Pearson NW of Roseau.

40#N added on 10/18/2022 to 100-0-0 on 5/2/2023 (+50N plots=140-60-40-10S total)

²-Lodging-9=Flat ;1=upright

³-Stubble color at harvest-1=brown,3=brown/green mix,5=green(measure of residual nitrogen?)

9-5-2023 sampling

MAG FARM			F2-B								
NO3-N #/acre			0-6"								
0-6"	6-24"	0-24"	pH	OM	P-O ppm	K ppm	Mg ppm	S1 lb	Zn ppm	B ppm	Mn ppm
5	3	8	8.4	2.8	5	103	1172	30	0.25	0.73	0.96

Soil test 9/21/2022 sampling -Pearson

NO3-N #/acre											
0-6"	6-24"	0-24"	pH	OM	P-O ppm	K ppm	Mg ppm	S1 lb	Zn ppm	B ppm	Mn ppm
15	9	24	7.9	2	16	67	298	32	0.27	0.33	1.44

Table 16.

True Armyworm (*Mythimna unipuncta*) Moth Trapping Project in Roseau and Lake of the Woods Counties - Summary Report for 2024

In 2020, a wide-spread outbreak of true armyworm (*Mythimna unipuncta*), and the subsequent feeding, caused significant damage to perennial ryegrass fields in NW MN. Reported ryegrass seed yield losses ranged from 0 to over 80%. The most severe damage occurred over the July 4th weekend.

Armyworms do not overwinter in northern MN but are transported into the area from southern states by low-level jet streams and southerly winds. To document armyworm moth flights into the perennial ryegrass growing region of MN, an armyworm moth trapping project was conducted in 2024. The objectives of this project were to determine: 1) the onset of armyworm moth migration and, 2) the scope and severity of armyworm moths in perennial ryegrass seed fields. Armyworm moths (males only) were trapped with a pheromone trap which were installed on field edges, or in the middle of grass seed fields. These pheromone traps were affixed to a shepherd hook and hung approximately 4 feet off the ground at six locations in NW MN.

Armyworm Moth Capture - 2024

Cold fronts were the dominate weather pattern in April and early May. The North Dakota Agricultural Weather Network (NDAWN) site at the U of MN Magnusson Research Farm documented winds from a north to northwest direction in 23 out of 30 days in April and 10 days in the first half of May. In the second half of May, winds switched to more of a southerly direction and south winds were recorded in 7 of 16 days from May 15-31 and in 12 out of 30 days in June. In the first half of June southerly winds were recorded on June 1&2, 4&5 and 14-16. Further, wind speeds of over 20 mph were recorded in 11 days in the latter half of May and in 19 out of 30 days in June. In 2024 all armyworm moth capture sites were in perennial ryegrass fields as previous data indicated that perennial ryegrass seemed to be the preferred site for armyworm moth activity. Scentry pheromone wing traps were placed in perennial ryegrass fields on May 14 & 15. Traps were inspected weekly, until moth capture, and every two to three days after moth capture and again, weekly, if no moths were captured in the trap. Armyworm moths were trapped on a sticky board and these trapped moths were removed from the sticky trap. In heavy moth flights, a new sticky base replaced the one covered with moths. A new pheromone lure replaced the old lure every three weeks.

The following farmer cooperators were willing to have armyworm traps in or near perennial ryegrass fields. Jade Estling, Kevin Johnson, Troy Johnson, Mark Melby, Brian and Sheldon Rice and Tony Wensloff. Without the cooperation of these individuals this armyworm trapping project would not be possible. Thank you for your cooperation.

The six armyworm moth trapping locations in perennial ryegrass seed production fields in 2024:

- Location 1:** Falun Township, Section 22. Trap placed in the middle of a ryegrass field.
- Location 2:** Stafford Township, Section 14, SW quarter. Trap placed on the edge of a ryegrass field.
- Location 3:** Jadis Township, Section 6. Trap placed in the edge of a ryegrass field.
- Location 4:** Ross Township, Section 4. Trap placed in the middle of a ryegrass field.
- Location 5:** Laona Township, Section 10. The trap was in a field boundary of two ryegrass fields.
- Location 6:** Lind Township, Section 4. The trap was placed on the edge of a ryegrass field.

Table 2. True Armyworm (*Mythimna unipuncta*) moth capture at six locations in Roseau County in 2024

<u>Date</u>	<u>Location</u>						<u>Total</u>
	<u>Falun</u>	<u>Stafford</u>	<u>Jadis</u>	<u>Ross</u>	<u>Laona</u>	<u>Lind</u>	
20-May	17	24	19	23	28	17	128
26-May	16	24	14	20	23	21	118
1-Jun	18	8	6	9	12	7	60
6-Jun	8	12	28	34	40	53	175
12-Jun	3	23	12	19	22	19	98
18-Jun	1	14	2	18	17	3	55
24-Jun	3	17	2	12	16	4	54
30-Jun	0	9	0	13	12	NA	34
Total	66	131	83	148	170	124	722

In 2024, this armyworm moth trapping project documented four significant moth captures that averaged over 3 moths/night. The calendar dates and the number of moths collected from the previous six days were:

- May 20 = 128
- June 26 = 118
- June 6 = 175
- July 12 = 98

Low-level jet streams have been documented to transport insect and disease pests into northern regions of the United States. These low-level jet streams, which are monitored by the University Center for Atmospheric Research (UCAR), move at wind speeds of 30-80 mph and are from 330 to 3000feet in elevation. These low-level jet streams are associated with a thunderstorm or rain event that aids in the deposit of armyworm moths. These low-level jet stream data will be an important tool in the monitoring of armyworm moth movement into the perennial ryegrass growing regions of northern MN.

Summary

Over a three-year period, this armyworm moth trapping project documented that the Scentry pheromone wing trap was effective in trapping armyworm moths. This moth trapping project documented four major flights in 2022, five in 2023 and four flights in 2024. Low-level jet stream maps produced by the University Center for Atmospheric Research (UCAR), can be used to document low-level jet stream events in the perennial ryegrass growing regions of northern MN. Localized thunderstorms and rain events seem to be important in the deposition of armyworm moths into the perennial ryegrass growing region of northern MN. The next step in this project will be to build information learned from this armyworm moth trapping project and try and determine a correlation between the number of trapped moths and number of armyworm larvae in ryegrass fields.

table 17.

2024 Canola Insect Monitoring Project-Roseau,Mn Bertha Armyworm and Diamondback Moth²

<u>¹Location</u>		Bertha Armyworm	Diamondback Moth	Growth stage
Magnusson Farm-	25-Jun	23	4	first bloom
-95.84613 48.88658	2-Jul	17	4	mid-flower-lower pods elongating
	9-Jul	7	9	lower pods starting to fill
	16-Jul	1	117	end flowering, seed enlarging in lower pods
	23-Jul	4	11	seed in lower pods green
	30-Jul	2	27	seed in lower pods green-yellow
	6-Aug	1	39	seed in lower pods yellow or brown
Total insects trapped 6/18-8/6/2024		55	211	

<u>¹Location</u>		Bertha Armyworm	Diamondback Moth	Growth stage
Rice Farm-	25-Jun	12	5	first bloom
-95.78837 48.85574	2-Jul	10	7	mid-flower-lower pods elongating
	9-Jul	2	19	lower pods starting to fill
	16-Jul	1	33	end flowering, seed enlarging in lower pods
	23-Jul	0	44	seed in lower pods green
	30-Jul	0	22	seed in lower pods green-yellow
	6-Aug	0	41	seed in lower pods yellow or brown
Total insects trapped 6/18-8/6/2024		25	171	

¹Location-

Rice Farm- 3.5 miles north and 4 miles west of Roseau,Mn

Magnusson Farms- 1 mile west and .5mile north of Roseau,Mn

²Pheromone trap monitors put into field margin on 6/18/2024 at both locations

Bertha armyworm- green bucket traps

Diamondback moth-wing traps

Traps set out- 6/18/2024

Fresh lure put into traps at both locations on 7/16.