

## **PROGRESS REPORT ON GRASS SEED PRODUCTION RESEARCH**

prepared by

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### **Grass-Legume Seed Institute Presentation**

**Roseau, MN - February 24, 2022**

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 perennial ryegrass plots on the Magnusson Research Farm:***

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

Ryegrass seeded at 5#/acre with spring wheat  
Sterling Blue(dicamba)+ 2,4-D amine 4 (0.75 + 0.75 pint) applied in mid-September  
Fertilize 30-30-30 mid-September after small grain harvest  
Spike tooth harrow after fall fertilizer application to spread straw  
Fertilize 110-0-0 applied early to mid-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. applied full heading, 1,700 - 1,900 GDD

#### **Fall seeded ryegrass in wheat stubble**

Pre-harvest glyphosate application to wheat , or  
glyphosate applied to wheat stubble prior to seeding ryegrass.  
Ryegrass seeded at 6#/acre after wheat harvest into existing stubble  
No broadleaf application in fall but other management for fall seeded ryegrass the same as spring seeded.  
If planted into summer fallow, no additional nitrogen is added.

#### **Tall Fescue**

Establishment=Seed at 7#/acre under spring wheat in May.  
60-50-50-10s September after wheat harvest and 80-0-0 early May.  
.75pt. 2,4-D a + .75pt. Sterling Blue late September.  
Bale off straw after harvest and clip 4"+ bale remaining residue in mid September.

#### **General seed harvest procedure for small research plot**

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 by University of Minnesota personnel.  
Cooperators asked to avoid 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 may be 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 harvest data.  
Experimental design usually consists of 2 or 3 treatment variables and 3 replicates/treatment.

#### **2021 Research Locations**

MagPlots=University of Minnesota-Magnusson Research Farm 2 miles north and 4.5 miles west of Roseau,Mn  
MagFarms=Magnusson Farms- NW of Roseau  
Brateng Farm= South of Roseau  
Rice Farms= NW of Roseau  
Ravndahlen/Tveit farms= 3 miles south of Arnesons Rocky Point

Table 1.

**Monthly and Year End Precipitation Totals\***  
**Roseau,Mn 1967-2020.**

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Yearly Total(in.)	Mean Deviation	Mean(F <sup>o</sup> ) 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	7.35	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	1.73	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	2.70	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	-4.26	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	-3.48	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	-1.16	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	3.89	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	-4.53	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	-6.75	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	-3.14	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	-1.96	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	-5.12	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	-3.43	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	1.02	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	-2.37	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	-0.63	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	-5.15	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	2.47	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	-3.20	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	-4.66	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	-5.65	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	-0.87	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	-10.90	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	7.71	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	-1.96	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	-0.79	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	-3.98	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	-0.63	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	3.41	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	-1.91	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	2.36	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	0.31	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	5.65	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	-3.79	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	3.24	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	1.89	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	11.55	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	8.71	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	-6.09	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	2.72	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	3.94	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	3.98	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	5.33	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	-4.86	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	-3.48	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	1.49	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	3.16	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	8.57	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	1.49	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	0.58	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	-4.43	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	9.49	35.2
2020	0.84	0.29	1.30	0.53	1.66	<b>6.29</b>	<b>8.23</b>	2.30	0.77	1.11	1.19	0.99	25.50	2.92	38.3
2021	0.35	0.23	0.14	1.32	1.64	<b>1.53</b>	<b>1.18</b>	3.52	1.18	3.00	2.07	1.50	17.66	-4.92	42.1
<b>52 year average annual precipitation</b>													<b>22.58</b>		
<b>50 year available mean temperature=</b>														<b>37.3</b>	

\*Precipitation amounts used are from the Magnusson Research Farm-near Roseau April/May-October and Minnesota Climatology Working Group nearest location or Fox NDAWN for the remainder of the year. Average precipitation the last 20 years=24.68". Average precipitation the previous 33 years=21.16"

Table 2.

**2020 Perennial Ryegrass Seed Production Variety Trial**  
**Magnusson Research Farm-Roseau,Mn. 2021 data and yields 2019-21**

Company	Variety	Seed Lot#	Seed Yield(#/acre)				Seed Yield as % of Mean			Harvest Ht.(in.)	Date	Heading (%)					
			2021	2020	2019 <sup>1</sup>	3yr.ave	2021	2020	2019 <sup>1</sup>			6/3	6/7	6/10	6/13	6/17	6/21
U of M	Green EmperorxRoyal Green	4020	1571	1384	1240	1398	129	108	124	18	14-Jul	4	10	38	70	90	98
U of M	Arctic Green	4113	1324	1364	1347	1345	109	107	134	18	17-Jul	0	5	20	50	73	94
DLF	Dilligent	4127	1315	NA	NA	NA	108	NA	NA	17	17-Jul	2	9	20	45	80	95
Pure Seed Testing	Gray Fox	4129	1277	1259	977	1171	105	99	98	18	17-Jul	4	13	30	58	76	95
U of M	Galactic Green(3999)	4050	1255	1286	1262	1268	103	101	126	18	19-Jul	1	6	30	50	73	91
Mountain view seed	Superstar GL	4125	1242	1420	1145	1269	102	111	114	17	19-Jul	1	6	25	45	78	95
U of M	Spreader IIIxArctic Green	4051	1199	1386	1233	1273	99	109	123	17	14-Jul	3	9	28	53	76	94
check	NK-200	3917	1179	1130	810	1040	97	88	81	24	23-Jul	0	6	15	43	70	93
U of M	Green Emperor	3976	1173	1426	1060	1220	97	112	106	15	19-Jul	1	7	23	45	70	93
Pure Seed Testing	Silver Sun	4128	1155	1130	907	1064	95	88	91	17	13-Jul	10	30	48	80	92	98
Pure Seed Testing	Silver Sport	4130	1113	1310	1130	1184	92	103	113	15	15-Jul	5	18	43	68	88	97
U of M	EPR-18(early line)	4103	1090	1264	NA	NA	90	99	NA	19	21-Jul	0	2	8	20	45	83
Mountain view seed	Sliders LS	4126	1084	NA	NA	NA	89	NA	NA	17	19-Jul	2	8	19	45	73	91
U of M	Forage-2018	4100	1030	1017	731	926	85	80	73	18	20-Jul	0	3	18	40	73	94
LSD @5% level			179	135	105	108	15	10	10	2	3	3	6	15	15	14	6
CV(%)			10	7	7	7	10	7	7	6	14	81	45	40	21	13	4
Trial mean by year			1215	1277	1003												

Experimental design:RCB with 4 reps

Planted 5/5/2020 with Linkert spring wheat @7#/acre

<sup>1</sup>- NA - Variety not planted and information not available

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Table 3.

**2019 Fine Fescue Seed Production Variety Trial**  
**Magnusson Research Farm-Roseau,Mn. 2021 data and yields from 2020.**

Species	Variety	Seed Lot#	Seed Yield(#/acre)			Harvest Ht.(in.)	Lodging <sup>1</sup>	Harvest Date	Heading (%)						
			2021	2020	2yr.ave				5/18	5/21	5/24	5/29	6/3	6/7	6/10
hard fescue	MN-HD	4065	1128	906	1017	21	1.0	26-Jun	9	28	55	78	94	99	99
hard fescue	SPHD	2	1006	765	886	20	1.0	29-Jun	6	20	58	78	95	99	99
hard fescue	Beacon	3	690	699	694	21	1.8	28-Jun	1	13	43	63	89	95	99
hard fescue	Gladiator	4	467	579	523	21	1.5	29-Jun	1	6	28	50	79	90	99
hard fescue	Jetty	5	959	681	820	21	2.3	28-Jun	5	15	40	60	91	99	99
chewing	Radar	6	788	661	724	25	2.5	1-Jul	0	0	1	18	53	83	96
strong creeping	Chantilly	7	58	402	230	20	1.0	1-Jul	0	0	0	1	4	8	10
LSD @ 5% level			209	102	117	2	0.7	2	4	9	9	8	10	7	2
CV(%)			19	10	11	30	5	4	86	55	20	11	10	6	2
Trial mean by year			728	670											

Experimental design:RCB with 4 reps

Planted 5/10/2019 with no companion crop @6#/acre

<sup>1</sup>-Lodging; 1=upright; 9=flat

Table 4.

**2018 Tall Fescue Variety Trial**  
**Magnusson Research Farm-Roseau,Mn**

Variety	MSP#	Source	Seed Yield(#/acre)				Harvest Ht.(in.)	Heading (%)			
			2019	2020	2021	2019-21		6/7	6/10	6/13	6/17
Cumberland	4080	Pure seed testing	1393	1346	725	<b>1155</b>	26	2	18	40	74
Rodin	4079	Lebanon Seaboard	1382	1496	690	<b>1189</b>	30	1	25	48	80
Titanium	4095	Mountain View Seed	1351	1555	790	<b>1232</b>	27	1	13	35	63
MN-TF15	4074	U of Mn-Watkins	1311	1697	599	<b>1202</b>	26	0	11	30	66
Monet	4077	Lebanon Seaboard	1210	1467	772	<b>1150</b>	31	2	30	55	84
Essential	4082	DLF	1144	1184	441	<b>923</b>	25	1	10	30	58
Davinci	4076	Lebanon Seaboard	1099	1206	779	<b>1028</b>	35	1	30	58	83
Raindance	4081	Pure seed testing	1084	954	583	<b>874</b>	28	1	18	43	75
Rembrandt	4078	Lebanon Seaboard	1075	1184	452	<b>903</b>	30	1	13	30	61
Coronado	4093	Pure seed testing	1006	1042	514	<b>854</b>	32	4	33	60	84
Bloodhound	4083	DLF	990	1094	423	<b>836</b>	28	1	13	33	64
K-31	4075	Check	761	952	432	<b>715</b>	37	11	43	68	90
		LSD @5% level	216	279	115	<b>148</b>	3	3	7	9	10
		CV(%)	13	15	13	<b>10</b>	7	105	25	15	9

Experimental design:RCB with 4 reps

All harvested 7-16-21 Trial Mean #/acre= 1151 1265 600

2021 Data + 2019&amp;2020 Seed Yields

Added fertilizer= 140-40-40-10s split fall/spring

Residue baled after harvested + clipped and baled 9/15/2020

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Table 5.

**2020 Perennial Ryegrass Winter Hardiness Trial**  
**Magnusson Research Farm Roseau,Mn & U of Minn. St. Paul Campus**

Variety	Seed lot	Winter Injury <sup>1</sup>		
		Roseau 5/8/21	St.Paul 4/7/21	Mean
Green EmperorxArctic Green	4031	2.5	1.0	1.8
Green Emperor	3976	2.0	1.0	1.5
Annual	4134	9.0	1.5	5.3
Galactic Green (3999)	4050	2.0	1.0	1.5
NK-200	3917	3.0	1.0	2.0
Accent II	4096	2.3	1.0	1.6
Forageur	4043	2.0	1.0	1.5
Arctic Green	4038	2.3	1.0	1.6
Spreader IIIxArctic Green	4051	4.0	1.0	2.5
Forage sel-2019	4150	2.3	1.0	1.6
Silver Sport	4130	1.0	1.0	1.0
EPR-18	4103	2.8	1.0	1.9
Forage sel-2020R	4148R	3.3	1.0	2.1
Forage sel-2020S	4149S	3.3	1.0	2.1
	LSD @5% level	1.0	0.2	0.5
	CV(%)	25	14	19

Experimental design:RCB with 4 reps

Single row plots planted-

Roseau = 9/9/2020

St.Paul =9/14/2020

<sup>1</sup>-Winter injury(visual rating)- 1= no injury; 9=dead.



Table 8.

**2021 Field Pea Variety Trial**

**Magnusson Research Farm. 2021 data and 2019-2021 yield**

**Field Pea**

	Bu/acre <sup>1</sup>			Harvest ht(in)	Flower Date	
	2021	2020	2019		1st	last
5 ACC Chrome	58.5	NA	NA	21.7	23-Jun	10-Jul
3 Shamrock	50.6	NA	NA	23.0	24-Jun	10-Jul
2 Empire	45.2	NA	NA	29.0	24-Jun	11-Jul
1 Cronos	43.4	17.7	NA	22.7	17-Jun	8-Jul
6 AAC Profit	48.5	36.2	108	25.0	24-Jun	11-Jul
4 Spider	46.2	24.5	96	24.3	24-Jun	10-Jul
7 Salamanca	49.8	36.6	96	24.0	22-Jun	9-Jul
LSD @ 5% Level	14.1	14	11	2.8	1	1
LSD @ 10% Level	11.6	.	.	3.4	1	1
CV(%)	16	34	7	8	2	6

Experimental Design: RCB w/3 reps

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**2021 Faba Bean Variety Trial**

**Magnusson Research Farm. 2021 data and 2019&2021 yield**

	Bu/acre <sup>1</sup>		Height(in)
	2021	2019	Harvest
Boxer	29.3	68	29
Victus	30.0	NA	28
EXP14	27.3	NA	26
LSD @ 5% Level	2.0	NS	2
LSD @ 10% Level	1.5	NS	2
CV(%)	3	11	4

Experimental Design: RCB w/3 reps

Blister beetle most active on Boxer and Victus in 2021

Plots not harvested in 2020 due to flooding.

**Management of both trials all years-**

Yield<sup>1</sup>=Bushels per acre at 12% moisture and 60#/bushel

Herbicide application-

Authority Elite 1.5pt.acre applied immediately after planting .

Site= Conventional tillage seedbed- Non-irrigated

Fertility application 10-50-50 Soil type- sandy loam

Previous crop- spring wheat

Planting Date= 5/7/2021(as early as possible in spring)

Harvest date-Faba beans 9/13/2021; Field Peas- 8/18/2021

Faba bean Seeding Rate= 197,000PLS/acre

Field pea Seeding Rate= 350,000PLS/acre

Table 9.

**2020-21 Perennial Ryegrass Fertility Trial**  
**Magnusson Research Farm-Roseau,Mn**

TRT#	Total N level	Application <sup>1</sup> timing	Seed Yield <sup>2</sup>		Harvest Ht(in.)	RCI <sup>3</sup>		
			#/acre	% mean		5/24	6/9	7/26 <sup>4</sup>
1	0-0-0	0	331	26	12	139	195	93
2	140+0+0	30-0-0--10/20	1324	104	18	449	537	121
3	140+0+0	30-0-0--10/20--0-40-0 4/27	1264	99	17	436	508	120
4	140+0+0	No fall N	1353	106	18	345	528	141
5	100+0+0	30-0-0--10/20	1168	92	17	386	453	106
6	140+0+0+20s	30-0-0-20s--10/20	1331	104	16	465	558	118
7	140+0+0+70s	30-0-0-20s--10/20	1351	106	17	392	509	102
8	100+0+0	30-0-0- same trt#5	1144	90	16	388	492	99
LSD @5% level			155	12	2	52	57	20
CV(%)			9	9	8	9	8	12

Experimental Design:RCB w/4reps

Variety=Arctic Green

Perennial ryegrass spring seeded 5/2020 under wheat.

Mean yield(not including 0# N)= 1276#/ac

Total #N

Trt#	Season	Treatment applications and timing <sup>1</sup>	Treatment Explanation-*
1	17	No added N fertilizer	No added N
2	140	30-0-0 on 10/13+95 -0-0 on 4/27	30#N oct- STANDARD- BMP
3	140	30-0-0 on 10/13+95-40-0 on 4/27	Standard + 0-40-0 spring
4	140	none in fall+125-0-0 spring	spring only N
5	100	30-0-0 on 10/13+55-40-0 on 4/27	30#N Oct-low N
6	140	30-0-0-20s on 10/13+95 -0-0 on 4/27	30#N oct + 20# sulfur Oct(82#AMS)
7	140	30-0-0-70s on 10/13+95 -0-0 on 4/27	30#N oct+20# sulfur oct(82#ams)+50#sulfur Spring(208#AMS)
8	100	30-0-0 on 10/13+55-40-0 on 4/27	30#N Oct-low N(40# liquid N was not applied)same trt# 5

**All plots received 17-40-40-10s 9-11-2020**\*-Standard application= 30#N on 10/13/2020  
and remaining 110#N on 4/27/2021.

10/11/2020 Soil test results

Depth	Olsen P	K	% OM	PH	NO3-N
0-6"	8 ppm	125 ppm	2.7	8.3	9 ppm
6-24"					7 ppm

\* Rational for treatments

<sup>1</sup>Treatment application not including 17-40-40-10s on 9/11/2020.<sup>2</sup>Seed Yield - Clean seed yield of each treatment in LBS/Acre and % of trial mean (not including no added N trt#1)<sup>3</sup>RCI-Relative Chlorophyll Index-higher value=more chlorophyll<sup>4</sup>RCI scored in harvested area. May be an indication of residual nitrogen after harvest



Table 10.

**2011-21 Perennial Ryegrass Fertility Trial Seed Yield Summaries**  
**Magnusson Research Farm-Roseau,Mn**

Trt. #	Nitrogen Fertilizer	Nitrogen Timing	Overall <sup>3</sup>		Seed Yield as % of Mean									
			Mean	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
1	0	0	29	26	24	20	21	45	38	29	27	28	21	36
2	100+0+0	Split <sup>1</sup>	98	91	99	103	90	104	90	----	92	96	112	108
3	140+0+0	Split <sup>1</sup>	107	104	104	111	101	99	110	99	104	104	118	118
4	140+40+0	Split <sup>1</sup> +(0-40-0spring)	108	99	96	100	107	106	109	127	120	----	----	----
5	140+0+0+20s	Split <sup>2</sup>	101	104	95	99	101	102	----	----	110	99	----	----
6	140+0+0	Split <sup>1</sup> +(90spring+20liq)	103	----	98	102	101	99	----	----	106	109	----	----
7	180+0+0	Split <sup>1</sup>	109	----	----	----	107	92	111	----	122	111	----	----
8	140+0+0	Spring only	103	106	104	99	94	91	106	----	96	104	119	115
LSD @5% level				12	10	13	11	13	12	20	11	16	11	12
CV(%)				9	8	10	8	9	9	16	8			

Experimental Design:RCB with 4 reps

Variety all years=Arctic Green

Yield Trial mean by year (#/acre)-- 1276 1584 1668 1631 1627 1220 1344 1244 1068 1499 1313

<sup>1</sup>-Split-30-40-40 applied fall and remainder in spring(increased to 30-50-50 in 2019)<sup>2</sup>-Split-30-50-50-20s(77#AMS / acre) applied in fall+110-0-0 in early May<sup>3</sup>-Treatment 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
- 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 30-40-40 applied Sept.-Oct. / 110-0-0-20s applied early May

**Observations/Conclusions- from past fertility trials**

Applying 10-20% of spring nitrogen as ESN has been beneficial in some years and is applied to perennial ryegrass at the U of M research farm as BMP.

Treatment #4 (ie. Adding 0-40-0 in spring) is less beneficial if beneficial at all, if P2O5 soil test levels above 7ppm

table 11.

**2021 Perennial Ryegrass Herbicide Management Trial  
Magnusson Research Farm**

Trt#	Herbicide Treatment	Rate	Manage Level <sup>1</sup>	Seed Yield(#/acre)			Yield as % of mean	Ht(in.) Harvest	Color <sup>3</sup> 7/10	RCI <sup>4</sup> 7/10	% Germ <sup>5</sup>
				2021	2020	2yr.ave					
1	Quelex+Widematch+.25%NIS/Tacoma	.75oz+1pt/10oz	BMP	1297	1370	1334	100	16	5.3	212	89
2	Callisto+Sterling Blue+2,4-D/Tacoma	3oz+12oz+12oz/10oz	BMP	1388	1546	1467	110	16	4.5	218	
3	Callisto+Sterling Blue+2,4-D/Tacoma	6oz+12oz+12oz/10oz	BMP	1206	NA <sup>2</sup>	NA	NA	16	5.3	214	93
4	Sterling Blue+2,4-D/Tacoma	12oz+12oz/10oz	BMP -	1235	1506	1371	102	17	4.3	177	
5	Sterling Blue+2,4-D/Tacoma	12oz+12oz/10oz	BMP	1374	1412	1393	104	16	5.3	217	90
6	Sterling Blue+2,4-D/Tacoma	12oz+12oz/10oz	BMP +	1224	1541	1383	103	16	5.0	184	
7	Sterling Blue+2,4-D/Tacoma	12oz+12oz/10oz	BMP ++	1197	1356	1277	95	17	4.5	197	
8	Wolverine	1.7pt +1pt.	BMP	1304	1359	1332	100	15	5.0	185	93
9	Facet+2,4-D+Sterling Blue	1.5pt+12oz+12oz	BMP	1257	1362	1310	98	15	4.8	192	92
10	Sterling Blue+2,4-D+Dual II/Tacoma	12oz+12oz+1pt/10oz	BMP	1311	1394	1353*	101	15	5.8	186	
11	No Treatment		BMP	1108	1263	1186	88	15	5.3	193	90
LSD @ 5% Level				148	138	137	10	1	1.3	29	
CV(%)				8	5	5	5	4	18.0	10	

Experimental design:RCB with 4 reps

Mean Yield-

1264 1411 1338

Harvest date=7-21-21

Variety=Arctic Green-- 3/4pt 2.4-D+3/4pt.Banvel applied 9-15-2020 to all plots

\*Prowl H2O in 2020 and Dual II Magnum in 2021

<sup>1</sup>Management level- Other than herbicide application

<sup>2</sup>6 oz. Callisto treatment 2021 only

<sup>3</sup>Color=visual rating 9= dark green; 1= light green

<sup>4</sup>RCI=Relative chlorophyll index- higher number=higher relative amount of chlorophyll

<sup>5</sup>Germination- Germinations of harvested seed of selected treatments.

5/27/2021 45f 1

6-2-21 9am 67F ssw4 54%RH

6-9-21-ESE 6-10 10%hd ht 12" 75F

6-25-21 Fungicide applications= 9:30am wsw 2-6mph 70F RH 80%

mid pollen shedding- fully headed 15" growth ht.

BMP = (Best management practice) 6oz. Apogee+2 Gal. 28%N +low cost fungicide / premium fungicide + 1gal 28%N 3 weeks before harvest

BMP - = BMP substitute no fungicide with Apogee / substitute low cost fungicide only 3 weeks before harvest

BMP + =growth regulator + premium fungicide + insecticide1X

BMP ++ =growth regulator + premium fungicide + insecticide 2X

**Trt# 2021 Treatment and Date**

- 1-- Quelex+WideMatch 5-24 / Tacoma 6-2/ Apogee + Tilt+ 2 gal 28%N 6-9 / Priaxor +1 gal 28%N 6-25
- 2-- 3oz Callisto+ 2,4-D+ Sterling Blue 5-24/ Tacoma 6-2/ Apogee + Tilt+ 2 gal 28%N 6-9 / Priaxor +1 gal 28%N 6-25
- 3-- 6 oz Callisto+ 2,4-D+ Sterling Blue 5-24/ Tacoma 6-2/ Apogee + Tilt+ 2 gal 28%N 6-9 / Priaxor +1 gal 28%N 6-25
- 4-- 2,4-D+ Sterling Blue 5-24/ Tacoma 6-2/ Apogee + 2gal 28%N 6-9 / Folicur 6-25
- 5-- **2,4-D+ Sterling Blue 5-24/ Tacoma 6-2/ Apogee + Tilt+ 2gal 28%N 6-9 / Priaxor 6-25+1gal 28%N 6-25(standard BMP)**
- 6-- 2,4-D+ Sterling Blue 5-24/ Tacoma + 2gal 28%N +Folicur 6-12/ Apogee + Quilt+ Warrior+2gal 28%N 6-9 / Priaxor +1gal 28%N 6-25
- 7-- 2,4-D+ Sterling Blue 5-24/ Tacoma + 2gal 28%N +Folicur 6-12/ Apogee + Quilt+ Warrior +2gal 28%N 6-9 / Priaxor +Warrior+1gal 28%N 6-25
- 8-- 2,4-D+ Sterling Blue 5-24/ Tacoma +2 gal 28%N +Folicur 6-12/ Apogee + Quilt +2gal 28%N 6-15 / Priaxor+1gal 28%N 6-25
- 9-- Wolverine 6-12/ Apogee + Tilt + 2gal 28%N 6-15 / Priaxor + 1gal 28%N 6-25
- 10-- 2,4-D+ Sterling Blue+Dual II Magnum 5-24/ Tacoma 6-2/ Apogee + Tilt+ 2 gal 28%N 6-9 / Priaxor +1 gal 28%N 6-25
- 11-- NO HERBICIDE--Apogee + Tilt+ 2 gal 28%N 6-15 / Priaxor +1 gal 28%N 6-25

Trade Name	Common name -Active ingredient/gallon(or % dry)	Use Rate/acre
Quelex	10% halauxifen+10% florasulum	.75oz
WideMatch	.75#CLOPYRALID + .75#FLUROXYPYR	1pt
Tacoma(Puma/Parady)	1#FENOXAPROP-P-ETHYL	10oz
Callisto	4# mesotrione	3oz
Sterling Blue	4# Dicamba	.75pt
2,4-D	4# 2,4-D amine	.75pt
Wolverine Advance	.4#FENOXAPROP-P-ETHYL + .13#PYRASULFOTOLE +1.05# BROMOXYNIL	1.7pt
Apogee	27.5% PROHEXADIONE CALCIUM	8oz
Preference	Non-ionic surfactant(90%NIS) (.25%NIS)	1qt./100gallons water
Amsol	1gallon=3.4# dry AMS =.7#N/gal	1 pt
28%N	2.9#N(UAN)/Gal	3 gal
Tilt	3.6#Propiconazole	4 oz
Quilt Xcel	1.02#PROPICONAZOLE + 1.18#AZOXYSTROBIN	12oz
Priaxor	1.39#FLUXAPYROXAD +2.78# PYRACLOSTROBIN	6oz
Warrior(Grizzly)	2.08#LAMBDAHALOTHIN	1.5oz
Folicur	3.6#Tebuconazole	4oz

Table 12.

**2021 Growth Regulator Applications to Perennial Ryegrass  
Rice Farms- 6 miles NW of Roseau**

Treatment	Rate	Additive	Seed yield #/acre	Harvest Height
1 No treatment		None	981	18
2 Palisade EC	.75pt	.25%NIS	995	17
3 Palisade EC	1.5pt	.25%NIS	888	16
4 Apogee	4oz.	.25%NIS+3gal.UAN	906	15
5 Apogee	6oz	.25%NIS+3gal.UAN	952	15
6 Apogee	8oz.	.25%NIS+3gal UAN	961	14
7 Apogee	8oz.	.25%NIS+2.5% UAN	975	16
8 Apogee	8oz.	.25%NIS+3gal.AMS	1030	16
LSD @ 5% Level			NS	1
CV(%)			10	6

Experimental Design:RCB/w 4 reps Variety-Evolution

Wolverine 1.7pt./ac +1pt Amsol 6/8  
PGR applied 6/9/2021 ESE 8-12mph 10% heading

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Table 13.

**2021 Wolverine and Growth Regulator Applications to Perennial Ryegrass  
Rice Farms-Roseau,Mn**

trt	Treatment	Seed yield #/acre	Harvest Height
1	Wolverine/Apogee	1164	15
2	Wolverine+Apogee	1166	17
3	Wolverine+Palisade	1046	17
LSD @ 5% Level		NS	1
CV(%)		6	4

Experimental Design:RCB/w 4 reps Variety-Evolution

PGR all and combos 6/9/21 10"ht 76F ese5-8 20%heading

Wolverine alone applied - 6/2/2021 at 9am 67F ssw4 56%RH

trt	Treatment	Timing	Timing
1	Wolverine/Apogee	6/2 & 6/9	1.7pt. + 1pt AmSol(.5#AMS ) / 6oz+.25%NIS+2.5%UAN
2	Wolverine+Apogee	9-Jun	1.7pt. + 6oz+.25%+2.5%UAN
3	Wolverine+Palisade EC	9-Jun	1.7pt.+ .75pt +.25%NIS

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Table 14.

**2021 Perennial Ryegrass Desiccation Treatments Applied as a Pre-harvest Aid  
Magnusson Research Farm**

Treatments and Rates	%Germ <sup>1</sup>	Abnormal <sup>2</sup>
1.5Pts. Gramoxone+.25%NIS	81	9
1.5Pts. Roundup PowerMax+1pt Amsol	90	2

3 strips applied of each treatment 7-25-2021 prior to harvest(Seed mature at application)

<sup>1</sup>%Germination- Selected treatments that may influence seed germination of harvested seed.

<sup>2</sup>Abnormal germinations added to show possible effect of herbicide treatment

Table 15.

**2021 Fungicide Trial on Perennial Ryegrass  
Magnusson Research Farm**

Treatment Name	Rate	Adjuvant	Seed yield #/acre	Height harvest	10-Jul Color <sup>1</sup>	10-Jul RCI <sup>2</sup>
Untreated Check			<b>1128</b>	17	4.3	190
Tebuconazole	3oz	.25%NIS	<b>1117</b>	16	4.3	167
Badge SC	1pt		<b>1115</b>	17	5.5	190
Tebuconazole+Badge	3oz.+1pt	.25%NIS	<b>1157</b>	17	4.5	184
Quilt Xcel	12oz	.25%NIS	<b>1159</b>	16	4.3	188
Priaxor D	6oz	.25%NIS	<b>1148</b>	16	4.5	185
LSD @ 5% Level			<b>NS</b>	NS	0.8	NS
CV(%)			9	3	11	8

Experimental Design:RCB/w 4 reps variety=Arctic Green

<sup>1</sup>Color-visual rating 1=light green;10=dark green

<sup>2</sup>RCI-Relative Chlorophyll Index-higher number =higher relative amount of chlorophyll

Applied 6/25/2021 wind west 2-6mph 10:30am ryegrass 15" fully headed and heavy pollen shedding

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Table 16.

**2021 Avadex Applications to Perennial Ryegrass for Resistant Wild Oat Control  
Rice Farms-6 mi. NW of Roseau**

Treatment	Application		Seed Yield #/acre	Height harvest	Injury <sup>1</sup> harvest	Stunting <sup>2</sup> 7-Jul	Vigor <sup>3</sup> 7-Jul	wild oat control <sup>4</sup>	%Germ <sup>5</sup>
	Timing	Rate							
Untreated Check	none		<b>1101</b>	16	1.0	2.7	6.0	0	90
Avadex MicroActiv	23-Apr	10#	<b>929</b>	14	2.7	4.7	5.3	55	
Avadex MicroActiv	23-Apr	15#	<b>940</b>	13	5.7	5.3	6.3	80	89
Avadex MicroActiv <sup>6</sup>	23-Apr	10#+Till	<b>899</b>	13	5.7	6.3	6.7	75	85
Tacoma	1-Jun	10oz.	<b>941</b>	13	1.7	4.0	5.7	85	
Dual II Magnum	23-Apr	1 pt	<b>1041</b>	13	4.0	5.3	6.3	0	
Avadex/Tacoma	4/23+6/1	10#/10oz	<b>819</b>	14	3.3	6.0	6.3	70	88
Avadex+Dual II	4/23+4/23	10#/1pt	<b>896</b>	13	6.3	6.7	6.7	40	91
LSD @ 5% Level			<b>203</b>	2	1.8	1.2	NS	NA	
CV(%)			12	7	27	13	16	NA	

Experimental Design; RCB w/3reps(no appropriate location for rep 4)

<sup>1</sup>Injury at harvest-9=most;1=none

<sup>2</sup>Stunting-9=worst;1=least

<sup>3</sup>Vigor- 9=most ; 1=best

<sup>4</sup>Wild oat control at harvest= %control-visual rating- insufficient data to run statistical analysis

<sup>5</sup>%Germination- Selected treatments that may influence seed germination of harvested seed.

<sup>6</sup>Spike tooth harrow used to incorporate Avadex after application in Trt# 4

Avadex and Tacoma applications made 4-28-21 11am,62F wind se5 39%RH hazy sun

Tacoma applied to trts. 5&7 6/9/2021 3pm wsw 10-15 80F 10% heading

3oz. Grizzly II applied to all plots 6/29/2021 ;all other operations were applied as BMP.

Badge SC copper hydroxide + copper oxychloride 2.27# metallic copper/gal.

Nexicor fluxapyroxad .25#,pyroclostrobin 1.67#,propiconazole 1.04#

Priaxor fluxapyroxad 1.39#,pyroclostrobin 2.78#

Folicur 3.6F tebuconazole 3.6#

Quilt Xcel Azoxystrobin 1.18#, propiconazole 1.02#

Grizzly Z Lambda-cyhalothrin 1#

Warrior w Lambda-cyhalothrin 2.08#

Avadex MicroActiv Triallate 10%

Table 17.

**2021 Ryegrass Yields with Spring Wheat Combined at Various Heights in 2020  
Magnusson Farm-1 mile west of Roseau**

Stubble Height	Seed Yield <sup>1</sup> #/acre	RCI <sup>2</sup> 8/3/2021
2"	1845	101
5"	1717	119
10"	1575	136

Plot size=45' x 1020' Wheat Harvest date-8/1/2021- (Straw baled after harvest)

<sup>1</sup>- Weigh wagon yields of perennial ryegrass from combine. Insufficient replication for statistical analysis

<sup>2</sup>-Relative Chlorophyll Index of perennial ryegrass- higher number=more chlorophyll

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Table 18.

**2021 Spring Residue Management - Perennial Ryegrass  
2 Locations<sup>1</sup> -Roseau ,Mn**

Treatment	Seed yield-#/acre		Harvest Ht(in.)		6/9 RCI <sup>2</sup>	
	Rice	MagPlot	Rice	MagPlot	Rice	MagPlot
1-no treatment	1172	972	17	15	493	442
2-Clip 3"	1222	1050	17	16	530	399
3-Clip 3"-Rake off straw	1380	975	17	15	536	438
4-Harrow	1243	NA	16	NA	507	NA
LSD @ 5% Level	118	NS	NS	NS	NS	NS
CV(%)	4	14	6	4	8	10

Experimental Design= RCB w 4 reps-MagPlot & 3 reps Rice Farms

<sup>1</sup>-Locations-MagPlot-Magnusson research farm ---Rice Farms- 6 miles NW of Roseau,Mn

<sup>2</sup>-Relative Chlorophyll Index of perennial ryegrass- higher number=more chlorophyll

Varieties- Evolution Rice Farms & Arctic Green MagPlots

Treatments imposed 4/27/2021

Harvest date - 7-20-21--both locations

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Table 18a.

**Spring Residue Management Seed Yield Summaries-2018-2021  
Rice Farms 2018 and 2021  
Magnusson Research Farm-2019-20**

Trt#	Clip Treatment <sup>1</sup>	Seed Yield-#/acre				Mean
		2021	2020	2019	2018- <sup>2</sup>	
1	No Treatment	1172	1395	1386	1430	1345
2	Clip only	1222	1475	1497	NA	1398
3	Clip-Rake off	1380	1537	1611	1610	1535
4	Harrow	1243	NA	NA	NA	NA
	LSD @ 5% Level	118	NS	197	63	
	CV(%)	5	8	7	2	

Experimental Design:RCB w/4reps

Varieties= Rice farm- 'Evolution'

Magnusson Research farm-'Arctic Green'

<sup>1</sup>-Clip and leave or clip and remove late April-early May

Wheat stubble= 7". Clip height=3"

<sup>2</sup>-No clip treatment in 2018 from Rice Farms location.

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Table 19.

**2021 Volunteer Wheat Regrowth with Underseeded Ryegrass  
Magnusson Research Farm<sup>1</sup>**

Volunteer Wheat Cut Height	Cut Date <sup>1</sup> 10/25/2021	Crude <sup>2</sup> Protein
3"	.63 Tons/ac.	30%
6"	.40 Tons/ac.	33%

Wheat stubble height - 5"

<sup>1</sup>-Linkert spring wheat harvested 8-6-2021. Volunteer harvested and dry matter yield here.

Wheat regrowth cut at 2 heights,dried and reported here.

<sup>2</sup>-Crude protein levels are approximate based on growth stage and cut height.

Table 20.

**2020 Kernza Residue Management  
Magnusson Research Farm**

TRT# Treatment	Seed yield #/acre	Dry Matter tons/acre	Harvest (In.)
1 Burn	604	2.5	51
2 Bale at harvest	433	2.1	49
3 Bale-Short clip+Bale	392	1.8	47
4 No Treatment	264	1.4	47
LSD @ 5% Level	205	0.7	NS
CV(%)	30	25	8

Experimental Design:RCB/w 4 reps

Harvest Date= 8-9-2021 Kernza -MN-Clearwater

Harvested 8/5/2020

Trt#1 Burned 8-11-2020

Trt#2 Raked off 8-10-2020

Trt#3 Clip-Rake 9-9-2020 Flail chopped off to 4" ht.

Trt#4 Kernza harvested and residue left on plot

Table 21.

**2020-21 Hard Fescue Fertility Management  
Magnusson Farm-1 Mile SW of Roseau,Mn**

Added Fertilizer	Seed	RCI <sup>1</sup>		Harvest
	Yield(#/ac)	5/18/21	Harvest	Ht(in.)
0-40-40	<b>378</b>	136	148	18
40-40-40	<b>670</b>	192	176	20
80-40-40	<b>903</b>	254	204	21
120-40-40	<b>854</b>	317	305	20
160-40-40	<b>1001</b>	363	324	22
LSD @ 5% Level	<b>161</b>	49	75	1
CV(%)	<b>13</b>	12	21	4

Experimental Design-RCB w 4 reps

Harvest Date-6-25-2021

Fertilizer applications -September 25,2020

<sup>1</sup>Relative Chlorophyll Index- higher number=more chlorophyll

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Table 22.

**2020 MN-HD Hard Fescue Residue Management  
Magnusson Farm-1 Mile SW of Roseau,Mn**

	Seed	Harvest
	Yield(#/ac)	Ht(in.)
1-Desiccate-Burn	601	20
2-Bale after harvest	567	21
3-Bale-Cut/Bale late	514	19
4-no treat	418	20
LSD @ 5% Level	138	2
CV(%)	16	5

Experimental Design-RCB w 4 reps

Trt#2-3- baled off after harvest 7-9-2020

Trt#3- clipped/raked off 9-15-20

Trt#1-Gramoxone Max applied 7/30/2020 4pm 81F 42%RH wind s 1-3mph south  
and burned 8-6-2020 Harvested 6-25-2021

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Table 23.

**2020 Grass Herbicide Screen in Seeding Year on Hard Fescue  
Magnusson Research Farm**

Treatment	Rate+adjuvant	Application Date	Seed Yield #/acre	Height(in) Harvest
Section 3	6oz.+1%COC	7/29/2020	634	20
Fusilade DX	12oz+1%COC	7/29/2020	730	20
Section 3	6oz.+1%COC	9/15/2020	462	19
Fusilade DX	12oz+1%COC	9/15/2020	549	19
No Treatment			617	19
		LSD @ 5% Level	133	NS
		CV(%)	12	5

Experimental Design-RCB w 3 reps variety=MN-HD

Hard Fescue planted 5/10/2020 with no cover crop

Date 1 application- 7-29-2020 trt 1& 2 fescue g. height= 3/4"-1.5"

10am 64F 81%RH wind W2mph

Date 2 application- 9-12-2020 730pm fescue g. height =1-2.5" ht.

730 pm 66F 56rh wind 5 wnw

Harvest Date=6/30/2021

Table 24.

**2019-2020 Hard Fescue Establishment Trial Summaries \***  
**Roseau, St. Paul and Rosemount Locations**

**2020 MN-HD Hard Fescue Establishment with Nurse Crop**  
**Roseau and Rosemount**

Nurse crop	2021 Seed Yield(#/acre)	
	Rosemount	Roseau
alone	1201	976
spring wheat	799	648
flax	941	795

Nurse crops planted along with hard fescue 5/2020 in both locations.

**2019 MN-HD Hard Fescue Establishment with Nurse Crop**  
**Roseau Location**

TRT#	Variety	Nurse crop	Seed Yield(#/acre)
			2021
1	MN-HD	alone	1433
2	MN-HD	Spring wheat	983

Hard fescue planted 10/30/2019. Spring wheat planted in trt#2- 5/2020.

No crop planted in trt#1 in 2020.

**2019 Fine Fescue Establishment with Winter Wheat**  
**St. Paul Location**

Species	Variety	Nurse crop	Seed Yield(#/acre)
			2021
hard fescue	MN-HD	alone	1181
hard fescue	MN-HD	winter wheat	802
Chewings	Radar	alone	971
Chewings	Radar	winter wheat	876

Fine fescues planted with winter wheat or alone 10/2019

Locations:

Roseau-Magnusson Research Farm

Rosemount-Umore Park-Forage Hill

St. Paul- St. Paul campus U of Mn. TROE

\*Data courtesy of Dr. Florence Sessoms-University of Minnesota



Table 25.

**2020-21 Tall Fescue Management Trial**  
**Tveit/Ravndahlen Farm- North of Roosevelt Mn**

TRT#	Residue Treatment	Total Fertilizer Applied	Nitrogen Fertilizer Timing	Seed Yield #/acre	Height(in) Harvest
1	Late chop	90-80-90-10s	90#N fall	694	27
2	Late chop	120-80-90-10s	50N fall+70N spring	863	29
3	Late chop	160-80-90-10s	90N fall+70N spring	948	28
4	Late chop	160-80-90-10s	50N fall+110N spring	901	29
5	Bale only	90-80-90-10s	90#N fall	707	29
6	Bale only	120-80-90-10s	50N fall+70N spring	781	29
7	Bale only	160-80-90-10s	90N fall+70N spring	1095	31
8	Bale only	160-80-90-10s	50N fall+110N spring	966	31
LSD @ 5% Level				157	1
CV(%)				12	3

Experimental Design-RCB w 4 reps Variety=Foxhound

Late Chop= TRT# 1-4= Bale residue after harvest 8/10 2020 and clip 3" and bale off 9/9/2020

Bale Only=TRT#5-8= Bale residue after harvest 8/10/2020

Fall fertilizer applications (including all P - K and Sulfur)-9/10/2020

Spring nitrogen fertilizer applications-4/23/2021

Yield Mean of Residue Management Treatments-

Late Chop= 852#/acre

Bale Only= 887#/acre

Yield Mean of Fertility Management Treatments-

90#N fall = 700#/acre

50N fall+70N spring= 822#/acre

90N fall+70N spring= 1022#/acre

50N fall+110N spring= 934#/acre

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Table 26.

**2020-21 Tall Fescue Fertility Trial**  
**Magnusson Research Farm-Roseau, Mn**

trt#	Total Fertilizer Applied	Additional Fall/spring	Seed Yield #/acre	Height(in) Harvest	RCI <sup>1</sup>		
					5/24/21	6/9/21	Harvest <sup>1</sup>
1	17-40-40-10s	0	313	20	144	173	145
2	120-40-40-10s	60 / 60	1137	27	487	629	305
3	120-40-40-10s	0 / 120	1075	27	454	710	351
4	120-40-40-10s	120 / 0	1155	26	368	554	272
5	160-40-40-10s	80 / 80	1251	24	540	715	291
6	160-40-40-10s	0 / 160	1039	25	481	723	430
7	80-40-40-10s	0 / 80	779	25	396	534	307
8	120-40-40-40s	60+30s / 60	1177	27	489	641	263
LSD @ 5% Level			209	3	98	106	70
CV(%)			14	8	15	12	16

Experimental Design-RCB w 4 reps Variety=Turfway

<sup>1</sup>RCI scored in harvested area. May be an indication of residual nitrogen after harvest

17-40-40-10s applied to all plots 9/11/2020

Fall N application- 10/13/2020 Spring applications= 4-27-2021

Table 27.

**2020 Tall Fescue Establishment Trial**

**Magnusson Research Farm**

Planting/Establishment Treatment	Seed Yield #/acre	Height(in) Harvest
Spring wheat 120#/ac & tall fescue 5/21/2020	<b>1317</b>	28
Spring wheat 75#/acre & tall fescue 5/21/2020	<b>1324</b>	26
Spring wheat only 120#/ac 5/21--- tall fescue 8/20 into stubble	<b>1081</b>	27
Tall fescue only 5/21/2020	<b>1571</b>	27
Tall fescue only 7/17/2020	<b>1159</b>	26
LSD @ 5% Level	<b>269</b>	NS
CV(%)	13	7

Experimental Design-RCB w 4 reps Tall fescue Variety=Turfway  
 Tall fescue seeded at 6#/acre Wheat Variety=Linkert

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Table 28.

**2021 Tall Fescue Growth Regulator Trial**

**Magnusson Research Farm**

Treatment	Rate+Adjuvant	Seed yield #/acre	Height(in) Harvest
Apogee	8oz.+ .25%NIS+2.5%- 28%N	<b>1473</b>	22
Palisade	16oz+.25%NIS	<b>1357</b>	25
no treat		<b>1449</b>	29
	LSD @ 5% Level	<b>NS</b>	3
	CV(%)	11	7

Experimental Design-RCB w 4 reps  
 Harvest date 7-15-2021  
 Apogee 8oz.+ .25%NIS(.24pt/ac.)+2.5%- 28%N(2.4pt/ac.)  
 Palisade EC 16oz+.25%NIS(.24pt/acre)  
 Applications 6/9/21- 11am with 10' bike sprayer @ 12GPA  
 Wind E12mph-84%RH -Pcldy-71F  
 GH--9-12" 30% heading

Table 29.

**2021 Tall Fescue Fungicide Trial  
F3 Magnusson Research Farm**

Treatment	Rate+Adjuvant	Seed yield	Height(in)
		#/acre	Harvest
Priaxor	6oz+.25%NIS	1391	28
Quilt Excel	12oz+.25%NIS	1267	26
No Treatment		1394	27
LSD @ 5% Level		NS	NS
CV(%)		6	4

Experimental Design-RCB w 4 reps  
 Applications made 6/25/2021 10am west 2-6mph  
 fully headed and mid pollen shedding  
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Table 30.

**2021 Callisto Applied to Per.Ryegrass  
Magnusson Research Farm**

Treatment	Rate	adjuvant	Seed yield	Ht.(in.)	
			#/acre	Harvest	%Germ <sup>1</sup>
Callisto	6 oz.	1% Destiny+2.5%AMSOL	929	15	92
	3 oz.	1% Destiny+2.5%AMS(AmSol)	1118	15	
	3 oz.	1% Destiny+2.5%-28%UAN	1050	15	
No treat			1104	16	93
LSD @ 5% Level			149	NS	
CV(%)			7	5	

Experimental Design-RCB w 3 reps Variety-Arctic Green  
 Applications- 5/27/2021 45F 10-15ENE 45%RH 4-6" 1-2nodes tall fescue 4-7" 1node

Table 30a.

**2021 Callisto Applied to Tall Fescue  
Magnusson Research Farm**

Treatment	Rate	adjuvant	Seed yield	
			#/acre	%Germ <sup>1</sup>
Callisto	6 oz.	1% Destiny+2.5%AMSOL	1104	97
	3 oz.	1% Destiny+2.5%AMS(AmSol)	1157	
	3 oz.	1% Destiny+2.5%-28%UAN	1077	
No treat			1163	96
LSD @ 5% Level			NS	
CV(%)			19	

Experimental Design-RCB w 3 reps Variety-Turfway  
 Applications- 5/27/2021 45F 10-15ENE 45%RH 4-6" 1-2nodes tall fescue 4-7" 1node

<sup>1</sup>%Germination - Harvested seed from selected treatments - germination results

Trade Name	Formulation(# AI/gallon)	Rate per acre+adjuvant
Quilt Xcel	1.02#PROPICONAZOLE + 1.18#AZOXYSTROBIN	12oz+1Qt Preference/100gal.
Priaxor	1.39#FLUXAPYROXAD +2.78# PYRACLOSTROBIN	6oz.+1Qt Preference/100gal.
Callisto	4# mesotrione	3/6oz/acre
Preference(NIS)	.25%	1 Qt./100 gallons
Destiny(MSO)	1%	1 gallon/100 gallons
AmSol 2.5%	(1 gallon=3.4#AMS)	2.5 gallons(8.5#) /100 gallons
28%N	2.5%	2.5 gallons/100 gallons

Table 31.

**2021 P & K Large Plot Fertility Wheat Trials**

**West Plant-Northern Resources and Jason / Greg Braaten Farms /Slater**

**2021 Wheat**

Treatment	West				Soil Test Levels 9-2021								
	Braaten	Plant	Slater	Mean	West		West		West		West Plant		
	Yield	Bu./Acre			Braaten	Plant	Mean	Braaten	Plant	Braaten	Plant	Ht(in)	RCI
					P	P		P	P	K	K	Harvest	6/15
Normal(1)	41.9	51.7	61.1	51.6	14.2	17	15.5	14	10	132	133	29	102
Plus 50(2)	47.4	57.9	63.8	56.4	14.4	17	15.7	19	9	130	135	28.5	140
LSD @5% level	0.4	NS	NS	5.2	0.1	NS	NS	NS	NS	NS	NS	NS	31
LSD @10% level	0.3	5.3	NS	3.9	0.1	NS	NS	NS	NS	NS	NS	NS	21
CV(%)	1	4	10	4	1	6	3	50	13	7	4	7	7

**2020 Soybean Trial**

Treatment	West				West		West		West		West		West		West		West		West		West					
	Braaten	Plant	Slater	Mean	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant				
	Yield(Bu./Acre	@13%			N %	P %	K %	S %	Ca %	Mg %	Zn ppm	Fe ppm	Mn ppm	Cu ppm	B ppm											
Normal(1)	30.6	43.5	50.0	41.4	5.8	5.1	0.39	0.38	1.4	2.3	0.30	0.30	1.47	1.13	0.64	0.48	25.8	20.8	93	71	70	68	9.2	7.3	54	41
Plus 50(2)	34.4	43.9	49.6	42.6	5.5	5.3	0.38	0.47	1.7	2.7	0.29	0.29	1.42	1.20	0.55	0.51	22.0	25.0	86	58	65	63	8.8	7.5	46	36
LSD @5% level	4	NS	NS	NS	0.4	0.2	0.05	0.06	0.3	0.3	0.03	0.03	0.20	0.09	0.09	0.03	6.4	3.3	12	17	18	5	0.9	2.0	6	4
LSD @10% level	3	NS	NS	NS	0.3	0.1	0.04	0.05	0.2	0.2	0.02	0.02	0.15	0.14	0.07	0.02	4.7	2.4	9	12	13	4	0.7	1.5	5	3
CV(%)	6	5	7	4	3	2	6	6	8	6	5	4	6	6	7	2	12	6	6	11	12	4	5	12	6	4

Braaten Farm Harvest and Soil Samples Taken 9/29/2020

Northern Resources Harvest and Soil Samples Taken 9/26/2020

Treatment	West		West		West		West		West		West		West		West		West		West		West					
	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant				
	N #/ac		P ppm		K ppm		S #/ac		B ppm		Zn ppm		Mn ppm		Cu ppm		Mg ppm		Ca ppm		OM %		Salt dS/m		CEC meq/kg	
Normal(1)	10.5	7.5	7.8	7.3	119	115	101	120	0.98	1.15	0.37	0.27	2.1	1.4	0.56	0.41	844	1103	5564	5113	5	4	0.58	1.30	35.4	35.8
Plus 50(2)	11.8	7.5	5.3	6.0	107	107	64	120	0.95	1.03	0.29	0.3	1.7	1.7	0.51	0.48	777	1116	5564	5265	5	4	0.44	1.50	34.8	36.7
LSD @5% level	2.4	4.5	4.6	2.7	21	16	75	0	0.08	0.20	0.07	0.08	0.7	0.6	0.11	0.08	110	190	521	126	1	1	0.14	0.85	3.5	1.6
LSD @10% level	1.8	3.3	3.4	2.0	16	12	56	0	0.05	0.15	0.05	0.06	0.5	0.4	0.08	0.06	82	140	386	93	0	0	0.10	0.62	2.6	1.2
CV(%)	9	27	31	18	8	6	41	0	4	8	10	12	16	17	9	9	6	8	4	1	5	6	12	27	4	2

Soil test date- Both locations- 5/4/2020

	West		West		West		West		West		West		West		West		West		West		West					
	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant	Braaten	Plant				
	N #/ac		P ppm		K ppm		S #/ac		B ppm		Zn ppm		Mn ppm		Cu ppm		Mg ppm		Ca ppm		OM %		Salt dS/m		CEC meq/kg	
	11	9	10	6	155	148	84	120	1.2	1.2	0.48	0.34	2.8	1.8	0.66	0.46	937	927	5869	5722	5.7	3.9	0.58	0.47	37.7	36.9

Braaten Farms P&K Tissue Samples Taken 7/30/20

Northern Resources Tissue Tests take 7/20/20

Seeding Date-

Fertilizer sources-

Phosphorous(P)- 11-52-0

Potassium(K) -0-0-60

Fertilizer application dates-

Braaten-- 5/22/2020 Slater--5/18/2020

Northern Resources--6/1/2020

Braaten-- 5/22/2020

Northern Resources--6/2/2020

Slater--5/18/2020







Table 35.

## Armyworm Moth Trapping Project in Roseau County Summary Report - 2021

**Table 1. Armyworm moth capture at four location in Roseau County in 2021**

Date	Location				Total
	1	2	3	4	
18-May	4	0	0	0	4
21-May	14	10	0	2	26
23-May	15	11	9	1	36
25-May	7	0	0	4	11
29-May	8	2	0	3	13
31-May	1	0	3	0	4
3-Jun	2	0	0	1	3
11-Jun	0	0	1	1	2
13-Jun	4	4	0	2	10
15-Jun	4 + 2*	3 + 2*	7	5	19
17-Jun	2	2 + 1*	0	3	7
20-Jun	0	1	4	0	5
24-Jun	0	0	0	0	0
<b>Total</b>	<b>61</b>	<b>33</b>	<b>24</b>	<b>22</b>	<b>140</b>

\*Spotted cutworm moth

Thirty eight moths were captured in a trap at the U of MN-Magnusson Research Farm from July 22-25.

### The four armyworm moth trapping locations in 2021:

**Location 1:** Jadis Township, Section 5, SW quarter.

Trap placed in the middle of ryegrass field.

**Location 2:** Jadis Township, Section 9, NE quarter.

Trap in a field border between a Kentucky bluegrass and perennial ryegrass seed field.

**Location 3:** Laona Township, Section 10, NE quarter.

Trap was in field a boundary of spring wheat and a perennial ryegrass seed field.

**Location 4:** Jadis Addition, Section 32, SE quarter. Trap was in middle of a Kentucky bluegrass seed field.