

PROGRESS REPORT ON GRASS SEED PRODUCTION RESEARCH

prepared by

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

http://www.mnturfseed.org/html/progress_reports.html

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Standard Management Practices for University of Minnesota Perennial Ryegrass Seed Production Research Plots

General management regime of perennial ryegrass plots on the Magnusson Research Farm:

Spring seeded ryegrass with wheat

Ryegrass seeded at 5#/acre with spring wheat
Banvel+ 2,4-D amine (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 100-0-0 applied early to mid-May, 300 - 600 GDD
Banvel+ 2,4-D amine (0.75+0.75 pint) applied late May, 700 - 900 GDD
Tecoma or Assure (8-10 oz) applied early June, 800 - 1,000 GDD
Apogee (6-8 oz) applied early heading, 1,100 - 1,300 GDD
Quilt Excel (10 oz) applied full heading, 1,700 - 1,900 GDD

Fall seeded ryegrass in wheat stubble

Ryegrass seeded at 5#/acre after wheat harvest into existing stubble
Pre-harvest glyphosate application to wheat , or
glyphosate applied to wheat stubble prior to seeding ryegrass.
No broadleaf application in fall but other management for fall seeded ryegrass the same as spring seeded.

On-farm small plot research trials

All crop planting and general management are done by the grower/cooperator.
Application of treatment variables, agronomic notes and harvest by University of Minnesota personnel.
Cooperators will avoid applications of treatments involved in the study to the research plot area.

General ryegrass 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 and other data are statistically analyzed and results summarized.

On-farm large plot trial research protocol

These experiments are conducted in fields with growers implementing all of the general field management.
Treatment variables 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 or local agronomists will assist the growers in collecting quality samples and recording data.
Experimental design usually consists if a limited number (2 or 3) of treatment variables and 3 replicates/treatment.

Highlights and new items to consider in ryegrass seed production management

Fertility- Higher application rates and possibly a split spring application of phosphorous maybe beneficial if soil level is low/medium.
Sulfur(AMS) applications in fall or spring may have benefit some years beyond the lake of the woods area.
Applying a mix of 10-15%ESN nitrogen with standard spring urea applications may have benefit.
Harrowing of spring planted ryegrass stands under small grain is generally beneficial.
Baling off/removing straw after grain harvest with spring planted ryegrass, would have short term fertility and residue competition benefits.
Over time, however, soil organic matter will be reduced.
Growth regulators- Apogee over 7-8oz./acre have diminished effects and may not be cost effective.
Adding 3 gallons of 28% UAN to Apogee and fungicide applications may have a yield benefit.
Yield loss may result from tank mixing broadleaf + grass herbicide and growth regulator.
Delaying swathing until seed moisture is <35% will potentially produce the highest yields
but shattering losses potentially can increase quickly below this threshold.
Norton applications can reduce impact of some problem weeds and volunteer grain.
Heavy trash residue, lack of rainfall, and other factors can reduce it's effectiveness.

**Table 1. Monthly and Year End Precipitation Totals*
Roseau ,Mn 1967-2015.**

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Yearly Total(in.)	DEVIATION
														FROM MEAN
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	-3.32
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	7.45
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	1.83
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	2.80
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	-4.16
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	-3.38
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	-1.06
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	3.99
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	-4.43
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	-6.65
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	-3.04
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	-1.86
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	-5.02
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	-3.33
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	1.12
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	-2.27
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	-0.53
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	-5.05
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	2.57
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	-3.10
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	-4.56
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	-5.55
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	-0.77
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	-10.80
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	7.81
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	-1.86
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	-0.69
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	-3.88
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	-0.53
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	3.51
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	-1.81
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	2.46
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	0.41
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	5.75
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	-3.69
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	3.34
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	1.99
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	11.65
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	8.81
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	-5.99
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	2.82
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	4.04
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	4.08
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	5.43
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	-4.76
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	-3.38
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	1.59
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	3.26
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	8.67

49 year average annual precipitation 22.48

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

Table 2.

2011 Kentucky Bluegrass Variety Trial
Magnusson Research Farm-2013-15

Variety	Seed lot	Seed Yield ¹								Estimated yield ² 2015	Harvest-2015			% Heading- 2015				
		#/ac.				% of Mean					Ht.(In.)	Date	Lodging ³	6/3	6/7	6/11	6/15	6/23
		2015	2014	2013	2013-15	2015	2014	2013	2013-15		2015							
39140-06	1	385	343	343	357	132	78	86	93	488	27	7/12	4.0	3	21	48	83	98
39141-06	2	20	67	165	84	7	18	41	22	50	23	7/9	1.0	0	0	0	4	23
39130-06	3	187	325	38	183	64	40	10	48	200	20	7/11	1.8	3	8	28	63	100
39138-06	4	82	200	62	115	28	25	16	30	100	22	7/7	1.0	1	10	25	56	86
39098-06	5	369	681	630	560	126	122	158	146	563	29	7/15	2.3	12	35	68	89	100
39142-06	6	142	289	162	198	49	43	41	52	238	23	7/11	1.3	0	2	10	33	97
39087-06	7	178	336	469	328	61	72	118	86	213	29	7/9	1.0	0	6	26	55	100
39149-06	8	67	154	20	80	23	17	5	21	63	23	7/7	1.0	0	0	3	13	45
39157-06	9	481	612	768	620	165	135	192	162	550	29	7/10	1.5	8	26	61	84	100
39117-06	10	314	421	412	382	108	83	103	100	350	25	7/15	1.0	1	14	38	75	100
ORBM-11.0380	3958	314	721	641	558	108	122	161	146	438	33	7/7	1.3	25	50	80	95	100
ORBM-11.0373	3957	158	291	200	217	54	47	50	57	213	28	7/7	4.5	3	19	45	78	100
ORBM-11.0383	3959	189	414	340	314	65	69	85	82	225	29	7/10	1.0	8	33	58	76	100
KBG-10.0537	3954	458	643	814	639	157	140	204	167	438	28	7/9	2.0	33	66	88	100	100
Park	3888	389	481	668	512	133	112	167	134	550	32	7/2	6.5	58	88	100	100	100
Dragon	3671	668	863	574	702	229	153	144	183	613	28	7/8	2.8	43	73	93	100	100
A99-3124	3897	369	668	547	528	126	115	137	138	525	23	7/15	1.3	0	1	9	33	91
Abbey	3608	469	730	336	512	161	112	84	134	525	26	7/10	1.0	2	21	43	78	100
LSD @ 5% level		87	91	97	53	22	20	24	14	108	2	3	1.9	9	10	12	13	17
CV(%)		21	14	17	10	21	14	17	10	21	5	21	67	59	27	19	13	13

Experimental Design: RCB w/4 reps

Mean seed yield 2013= 399 #/ac.

Mean seed yield 2014= 458 #/ac.

Mean seed yield 2015= 292 #/ac.

¹-Actual harvested, clean seed yield

²-Visual estimate of seed yield- #/acre

³-Lodging-1=no lodging; 9=flat

Management:

All plots burned 8/11/2014

125-40-40-10s applied 10/22/2014

2pt. Curtail+.75pt Clarity applied 9/24/2014

Table 3.

2012 Fine Fescue Variety Trial
Magnusson Research Farm- 2013-15

Cultivar	Fescue Species	Company	Seed Yield(#/ac.) ¹				Estimate 2015 ²	Harvest			% heading			
			2013	2014	2015	mean		Date	Ht.(in.)	Lodging ³	6/3	6/7	6/11	6/15
1 Bridgeport II	Chewings	Barenbrug	194	545	280	340	263	7/11	34	2	38	55	74	91
2 Culumbra II	Chewings	ProSeeds Marketing	198	830	476	501	513	7/11	33	1	23	48	68	93
3 Enchantment	Chewings	Pure Seed	105	583	243	310	213	7/11	34	1	23	43	65	81
4 J-5	Chewings	Jacklin Seed by Simplot	220	632	547	467	525	7/11	32	1	45	68	84	99
5 Longfellow III	Chewings	DLF International	85	1072	498	552	325	7/11	32	2	15	38	60	81
6 PSG 50C3	Chewings	Seed Research of Oregon	180	1137	623	647	488	7/11	31	2	15	38	66	90
7 PSG SPRS	Chewings	Seed Research of Oregon	227	890	414	510	375	7/11	31	1	40	60	76	94
8 Radar	Chewings	Peak Plant Genetics	247	854	563	555	463	7/11	31	1	20	38	63	86
9 Windward	Chewings	Seed Research of Oregon	154	1001	636	597	538	7/11	32	1	40	65	79	95
10 Wrigley 2	Chewings	DLF International	138	837	409	461	325	7/11	31	1	30	50	71	88
11 Azay Blue	Blue hard	Seed Research of Oregon	56	959	416	477	375	7/3	26	1	60	75	86	100
20 SR 3210	Blue hard	Seed Research of Oregon	111	1046	427	528	463	7/3	28	4	28	85	91	100
12 Barok	Sheep	Barenbrug	4	679	205	296	238	7/2	22	3	38	55	80	100
13 Barpreza	Sheep	Barenbrug	5	392	236	211	400	7/11	27	2	45	65	85	99
14 Bighorn GT	Hard	Pure Seed	26	725	129	293	125	7/6	26	2	30	48	75	100
15 Bluearay	Hard	Peak Plant Genetics	16	785	136	312	119	7/6	23	1	23	48	79	100
16 Hardtop	Hard	Barenbrug	24	685	102	271	100	7/3	26	1	28	48	80	100
17 MNHD	Hard	University of Minnesota	69	1213	247	510	200	7/5	23	1	35	45	79	100
18 PSG 3TH3	Hard	Seed Research of Oregon	49	774	105	309	131	7/7	24	1	35	53	81	100
19 Soil Guard	Hard	Pure Seed	38	877	156	357	150	7/6	25	1	38	53	81	100
21 07-1 FF	Creeping red	Seed Research of Oregon	256	340	138	245	125	7/17	30	4	0	2	38	75
22 BRJDT	Strong creeping red	Seed Research of Oregon	360	289	82	223	150	7/17	30	3	0	6	35	78
23 Cindy Lou	Strong creeping red	DLF International	196	409	131	245	119	7/17	28	2	0	8	43	78
24 Contender	Strong creeping red	Barenbrug	234	327	174	245	163	7/17	29	2	1	18	50	88
25 Epic	Strong creeping red	ProSeeds Marketing	127	247	42	139	50	7/17	27	1	0	0	38	73
26 OR C126	Strong creeping red	Seed Research of Oregon	425	347	171	314	156	7/17	28	2	0	8	50	83
27 PPG-FRR 103	Strong creeping red	Peak Plant Genetics	156	243	93	164	106	7/17	26	2	1	12	45	78
28 PSG 5J5115 L	Strong creeping red	Seed Research of Oregon	174	320	107	200	75	7/17	27	1	0	1	38	70
29 PSG 5J5115E	Strong creeping red	Seed Research of Oregon	176	312	100	196	125	7/17	27	1	1	12	48	80
30 Shademaster III	Strong creeping red	Pure Seed	80	289	151	174	188	7/17	27	1	3	19	50	83
		LSD @5% level	70	151	72	59	84	2	2	1	12	15	13	6
		CV(%)	34	16	19	11	23	11	4	41	39	27	13	5

Seeding date- 5/1/2012 @5#/acre

¹-Actual harvested, clean seed yield²-Visual estimate of seed yield- #/acre³-lodging- 1=upright;9=flat

Management: Residue baled off after harvest

2pt. Curtail+.5pt Clarity applied 9/24/2014

12oz. Fusilade + 1% crop oil 5/25/2015

Fertilizer applied 10/22/2014 105-40-40-10s

Table 6.

2014 Added Phosphorous to Perennial Ryegrass¹
Rice Farms-Northwest of Roseau,Mn

trt#	Fertilizer Rate ²	Seed ³ Yield(#/ac)
1	6-30-30	474
2	12-60-30	452
LSD @5% level		NS

Experimental Design: RCB with 3 reps

¹Variety=Evolution

²Fertilizer applied 9/23/2014 to entire area received 6-30-30; Trt#2 had additional 6-30-0 application

³Clean seed yield corrected to 12%moisture

Added fertilizer treatment, data collection and yield subsampling done by U of M

Harvest and all other management operations done by grower using best management practices.

Plot size=70' x 600'

Soil test results- 9/10/2014

Olsen P	NH ₄ OAc-K	LOI OM	Water	SO ₄ -S
(ppm)	(ppm)	(%)	pH	(ppm)
10	125	4.5	7.9	6

Results/comments:

A higher applied phosphorous rate did not significantly affect ryegrass yield.

Soil phosphorous levels at this site were not deficient and winter injury/weak stands

are possible causes for lack of response.

Table 7.

2014-15 Perennial Ryegrass Fertility Trial
F6 Magnusson Research Farm

Trt#	Additional Fertilizer Rate: dry N level	Application timing	Yield ¹ #/ac.	Shatter ² corrected		Harvest Ht.(in.)	Lodging ³
				Yield #/ac	Yield % of mean		
1	0	0(fall 8-40-40)	181	284	28.6	20	1.0
2	140+0+0	Split*NO added 'P' or 'K'	686	832	83.7	24	6.0
3	100+0+0	Fall	NH				
4	140+0+0	Fall	NH				
5	100+0+0	Split*	NH				
6	140+0+0	Split*	781	990	99.2	25	6.0
7	180+0+0	Split*	NH				
8	100+0+0	spring	NH				
9	140+0+0	spring	NH				
10	140+0+0+20s	Split**	NH				
11	140+0+0	8-40-40(9/25/14) split*	726	1016	102.1	26	7.0
12	140+0+0	30-40-40(9/25/14) split*	648	933	93.7	25	7.3
13	140+0+0	straw left+ trt#6	NH				
14	100+0+0	Split*(50+20liq)	NH				
15	140+0+0	Split*(8-40-40)+(8-40-0 spring)	987	1206	126.6	26	5.7
16	100+0+0	straw left+ trt#5	NH				
LSD @5% level			197	246	19.8	2	3.0
CV(%)			16	15	15	5	30

Severe winter injury on all treatments

Experimental design:RCB with 4 reps--(only 3 reps harvested)

Variety=Arctic Green- spring planted under spring wheat

¹Yield-Actual harvested clean seed yield

NH=not harvested- only selected treatments harvested due to winter injury

²Shatter corrected=actual yield+visual estimate of shattered seed

³Lodging-1=upright ; 9=flat

*Split-30# N applied 10/23/2014

**Split-30#N-20#N ammonium sulfate+10#N urea applied 10/23/2014

Early fall fertilizer applied 9/25/2014

Standard fall fertilizer applied 10/23/2015

spring fertilizer applied 5/1/2015

Trt. # Explanation of fertility treatments October 2014;May 2015

- 1 8-40-40 only no added nitrogen
- 2 No added P or K 30-0-0 applied 10-23 / 110-0-0 applied 5-1
- 6 30-40-40 applied 10-23 / 110-0-0 applied 5-1(Standard)
- 11 8-40-40 applied 9-25 / 132-0-0 applied 5-1
- 12 30-40-40 applied 9-25 / 110-0-0 applied 5-1
- 15 30-40-40 applied 10-23 / 110-40-0 applied 5-1

Soil test 10/1/2014

Olsen P (ppm)	NH4OAc-K (ppm)	OM (%)	PH
7	101	3.6	8.2

Table 8.

2011-15 Perennial Ryegrass Fertility Trial
F2B Magnusson Research Farm

Trt. #	Total Nitrogen	Nitrogen Application timing	Yield(#/ac.) 2015	Yield as % of mean				
				2015	2014	2013	2012	2011
1	100+0+0	Split*			92	96	112	108
2	140+0+0	Split*	990	99	104	104	118	118
3	140+0+0+20s	Split**			110	99	----	----
4	180+0+0	Split*			122	111	----	----
5	100+0+0	spring			95	93	96	108
6	140+0+0	spring			96	104	119	115
7	100+0+0	Fall			67	93	83	110
8	140+0+0	Fall			96	100		119
9	140+0+0	(8-80-40)Split*			107	----	----	----
10	140+0+0	8-40-40(9/25/13) split*	1016	102	101	----	----	----
11	140+0+0	30-40-40(9/25/13) split*	933	94	101	----	----	----
12	140+0+0	(8-40-40)+(0-40-0spring)Split*	1206	127	120	----	----	----
13	140+0+0	(spring 8-80-40)Split*			109	----	----	----
14	140+0+0	(spring 8-40-40)Split*			109	----	----	----
15	100+0+0	Split*+(50spring+20liq)			82	----	----	----
16	140+0+0	Split*+(90spring+20liq)			106	109	----	----
17	100+0+0	Spring residue removal/split*			96	----	----	----
18	140+0+0	Spring residue removal/split*			107	----	----	----
19	140+0+0	NO added P OR K(splitN)	832	84	81	----	----	----
20	0	0	284	29	27	28	21	36
LSD @5% level			246	20	11	16	11	12
CV(%)			16	16	8			

Experimental design:RCB with 4 reps

Variety=Arctic Green

2015 Trial mean(excluding 0-N fertilizer)=1244 #/ac.

*Split-30# N applied late October

**Split-30#N-20#N ammonium sulfate+10#N urea applied late October

spring fertilizer applied 5/1/2015

Trt. #	Explanation of fertility treatments October 2013;May-June 2014
1	30-40-40 applied 10-22 / 70-0-0 applied 5-19
2	30-40-40 applied 10-22 / 110-0-0 applied 5-19(Standard)
3	30-40-40-20s applied 10-22 / 110-0-0 applied 5-19
4	30-40-40 applied 10-22 / 150-0-0 applied 5-19
5	8-40-40 applied 10-22 / 92-0-0 applied 5-19
6	8-40-40 applied 10-22 / 132-0-0 applied 5-19
7	100-40-40 applied 10-22
8	140-40-40 applied 10-22
9	30-80-40 applied 10-22 / 110-0-0 applied 5-19
10	8-40-40 applied 9-25 / 132-0-0 applied 5-19
11	30-40-40 applied 9-25 / 110-0-0 applied 5-19
12	30-40-40 applied 10-22 / 110-40-0 applied 5-19
13	30-0-0 applied 10-22 / 110-80-40 applied 5-19
14	30-0-0 applied 10-22 / 110-40-40 applied 5-19
15	30-40-40 applied 10-22 / 50-0-0 applied 5-19 / 6 gal. 28%UAN applied 6-20
16	30-40-40 applied 10-22 / 90-0-0 applied 5-19 / 6 gal. 28%UAN applied 6-20
17	30-40-40 applied 10-22 / 1 ton/ac. residue removed 5-17 / 70-0-0 applied 5-19
18	30-40-40 applied 10-22 / 1 ton/ac. residue removed 5-17 / 110-0-0 applied 5-19
19	30-0-0 applied 10-22 / 110-0-0 applied 5-19
20	No fertilizer

Table 9.

2014-15 Ryegrass Phosphorous Trial
Magnusson Research Farm-Roseau,Mn.

Trt#	Fertility Treatment	Fertilizer timing*	Seed Yield(#/ac.)		Harvest-8/17/15		%stand ³ 5/23/2015	RCI ⁴ 7/21/2015
			Actual	Shatter ¹ Added	Lodging ²	Ht.(in.)		
1	0-0-0	NO	812	839	6.5	24	81	423
2	0-20-40	EF	886	920	6.5	25	59	451
3	0-40-40	EF	968	977	6.3	24	53	409
4	0-60-40	EF	832	878	7.3	26	70	348
5	0-80-40	EF	846	894	7.3	26	73	370
6	0-0-40	EF	748	798	4.8	24	60	438
7	0-20-40	SF	741	775	6.0	25	73	404
8	0-40-40	SF	832	878	5.5	25	58	397
9	0-60-40	SF	908	963	7.8	26	69	336
10	0-80-40	SF	972	1016	7.5	27	54	388
11	0-0-40	SF	790	832	5.8	25	63	406
12	0-20-40	S	928	939	6.0	24	48	430
13	0-40-40	S	808	864	7.0	26	65	362
14	0-60-40	S	768	809	7.0	25	70	329
15	0-80-40	S	797	867	7.3	27	79	326
16	0-0-40	S	863	863	6.5	24	46	470
17	0-20-40	F/S	708	737	7.0	25	73	374
18	0-40-40	F/S	861	882	6.5	25	51	402
19	0-60-40	F/S	852	903	7.3	26	70	337
20	0-80-40	F/S	843	912	7.0	26	63	314
21	0-0-40	F/S	803	817	5.8	25	55	478
LSD @5% level			219	196	1.7	2	30	81
CV(%)			18	16	19	5	34	15

Experimental design:RCB with 4 reps

Fertilizer timing*

EF=Early Fall-2014 (9/22/2014)

SF=Standard Fall(10/22-2014)

S=Spring greenup-5/1-2015

F/S=Split Fall+Spring-10/22& 5/1

All plots received 120-0-0 5/1/2015

¹Shatter added- visual rating of %seed shattered before harvest+actual yield

²Lodging-1=upright; 9=flat

³%stand-visual rating of new growth

⁴RCI-Relative chlorophyll index- higher number=more chlorophyll

Planted with spring wheat 6/1/2014

Ryegrass variety-Arctic Green @5#/ac.

Management was done using best management practices

Soil test results=	Olsen P	NH4O-K	% OM	PH
10/1/2015	4 ppm	77ppm	3.2	7.9

Results/comments:

Inconsistent treatment effects observed in the trial.

Variable amounts of winter injury by plot location may have been the cause.

This trial will be repeated in 2016.

Table 10.

**2014-15 Nortron Applications to Perennial Ryegrass
Rice Farms-Roseau,Mn**

Trt#	Product	Rate	Timing	Ht.(in.)	Lodging	Wild oat control	Seed Yield(#/Ac.)
1	No treatment			23	4	0	926
2	Nortron	2 pt.	10/22/2014	23	2.5	55	937
3	Nortron	4 pt.	10/22/2014	23	2.8	43	963
4	Nortron	2 pt.	4/24/2014	24	3.3	58	1041
5	Nortron	4 pt.	4/24/2015	24	3.5	38	1115
LSD @5% level				NS	NS	21	NS
CV(%)				4	38	36	16

Experimental design:RCB w/4reps

Ryegrass variety-Evolution

Harvest date- 8/3/2015

All field operations, except Nortron applications,
done by grower using best management practices

10/22/2014 application - wind S 8mph 60F soil conditions -somewhat dry

4/24/2015 application- 10:00am- ryegrass still dormant-some green at the crown
topsoil wet with frost at 8"

Results/comments:

There were 3 flushes of wild oats in this trial. The first 2 flushes were well controlled with Nortron but 3rd flush was not. Seed yields were not significantly different among treatments.

Table 11.

2015 Preemergent Grass Herbicide Applications to Perennial Ryegrass Rice Farms-north of Roseau,Mn.

Trt#	Treatments:	Application*		Seed Yield
		Rate	Date	#/acre
1	No Treatment	0		636
2	Prowl H2O	3 pt	6/11/2015	801
3	Facet L	1.5 pt	6/11/2015	721
4	Prowl+Facet	3+1.5	6/11/2015	685
5	Outlook	1 pt	6/11/2015	743
6	Outlook	2 pt	6/11/2015	643
7	Prowl H2O	6 pt	6/11/2015	650
8	Facet L	3 pt	6/11/2015	721
9	Facet L*	3 pt	7/1/2015	623
10	Prowl H2O	3 pt	7/1/2015	574
LSD @5%level				122
CV(%)				12

Experimental design: RCB w/4reps

*Trt# 7-Facet L applied 7/1/2015 had 2pt./ac. COC additive, all other applications had no additive.

Perennial ryegrass variety= Evolution

Harvest date=8/2/2015

Plot management done by grower using best management practices.

Winter injury caused stand loss and crown injury preventing optimal seed yields.

No grass weeds observed in any plots at harvest.

Tacoma application on 6/15 had close to or at 100% control of barnyard and other grasses up to harvest

No phyto symptoms observed in any treatments 14DAT or at harvest

Treatments 1-7 applied 6/11/2015 co2 bike sprayer at 12gpa 28psi

wind se 4-8mph growth stage 3-4 nodes

10 oz.Tacoma applied to entire field by growers 6/15/2015

Treatments 9 & 10 apply 7/1/2015 10:00am sunny 65F wind SSW 5mph

Growth stage= pollen shedding

Product	common name	#Al./gal
Outlook	dimethenamid	6
Prowl H2O	pendamethalin	3.8
Facet L	quinclorac	1.5

Results/comments:

Another flush of grasses did not emerge after the post emergent herbicide(Tacoma) application on 6/15.

No treatments significantly decreased seed yield.

Table 12a.

2015 Pesticide Mix Combinations Applied to Perennial Ryegrass

Rice Farm

Trt#	6/11 trts Rates	6/12 trts Rates	6/19 trts Rates	Yield #/acre	Yield % of mean	Ht.	lodging
1	Tacoma-10oz.+Apogee-4oz.	2,4D-3/4pt+Clarity-3/4pt		1010	101	22	3.3
2	Tacoma-10oz.	2,4D-3/4pt+Clarity-3/4pt	Apogee 4oz.	1041	104	22	4.3
3	Tacoma-10oz.	2,4D-3/4pt+Clarity-3/4pt	Apogee 8oz.	1144	114	22	2.8
4	Tacoma-10oz.	2,4D-3/4pt+Clarity-3/4pt	none	910	90	23	7.0
5	2,4-D-3/4pt+Clarity-3/4pt+Apogee-8oz.		Tacoma-10oz.	914	91	22	5.8
			LSD @5% level	107	10	NS	0.9
			CV(%)	7	7	6	12

Experimental Design:RCB w/4 reps

Ryegrass variety=Evolution

Harvest date=8/3/2015

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Table 12b.

2015 Pesticide Mix Combinations Applied to 'AssureII tolerant' Perennial Ryegrass

MagPlots- F6 SW

Trt#	6/10 trts Rates	6/12 trts Rates	6/19 trts Rates	Yield #/acre	Yield % of mean	Ht.	lodging
1	Assure II-10oz.+Apogee-4 oz.	2,4D-3/4pt+Clarity-3/4pt		854	102	24	4
2	Assure II-10oz.	2,4D-3/4pt+Clarity-3/4pt	Apogee 4oz.	774	92	24	6
3	Assure II-10oz.	2,4D-3/4pt+Clarity-3/4pt	Apogee 8oz.	976	117	24	3.7
4	Assure II-10oz.	2,4D-3/4pt+Clarity-3/4pt	none	742	89	25	7.7
			LSD @5% level	NS	NS	NS	1.8
			CV(%)	22	22	5	17

Experimental design:RCB w/3reps

Ryegrass variety=Arctic Green

Harvest date= 8/10/2015

6/10/2015 trts-6pm 70F wind sw5 -ryegrass GS= mostly 2 nodes on main stem

6/11/2015 trts- 11am 68F wind SE 4mph -ryegrass GS= mostly 2 nodes on main stem

6/12/2015 trts-3pm 80F

6/19/2015 trts- 70F 10am ryegrass GS=mid-boot stage

Pesticides/Rates- tank mix trials

Common name	Trade name	Use Rate	Adjuvant
2,4-D amine	2,4-D amine 4	.75pt.	
Dicamba	Clarity/Sterling Blue 4	.75pt.	
Fenoxypop	Tacoma/Puma 1EC	10oz.	
prohexadione	Apogee 27.5%	4/8 oz.	.25%NIS+2.5%-28%N
Quizalofop	Assure II	10oz.	.25%NIS

Results/comments:

Grass,broadleaf and growth regulator applications, applied separately, had the highest yield.

8oz. of Apogee had higher yield than the 4oz. Rate.

If the broadleaf control application is applied first, it is suggested that grass herbicide application is delayed at least 7 days.

Table 13.

**2015 Fungicide Applications to Perennial Ryegrass
at 2 Locations in northern Minnesota¹**

Trt#	Product	Adjuvant	Rate	Seed Yield (#/acre)			Crown Rust incidence ³		Lodging	
				Mean 2 locations	Pieper ²	Mag	Pieper	Mag	Pieper	Mag
1	No treatment			957	911	1002	0.5	2	8	6
2	Quilt Xcel 2.2 SE	.25%NIS	14oz	1028	960	1096	0	0	7.5	3.5
3	Absolute 4.36 SC	.25%NIS	7.5oz	1042	938	1147	0	0	7.3	4.8
4	A 21664	.5%COG	13.7	1099	958	1241	0	0	7.8	4.3
5	A 21664	.5%COG	27.4	1095	1016	1174	0	0.3	8.5	6.5
6	Elatus 45WG	.25%NIS	7oz(dry)	1034	1042	1025	0	0	8.3	4.3
7	Priaxor	.25%NIS	6oz.	960	969	951	0	0	8.3	2.5
8	Folicur	5oz	.25%NIS	NA	NA	1227	NA	0.5	NA	6
		LSD @5% level		106	117	201	NS	1.2	NS	3.4
		CV(%)		6.8	8.3	12.3	397	243	12	47

Ryegrass varieties= Pieper-Royal Green ; Magnusson- Fiesta IV

Harvest date- 8/6/2015

No observed effects of treatments to ryegrass 10DAT or at harvest

No incidence of rust observed prior to harvest at either location

¹-Locations-

Magnusson-Roseau county- 2mi. N and 3 mi. W of Roseau Mn

Pieper - Lake of the Woods county- 6 mi. N and 3mi. E of Williams,Mn

Height at harvest = Pieper location- 33" ; Magnusson location 28"

²- No blanket fungicide treatments applied at Pieper location except for treatments

5oz. Folicur applied at Magnusson location to all plots with growth regulator 6/18 to all plots

³Crown rust incidence at harvest; 0= none; 9=severe

⁴Lodging; 1=none; 9= flat

Spray applications made with CO2 bicycle sprayer TT-jet nozzels @ 28psi - 12GPS

Pieper location

Treatments applied 7/2/2015 1:00pm

wind wnw 5mph 72F

GS= Heavy/mid pollen shed

Magnusson location

Treatments applied 7/20/2015

wind = 5-12mph WNW 72F

GS- milk/soft dough stage

Table 14.

**2014-15 Ryegrass Date of Planting
F7 Magnusson Research Farm**

Trt.#	Treatment	Plant date	Seed Yield #/ac.	shatter yield ⁴	% shattering ⁵	lodging ⁶	Ht.(in.)
1	Wheat+ryegrass ¹	6/4/2014	1 725	954	25	6.3	26
2	wheat stubble ²	9/8/2014	2 662	776	14	5.5	26
3	Prevent/fallow plant ³	8/20/2014	3 465	469	1	4.0	22
LSD @5% level			195	240	10	NS	4
CV(%)			18	19	46	26	9

Experimental Design: RCB with 4 reps

Ryegrass variety=Arctic Green Previous crop=soybeans

Ryegrass production used best management practices

¹Trt#1= 5#/ac. Ryegrass + 100# wheat planted 6/4/2014

²Trt#2=Wheat harvested 9/5/2014 and 5#/ac. Ryegrass planted 9/8/2014

³Trt#3=5#/ac. Ryegrass+20#/ac. Wheat planted into black ground 8/20/2014

⁴Actual seed yield + visual estimate of seed shattering

⁵Visual estimate of seed shattering prior to harvest

⁶Lodging- 9=flat ; 1=upright

Results/comments:

Spring planted ryegrass had the highest yield.

Fall planted ryegrass into stubble had higher yield than fallow planting.

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Table 15.

**2014-15 Fall Planted Wheat Residue Management with Under seeded Perennial Ryegrass
Magnusson Farms-Northwest of Roseau**

Variety=Fiesta IV

Treatment*	Ryegrass stand 6/4/15
None	0%
Flail chop-Oct.22,2015	15%
Flail chop-Apr.28,2016	1.7%

*Flail chop treatments cut to 8" height

Canopy Height- October 22= 18"

Planting date into black ground- 8/5/2015 5# perennial ryegrass + 20# spring wheat

Seeding Rate-spring wheat-20#/acre --perennial ryegrass-5#/acre

Plot design- 3- 24' x 120' plots per treatment with 6' untreated between each plot

Ryegrass plot stands were poor and not kept for production.

Results/comments:

Fall wheat cover growth may have been more than ideal.

Ryegrass stand was better when wheat residue was clipped in late October.

Table 16.

2015 Ryegrass Plant Recovery from Winter Injury

Location-Magnusson Farm--fall plant Fiesta IV

MagPlots--spring plant Arctic Green

Spring plant- Arctic Green¹				
Plant type ⁴	Ripe seed head#	Immature head # ²	Green rating ³	% total yield of ripe seed/immature*
1)Healthy	74	48	2	75%
2)Injured	14	62	4	30%
3)Weak	8	10	6	50%

Fall plant -Fiesta IV¹				
Plant type ⁴	Ripe seed head#	Immature head # ²	Green rating ³	% total yield of ripe seed/immature*
1)Healthy	80	20	0	85%
2)Injured	22	33	4	40%
3)Weak	18	45	8	25%

Protocol--

3 plants of each type and from each field were hand dug on 5/1/2015 and placed into pots.

Plants were taken to St.Paul and put into greenhouse to grow out.

On 7/8, panicles were removed from all plants,counted and rated for maturity.

¹Spring planted Arctic Green had moderate winter injury.

Fall planted Fiesta IV had more severe winter injury.

²Immature heads indicate late tillers that emerge from injured crowns.

³Green rating estimate of the majority of immature heads-

2=soft dough ,4=milk, 6=pollenated, 8=not pollenated

⁴The plant types selected were 1) normal, healthy ryegrass plant,

2) a moderately injured plant and 3) a severely injured,weak plant.

* Ripe and Immature panicles threshed. The amount of ripe seed of the total is stated as %.

Results/comments:

Late emerging panicles(heads) tended to pollenate and fill poorly.

Winter injured plants had less uniform panicle emergence and yield potential was reduced.

Table 17.

2014 Additional Phosphorous Applied to Spring Wheat and 2015 Residual effect on soybeans

Location 1=Rice Farm-3 mi. North and 5 mi. west of Roseau-variety-Linkert

Location 2=Magnusson Farms-1mi.west and 1 mile north of Roseau-variety-Samson

Treatment	2014 Spring wheat		2015 Soybean Mag ⁴	Soil test -P2O5(PPM)				2015 post harvest
	Yield- Bu./acre ³			2014 Early Spring		2014 post harvest		
	Rice	Mag	Rice	Mag	Rice	Mag	Mag	
1)Standard In Furrow ¹	66.7	74.1	42.4	9.5	4	7	2.7	2
2)Standard In Furrow ² +13-60-0	66.7	82.5	44.5	9.5	4	9.7	4	2.7
LSD @5% level	NS	4.6	NS	NA	NA	NS	1	NS
CV(%)	4	5	8			32	31	30

Experimental design=RCB w/3reps

Plots size=70' x 600'

¹-7-30-30 applied in furrow to all plots at wheat planting-2014

²-13-60-0 broadcast prior to final seedbed prep + 7-30-30 in furrow at planting-2014

³-Adjusted yield to 12.5%moisture

⁴-Magnusson location only-

Rice location had too much water damage to harvest soybean yields.

7-30-30 applied in furrow at planting to all plots of Magnusson soybeans-5/2015.

Magnusson Farms

0-6" Soil test Post harvest soybeans-9/24/2015				
2014 pre-plant added fertilizer	Olsen P (ppm)	K (ppm)	OM (%)	pH
None	2.0	97	3.4	8.2
13-60-0	2.7	95	3.4	8.2

Objective:

Determine if additional phosphorous application on high ph soils can increase crop yields in application year and the following year.

Compare wheat yield in year 1 and soybean yield in year 2.

Observations:

Wheat yields on the Magnusson location were significantly higher with added phosphorous but not on the Rice location.

Soybean yields were also higher in year 2 on the Magnusson location but not significantly so.

Rice location had water damage to plot area and year 2 and no soybean yields taken.

If soil phosphorous levels are very low and PH is high, additional P applications may have yield and economic benefit.

Table 18.

2015 Soybean Fertility Residue Trial-Overlayed on 2014 Wheat treatments
Magnusson Research farm--Pioneer P01T23R

Planted 5/31/2015

TRT#	2014 Trts	App ¹ Method	Yield ² Bu./acre	RCI ³		Plant Tissue samples ⁴ -%			
				7/21/15	8/25/15	Nitrogen	Phosphorus	Potassium	Sulfur
1	0-0-0	None	32	305	499	4.2	0.35	2.18	0.21
2	9-30-30	B	34	360	561	4.1	0.37	2.10	0.21
3	9-30-30	I	32	355	528	4.1	0.36	2.13	0.21
4	18-60-60	B	37	357	487	4.2	0.37	2.18	0.20
5	18-60-60	I	37	369	554	4.3	0.38	2.15	0.22
6	18-60-30	B	34	366	521	4.3	0.39	2.10	0.22
7	18-60-30	I	33	347	505	4.1	0.37	2.08	0.21
8	13-45-30	I	37	344	502	4.4	0.39	2.23	0.21
9	9-30-30-7s	B	35	353	550	4.4	0.40	2.13	0.23
10	18-60-30-14s	I	33	367	539	4.2	0.37	1.98	0.22
11	9-30-30-7s	I	38	345	555	4.1	0.40	2.23	0.22
12*	39-30-30	I	33	318	492	4.3	0.37	2.13	0.21
13*	69-30-30	I	35	365	486	4.3	0.38	2.08	0.22
14*	39-60-30	I	37	339	541	4.3	0.37	2.00	0.21
LSD @5% level			6	41	74	0.3	0.03	0.21	0.02
CV			12	8	10	5	7	7	7

*- Nitrogen source on trts 12-14= ESN

¹-All Fertility treatments applied either broadcast(B)
prior to final seedbed tillage or in furrow(I) at planting- wheat 2014

²- Yields adjusted to 13% moisture

³ RCI=Relative chlorophyll index- higher number -more chlorophyll

⁴- Tissue test at flowering(R1) on new growth trifoliolate leaves--7/22

Soil test results- Spring 2014(Entire area tested prior to fertilizer application)

P2O5= 4ppm

SO4=5ppm

NO3=34#/acre

Soil test results- Post harvest-2014(treatments 1&5 only)

P2O5= treatments 1 = 6ppm; treatment 5= 6.5ppm

Best management practices used on all plots. 2oz Warrior 8/17

Table 19.

2015 Wheat Fertility Applications to Spring Wheat¹**Magnusson Research farm****140# total nitrogen added to all plots**

TRT#	Treatment	Fertilizer App*	Yield @ 12.5% moisture					Test Wt. bushels	% Protein	Harvest Ht.(in.)	RCI 21-Jul	Tissue samples- 7/22		
			% of Mean			Bushels/acre						N	P	K
			2 Yr.ave.	2015	2014	2014	2015							
1	0-0-0	NONE	92	99	86	96	66	58	14.9	29.0	526	3.4	0.22	1.3
2	9-30-30	B	101	101	101	111	67	57	14.9	29.0	540	3.4	0.23	1.3
3	9-30-30	I	95	93	97	108	61	58	15.2	29.0	538	3.6	0.23	1.3
4	18-60-60	B	100	101	98	109	67	57	15.3	28.0	584	3.4	0.23	1.3
5	18-60-60	I	101	97	104	115	65	58	15.1	29.0	587	3.5	0.24	1.3
6	18-60-30	B	99	97	101	112	65	57	14.8	27.0	502	3.2	0.21	1.3
7	18-60-30	I	101	100	101	112	67	57	15.3	29.0	562	3.5	0.23	1.3
8	13-45-30	I	97	97	97	108	64	59	15.1	29.0	586	3.5	0.24	1.4
9	9-30-30-7s	B	98	102	94	104	67	58	14.8	29.0	537	3.3	0.23	1.4
10	18-60-30-14s	I	106	103	108	120	68	58	15.1	30.0	575	3.3	0.23	1.4
11	9-30-30-7s	I	100	97	102	113	65	58	14.8	29.0	545	3.3	0.23	1.3
12	39-30-30 ²	I	99	99	98	108	66	58	14.8	29.0	574	3.4	0.22	1.3
13	69-30-30 ³	I	104	105	103	115	69	57	15.2	28.0	581	3.4	0.23	1.3
14	39-60-30 ²	I	108	108	107	119	72	56	14.9	30.0	629	3.4	0.23	1.3
LSD @5% level			6	8	7	9	5	2	NS	1.5	95	0.2	NS	NS
CV(%)			5	5.6	5.5	5.5	5.6	3	2	4	12	5	7	9

Experimental design:RCB w/4reps Wheat variety='Samson' Planting date-4/28/2015		Soil test pre-plant- 4/26/2015					
		soil depth	NO ₃ -N (ppm)	Olsen P (ppm)	K (ppm)	OM (%)	pH
		0-6"	9	4	111	2.6	8
		6-24"	6				

App*= Fertilizer application method-

I= in-furrow at seeding; B=Broadcast prior to final seed bed prep

¹2015 data + 2014 yield data²ESN applied in furrow 30#N/acre³ESN applied in furrow 60#N/acre

Yield**-corrected to 12% moisture- Mean yield =66bu/ac.

Harvest date=8/18/2015

Plots managed using best management practices.