

PROGRESS REPORT ON SEED PRODUCTION RESEARCH

prepared by

N.J. Ehlke and D.J. Vellekson
Department of Agronomy and Plant Genetics
University of Minnesota
St. Paul, Minnesota 55108

for

**PRESENTATION AT THE GRASS-LEGUME SEED INSTITUTE
Roseau, Minnesota**

March 18, 2004

Weather:

Table 1. Monthly precipitation at Roseau, MN 1967-2003.

Variety Trials:

- Table 2. Kentucky bluegrass seeded in 2001
Table 3. Kentucky bluegrass seeded in 2001 – Organic soil
Table 4. Perennial ryegrass seeded in 2002.
Table 5. Perennial ryegrass winter hardiness trial seeded in 2002 – St. Paul and Roseau.
Table 6. Birdsfoot trefoil seeded in 2002.

Other Trials:

- Table 7. 'Palisade' applied to perennial ryegrass-Helmstetter/Magnusson farms
Table 8. Wild oat herbicides applied to spring wheat with underseeded grasses
Table 9. Herbicides applied to native grasses and legumes for establishment
Table 10. Herbicide screen on NF-93 Kura clover-Bicker farm
Table 11. Unique Kentucky bluegrass seedling tolerance to pre-emergence herbicides-Helmstetter Farm
Table 12. Tolerance of perennial ryegrass to time of application of Assure II –St. Paul

General plot overview

Most plots on the Magnusson farm were lost to the flood in June 2002. This is of course a major loss. Crops that require longer establishment times and data over a number of years such as Kentucky bluegrass are a particular problem. Late summer and fall of 2002 proved to be favorable for reestablishment of many trials and the road to getting research efforts back up to speed are well underway. Weather was generally good in 2003. Yields of many crops were high and fall moisture was generally good for establishing and setting seed on perennial crops.

Kentucky bluegrass

The only trial salvaged in 2002 was the 2001 Kentucky bluegrass variety trial. University of Minnesota and Rutgers experimentals have seed yield and other data in Table 2. Several Rutgers lines are at or near the top in seed yield. These lines could be jointly released with the University of Minnesota to area growers. Turf quality of these lines is also very good so market prices of these lines could make them profitable to grow. Controlling off-type (i.e. tall Park type) seedlings will be of concern growing these improved varieties. Several trials are currently in place in an attempt to address this problem. Table 11 has five pre-emergent herbicides that were applied to 'Unique' Kentucky bluegrass in early May after a fall seeding on the Helmstetter farm north of Roosevelt. Crop injury and weed control ratings are in this table. Plots will be rated to determine if there has been a reduction in off-types in 2004. Another trial, started in 2003 in two locations, uses different tillage and cropping systems, seeding dates, and herbicide timing to accomplish off-type control. Data will start being collected in 2004. These trials will need to be repeated and refined over years to give the best available options for seedling and off-type control in new varieties.

Perennial ryegrass

Perennial ryegrass seed yields in 2003 were generally good. An improvement in the Assure II tolerant P101 perennial ryegrass (P201) is in field increase and will hopefully have seed available in fall of 2004. P201 has been crossed to Rutgers material and there seems to be a large improvement in turf quality. Full recovery of the herbicide tolerance and other traits will take several years, however, but this will likely be the next release of a herbicide tolerant perennial ryegrass variety in Minnesota. Good winter hardiness notes were obtained in 2003. Several lines again showed very good winter hardiness in this trial. The U of M line WH x TQ stands out compared to all commercial and experimental lines in the trial. A fine fescue x perennial ryegrass cross (FF x PR18) showed no winter injury. This line is in early development stages, but its persistence and winter hardiness seem exceptionally good. The growth regulator 'Palisade' has been used experimentally for several years in northern Minnesota to increase perennial ryegrass seed yields. A limited use clearance was obtained in 2003 for its use in production fields. Data from two locations in 2003 and means of all trials are in Table 7. During most years, we have obtained significantly higher seed yields using 'Palisade'. In 2003, we did not see this consistent result. The treatment is relatively expensive, costing approximately \$30 per acre. An additional 40 pounds of nitrogen per acre is also recommended to increase the value of the Palisade treatment. With good growing conditions, a yield increase should usually be realized with a Palisade application. This year, the Helmstetter location was under drought stress which likely caused the lack of yield response. The Magnusson location test plots were placed by mistake on a sand ridge lacking fertility and moisture and yield data should be viewed with caution.

Herbicide trials

Table 8 has some commonly used wild oat herbicides that were applied to spring wheat. Some or all of these herbicides will be screened in a separate trial in 2004 on production year non-AAOP tolerant (Assure II) perennial ryegrass for wild oat control. Avenge herbicide seems to be tolerated the best across all grass species of all the herbicides tested. Silverado is a new 'SU' type herbicide and shows good tolerance in all species except perennial ryegrass. Table 9 has data from a herbicide establishment screen of native grasses and legumes. The 8/29/03 ratings are the most inclusive and shows seeding year data for tolerance to numerous herbicides. This data is only for the establishment year and should not be used as an indication of tolerance in subsequent years. This trial will be refined and repeated in 2004.

Table 1. Monthly precipitation and average 'Park' kentucky bluegrass experimental plot seed yields at Roseau, Mn. From 1967-2003

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Yearly Total	Deviation from normal	Park' bluegrass test plot yield (lbs/A.)
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	-2.34	
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	8.43	650
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	2.81	488
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	3.78	673
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	-3.18	492
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	-2.40	405
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	-0.08	422
1974	0.88	0.87	0.16	2.72	4.12	1.56	2.56	10.97	0.42	0.66	0.15	1.40	26.47	4.97	642
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	-3.45	504
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	-5.67	146
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	-2.06	140
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	-0.88	507
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	-4.04	415
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	-2.35	62
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	2.10	625
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	-1.29	595
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	0.45	605
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	-4.07	613
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	3.55	525
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	-2.12	488
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	-3.58	288
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	-4.57	152
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	0.21	320
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	-9.82	160
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	8.79	210
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	-0.88	630
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	0.29	490
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	-2.90	230
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	0.45	300
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	4.49	250
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	-0.83	350
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	3.44	275
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	1.39	400
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	6.73	550
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	-2.71	575
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	4.32	300*
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	2.97	550
													21.50		

* No seed harvested on experimental plots at Roseau in 2002 due to flooding

37 year average

Table 2. 2001 Kentucky Bluegrass Variety Trial, Magnusson Research Farm, Roseau, MN.

Entry	MSP #	Lodging	Harvest	Harvest	Heading - 2003						Seed yield
			date	height	5/31	6/2	6/5	6/12	6/16	6/19	
		score	July	(in)	-----%						lbs/A
Abbey	2606	1.0	9	23	T	13	27	53	84	99	604
Lato	3408	3.3	8	32	2	15	37	60	79	91	205
Midnight	3254	1.0	15	22	0	0	3	9	18	58	388
Minnfine	3252	5.8	3	33	48	76	98	100	100	100	627
Northstar	3409	1.0	16	16	0	0	38	55	86	88	248
Opti-Green	3410	1.0	16	27	0	0	8	50	84	98	430
Park	3021	4.5	4	33	14	61	93	100	100	100	560
Trenton	3047	2.3	11	30	0	13	38	58	75	88	221
Unique	3411	1.0	17	25	0	0	0	27	34	58	575
1621S	1621	1.0	13	21	0	0	8	28	56	89	368
1628S exp	1628	1.0	13	18	0	0	8	53	85	98	566
1646S	1646	1.0	10	20	0	0	8	60	81	100	578
2073S exp	2073	1.0	15	22	0	0	3	36	73	93	406
3073R exp	3073	1.0	15	20	0	0	3	23	60	88	466
3075R	3075	1.0	15	20	0	0	4	38	74	94	488
484S exp	484	1.0	15	21	3	0	3	28	69	95	390
490S	490	1.0	16	20	0	0	0	20	49	84	341
A97-1433	3314	1.0	15	18	0	0	5	34	50	90	207
A97-1436	3315	1.0	16	19	0	0	5	45	65	96	323
A97-1510	3316	1.0	15	22	0	0	4	53	76	96	388
A97-1523	3317	1.0	15	21	0	0	0	23	50	83	415
A99-2626	3416	1.0	16	23	0	0	0	8	33	60	649
A99-2628	3417	1.0	17	23	0	0	0	8	33	70	629
A99-2679	3418	1.0	16	24	0	0	0	24	63	81	586
A99-2893	3419	1.0	17	24	0	0	0	2	18	48	624
A99-2981	3420	1.0	11	26	0	5	46	65	98	100	508
A99-3240	3421	1.0	8	26	0	T	28	53	70	84	301
cell5	c5	1.0	14	21	0	0	9	38	50	75	154
cell7	c7	1.0	13	20	T	3	13	43	43	54	98
cell111	c111	1.0	15	18	0	0	0	9	28	63	259
cell120	c120	1.0	15	22	0	2	3	30	54	88	386
cell128	c128	1.0	16	24	0	0	0	45	63	94	332
LSD @5%		0.6	2	2	4	11	19	20	26	23	97

Lodging: 1=no lodging to 9 = complete lodging
 Fertility: 100 lbs/A nitrogen in the Fall, 2002
 Experimental design: RCB w/4reps

Table 3.* Kentucky Bluegrass Seed Production Variety Trial
Organic Soil - Habstritt Farm, Roseau, MN

Entry	MSP #	Estimated Seed Yield	
		6/26/03	
		lbs/A	
Abbey	2606	50	
Lato	3408	58	
Midnight	3254	93	
Minnfine	3252	150	
Park	3021	225	
Unique	3411	105	
1621S	1621	95	
1628S exp	1628	120	
1646S	1646	83	
2073S exp	2073	110	
3073R exp	3073	110	
3075R	3075	160	
484S exp	484	124	
490S	490	49	
A99-2626	3416	83	
A99-2628	3417	110	
cell5	5	100	
cell111	111	66	
cell120	120	58	
cell128	128	35	
LSD 5%		66	

* This trial was flooded in 2002 and had areas of water injury.
Interpret the data with caution.

Table 4. 2002 Perennial Ryegrass Seed Production Variety Trial

Entry	MSP #	Heading - 6/12/03	
		%	Seed Yield lbs/A
P101	3366	28	1120
NK-200*	3179	3	651
Spreader2	3393	4	950
TQ x SP	3414	6	1042
Wh sel	3373	4	1001
WH x TQ	3372	11	1045
Blackhawk	3031	35	1045
P201	3478	20	1071
LSD @5%		12	185

* severe rust on NK-200 may have reduced yields
Seeded with wheat on 8/7/2002: Magnusson Research Farm

Table 5. 2002 Perennial Ryegrass Winter Hardiness Evaluation: Roseau and St. Paul, MN.

Entry	msp #	Winter Injury Rating Score*						Overall mean
		St. Paul			Roseau			
		4/15/03	4/30/03	mean	5/8/03	5/31/03	mean	
Affinity	3030	3.5	3.5	3.5	9.3	8.9	9.1	6.3
Barfort	3486	10.0	9.0	9.5	9.8	9.8	9.8	9.7
Bargala	3487	8.8	8.5	8.6	9.5	9.3	9.4	9.0
Barspectra	3175	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Bella	3488	4.5	4.8	4.6	8.8	7.8	8.3	6.5
Blackhawk	3031	4.5	3.8	4.1	9.0	7.8	8.4	6.3
Brightstar SLT	3457	4.5	3.8	4.1	8.5	7.9	8.2	6.2
Citation Fore	3456	3.5	3.8	3.6	8.3	7.5	7.9	5.8
Evening Shade	3489	3.8	4.0	3.9	8.8	8.3	8.5	6.2
FF x PR 18***	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Laredo	3490	4.8	4.3	4.5	9.5	8.6	9.1	6.8
Mara	3485	2.8	3.0	2.9	9.0	8.0	8.5	5.7
NK-200**	3179	3.8	3.5	3.6	7.3	6.8	7.0	5.4
P101	3366	4.0	3.8	3.9	8.8	8.8	8.8	6.4
P201	3478	3.0	3.5	3.3	8.3	7.6	7.9	5.6
Paragon	3491	3.5	3.8	3.6	8.8	8.0	8.4	6.0
PickPR A-97	3481	2.8	2.3	2.5	8.5	6.8	7.6	5.1
PickPR C-97	3482	3.0	3.3	3.1	8.3	7.5	7.9	5.5
PST-21NO	3461	5.3	4.3	4.8	7.8	7.8	7.8	6.3
PST-2CNR	3460	4.0	4.0	4.0	9.0	9.0	9.0	6.5
PST-2CO	3459	4.3	3.8	4.0	8.8	7.9	8.3	6.2
PST-2CUL	3462	4.5	4.0	4.3	8.8	8.8	8.8	6.5
Repell	3492	3.0	2.8	2.9	8.3	7.0	7.6	5.3
Salinas	3458	4.3	3.5	3.9	8.8	7.5	8.1	6.0
Spreader2	3393	3.0	3.3	3.1	8.0	7.1	7.6	5.4
TQ x SP	3414	2.3	2.5	2.4	8.5	8.0	8.3	5.3
ULV-1-02	3483	3.5	3.3	3.4	9.0	8.8	8.9	6.1
ULV-2-02	3484	4.8	4.5	4.6	9.0	8.8	8.9	6.8
Wh sel	3373	2.3	2.3	2.3	7.8	5.3	6.5	4.4
WH x TQ	3372	2.8	2.5	2.6	5.5	3.9	4.7	3.7
WHC Bulk1-00	3480	3.8	3.5	3.6	8.0	7.3	7.6	5.7
WHC Bulk2-00	3479	3.8	3.3	3.5	8.5	8.3	8.4	6.0
LSD @5%		1.5	1.3	1.2	1.3	1.8	1.4	1.0

*Winter injury rating scale: 1= no injury to 10 = dead.

** poor stand of NK-200

*** FF x PR18 = Betts red fescue x ryegrass cross

St. Paul field L4B-seeded 9/3/02

Roseau field 5 NW- seeded 8/7/02

Experimental design: RCB w/4 reps

Table 6. BirdsfootTrefoil Variety Trial, Magnusson Research Farm, Roseau, MN.

Entry	MSP#	Growth Habit*		Seed Yield lbs/A **	Bloom 6/15/03 %	Entry Description
		9/12/02 score	6/15/03 %			
MN 144 myco sel.	3465	5.0		146	28	C4 progeny for Mycoleptodiscus terrestris resistance-RR Smith, USDA-ARS
Georgia 1	3143	5.0		195	28	southern type out of Georgia - not winter hardy
Pardee	3422	5.0		158	25	Released from Cornell-does not persist well in Minn.
Viking	3395	4.0		222	4	Standard erect type- intermediate winter hardiness
Roseau	3214	3.3		271	0	glyphosate tolerant selected from Norcen
Low Tannin	3426	3.3		273	2	low condensed tannin germplasm- U of M- UofWi. Trials pending
High Tannin	3428	3.0		193	4	Hi condensed tannin germplasm-U of M- U of W trials pending
Dawn	3142	3.0		251	4	Standard variety
WH. Sel.	3249	2.8		322	T	winter hardy germplasm-Minn.
Nueltin	3213	2.8		215	T	glyphosate tolerant selected from Leo
Mn.FR 95-105	3325	2.8		224	5	PEI selection for root lesion nematode
Persist	3384	2.5		244	5	St. Paul pasture selection for persistence under grazing
LSS syn.2	3332	2.5		239	2	large seed selection
NC-83 germplasm	3427	2.3		215	6	15 selected clones (9 of the 15 clones comprise the variety 'Norcen')
Persist II	3440	2.3		281	4	persistence under simulated grazing
Fusarium Sel.	3378	2.0		232	2	plant selection increase for resistance to fusarium-Rosemount
Norcen	3173	1.5		249	2	Standard variety
LSD @5%		0.5		54	4	

*Growth Habit score: 1=prostrate to 5=erect

**Trial harvested: 8/28/03

Trial seeded: 7/16/02

Experimental Design: RCB with 4 reps

Table 7. Palisade x Fertility on Perennial Ryegrass
Helmstetter and Magnusson farms*

Palisade		Spring		Helmstetter			Magnusson		
treatment	Date	Fertility	Seed Yield	Height (in)	Lodging **	Height (in)	Lodging**	Seed Yield	
pint/A		lbs/A N	lbs/A % of check	7/9/03	8/5/03	7/21/03	7/21/03	lbs/A	
1.0	early	80	939	99	26	2.0	24	870	
1.5	early	80	1006	106	25	1.5	20	754	
2.0	early	80	934	98	22	1.0	18	649	
1.0	late	80	1021	107	25	3.0	27	1077	
1.5	late	80	1059	111	25	2.2	24	963	
2.0	late	80	972	102	24	1.3	23	816	
0.0		80	950	100	29	7.0	29	950	
1.0	early	40	868	92	25	1.8	20	537	
1.5	early	40	937	99	24	1.5	18	529	
2.0	early	40	943	100	21	1.0	16	506	
1.0	late	40	926	98	25	2.3	23	582	
1.5	late	40	1010	107	24	1.5	23	772	
2.0	late	40	950	101	23	1.0	18	653	
0.0		40	945	100	29	5.3	26	767	
1.0	early	0	600	82	23	1.3	20	430	
1.5	early	0	738	101	22	1.0	15	422	
2.0	early	0	691	94	20	1.0	14	341	
1.0	late	0	707	96	24	1.0	22	575	
1.5	late	0	892	122	23	1.3	18	410	
2.0	late	0	805	110	22	1.0	17	453	
0.0		0	734	100	28	3.5	24	468	
LSD @5%			202		1.4	1.4	3.2	1.5	308

*Helmstetter perennial ryegrass variety = WH x TQ

Magnusson perennial ryegrass variety = P101- this trial was set up by mistake on a sand ridge and was under moisture and fertility stress. Yield data should be viewed with caution.

** lodging: 1=no lodging to 10=complete lodging

Fertility Treatments: 100 lbs/A nitrogen in the fall
0, 40 or 80 lbs/A N (urea based) additional fertility in the spring
Application dates: Helmstetter - 5/9/03 and Magnusson - 5/6/03

Early Palisade treatment Helmstetter 5/28/03
Magnusson 5/31/03

Late Palisade treatment Helmstetter-6/10/03
Magnusson-6/11/03

Average seed yield of 5 Palisade trials from 2000-2003

1 pt.= 125% of no treatment

2 pt.= 128% of no treatment

mean fertility-120#/ac

mean application date 6/4/03

Table 8. 2003 Tolerance of underseeded grasses to wild oat herbicides applied to spring wheat

	Treatment												
	1	2	3	4	5	6	7	8	9	10	11	12	13
	Injury Rating* - 10/17/03												
Park	3.7	6.0	2.3	5.0	4.0	1.3	1.0	4.0	6.0	2.0	5.3	2.7	3.0
Midnight	4.7	7.3	2.7	5.0	5.7	2.0	1.0	5.7	7.3	2.3	6.7	3.7	3.3
Palaton	4.3	6.3	7.3	7.0	6.3	1.3	1.0	6.7	8.0	2.0	7.3	6.0	6.7
Climax	2.3	5.3	3.3	6.7	8.7	2.0	1.0	8.0	7.0	2.3	8.0	3.0	7.3
P101	2.0	2.3	6.3	1.7	2.0	1.7	1.0	2.7	2.0	3.7	2.0	1.7	2.0
TQ x Spr.	3.0	2.0	5.3	2.0	2.0	1.7	1.0	4.0	2.7	3.7	2.7	2.3	2.0

	Treatment												
	1	2	3	4	5	6	7	8	9	10	11	12	13
	Injury Rating* - 9/16/03												
Palaton	6.7	7.3	6.7	8.0	6.7	3.3	1.0	8.0	8.3	3.7	8.0	6.3	5.3
Climax	4.3	6.7	3.0	7.3	9.0	2.0	1.0	9.0	7.7	2.7	8.7	2.7	7.0
P101	3.7	2.3	7.3	2.7	2.3	2.0	1.0	5.0	5.7	4.3	3.3	3.0	3.3
TQ x Spr	4.7	2.3	7.7	2.7	4.0	2.0	1.0	6.3	5.3	4.3	4.3	3.0	3.3

Ansen wheat and underseeded grasses planted - 4/30/03

1 pt. Bronate applied to entire area on 6/11/03

Treatments 1-10 applied 5/31/03: 10 am, wind 3-8 WNW and 60F ;6/11: 10:am wind w 5mph and 65F -sprayer output= 16gpa@26psi

Growth Stage: 5/31- wheat 3 leaf stage, perennial ryegrass emerged at 2 leaf stage, other species not emerged

Growth stage: 6/11 - wheat 5 leaf stage and most grasses emerged

*Injury Rating: 1=no injury to 9=dead; best ratings obtained on 10/17/03.

Experimental design=RCB w/3reps

2001 Tolerance of underseeded grasses to wild oat herbicides applied to spring wheat

	Treatment						
	1	2	3	4	5	6	7
	Injury Rating* - 10/8/01						
Park	3.0	5.0	5.0	4.0	3.0	1.0	1.0
Colt timothy	3.0	7.0	8.0	8.0	9.0	1.0	1.0
Chiefton	5.0	3.0	9.0	6.0	9.0	1.0	1.0
P101	1.0	1.0	9.0	1.0	1.0	1.0	1.0

Trial seeded on 6/21/01 and sprayed on 7/5/01.

Table 8 cont. 2003 Tolerance of underseeded grasses to wild oat herbicides applied to spring wheat

Trt.	Trade name	Chemical	Application rate	Timing
1	Achieve + Supercharge + 28% N	tralkoxydim	0.5 lbs/A	5/31/03
2	Assert + NIS	imaxamethabenz	1.2 pt	5/31/03
3	Everest + NIS	flucarbazone	0.61 oz	5/31/03
4	Puma	fenoxyprop	0.66 pt	5/31/03
5	Discover + DSV	clodinafop	4 oz	5/31/03
6	Avenge + NIS	difenzoquat	3 pt	5/31/03
7	No Treatment			
8	Harmony Extra + Discover	tribenuron, thifensulfuron + clodinafop	0.4 oz + 4 oz	5/31/03
9	Harmony Extra + Assert	tribenuron, thifensulfuron + imaxamethabenz	0.4 oz + 1.2 pt	5/31/03
10	Silverado	mesosulfuron	0.78oz + 1.5 pt	5/31/03
11	Discover	clodinafop	4 oz	6/11/03
12	Assert	imaxamethabenz	1.2 pt	6/11/03
13	Puma	fenoxyprop	0.66 pt	6/11/03

Species	Seeding Rate	seed lot #
1 Park Kentucky bluegrass	3 lbs/A in 6 inch rows	3324
2 Midnight Kentucky bluegrass	3 lbs/A in 6 inch rows	3539
3 Climax Timothy	1 lbs/A in 6 inch rows	3537
4 Palaton Reed canarygrass	3 lbs/A in 6 inch rows	3433
5 P101 Perennial ryegrass	5 lbs/A in 14 inch rows	3366
6 TQ x Spread Perennial ryegrass	5 lbs/A in 14 inch rows	3414

Table 9. 2003 Native Grass/Legume Herbicide Establishment Trial- Magnusson Research Farm

Species	Herbicide Treatments																											
	AA	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
Can.wildrye	1.5	9.0	6.5	3.0	7.5	9.0	9.0	2.5	8.5	7.5	9.0	2.0	8.5	1.0	9.0	7.0	9.0	9.0	7.0	2.0	7.0	4.0	2.5	4.0	8.5	8.0	4.5	
B. bluestem	2.0	4.0	9.0	3.5	2.0	4.5	6.5	6.0	7.0	4.0	2.0	7.0	4.5	1.0	8.5	4.5	8.0	3.5	4.0	2.0	4.0	4.0	3.0	1.5	4.0	4.0	6.0	
Indiangrass	2.5	7.5	8.0	3.5	3.0	5.0	6.5	4.5	8.0	4.5	8.0	5.5	5.0	1.0	8.5	3.5	7.5	4.0	6.0	2.0	4.0	5.5	3.0	2.5	5.0	8.5	6.5	
Si-oats gra	1.5	8.0	7.0	7.5	3.5	4.0	8.0	2.5	8.5	3.5	9.0	7.5	4.5	1.0	8.5	3.5	6.5	7.0	4.0	1.5	3.0	3.5	3.0	3.5	4.0	7.5	7.0	
I. bundlef	1.5	9.0	4.0	6.5	3.5	5.5	7.0	5.0	8.0	7.0	2.5	4.0	2.0	1.0	9.0	2.5	3.5	2.5	5.0	3.5	1.5	5.0	3.5	6.5	8.5	3.5	4.5	
Per. Flax	2.5	9.0	8.5	8.5	4.5	7.5	9.0	4.5	9.0	9.0	4.0	1.5	8.5	1.0	9.0	3.0	4.0	8.5	3.5	3.0	5.5	7.0	3.5	8.5	8.0	2.5	3.5	
Wild senna	3.0	6.5	9.0	6.0	3.0	5.0	8.5	4.0	7.5	8.0	1.0	2.5	5.5	1.0	8.5	3.0	7.5	9.0	3.5	2.5	5.0	3.5	4.0	4.0	6.5	5.5	3.5	
P. prairie cl.	2.5	9.0	2.5	9.0	3.5	5.0	8.0	7.5	8.5	6.0	5.0	3.0	2.5	1.0	9.0	3.5	4.5	3.5	4.0	2.5	2.5	6.5	4.5	7.5	9.0	4.5	3.5	
False indigo	2.5	9.0	3.0	9.0	3.5	5.0	8.5	5.5	9.0	8.5	3.5	3.0	5.0	1.0	9.0	3.5	7.5	8.0	4.0	3.0	3.0	4.5	4.5	8.0	8.5	4.5	5.5	
Weed control**	2.0	8.5	6.5	5.5	5.5	6.5	8.5	8.0	8.0	8.0	7.5	7.0	7.5	8.0	1.0	9.0	7.0	8.5	8.0	4.0	4.5	7.0	4.5	3.5	5.0	4.0	6.5	5.0
Species	Herbicide Treatments																											
	A	B	C	D	E	F	G	H	I	L	K	L	M	N	Q	T	Injury Rating: 7/17/03											
Can.wildrye	9.0	5.5	3.0	6.0	9.0	9.0	2.5	8.0	7.0	9.0	2.0	8.5	1.0	9.0	7.5	5.5	Injury Rating: 8/29/03											
B. bluestem	5.0	9.0	3.0	3.0	4.5	6.5	6.5	7.5	5.0	2.0	6.5	6.0	1.0	8.5	2.5	2.5	Injury Rating: 8/29/03											
Indiangrass	8.0	9.0	3.0	3.0	5.5	6.5	5.0	9.0	5.5	8.5	6.5	6.0	1.0	8.5	3.5	3.0	Injury Rating: 8/29/03											
Si-oats gra	8.5	8.5	8.0	3.0	6.0	7.5	5.5	8.0	5.0	9.0	8.0	6.5	1.0	8.5	6.5	2.0	Injury Rating: 8/29/03											
I. bundlef	9.0	5.0	7.5	2.5	6.0	7.0	6.5	7.5	8.0	3.0	3.5	3.0	1.0	9.0	5.0	3.0	Injury Rating: 8/29/03											
Per. Flax	9.0	9.0	9.0	3.5	8.5	9.0	6.0	9.0	8.5	4.5	3.0	9.0	1.0	8.5	8.0	6.0	Injury Rating: 8/29/03											
Wild senna	7.5	9.0	6.0	2.5	6.0	8.0	5.5	7.0	8.0	2.5	4.5	8.0	1.0	9.0	8.5	8.0	Injury Rating: 8/29/03											
P. prairie cl.	9.0	3.5	9.0	2.5	5.5	8.0	8.0	8.0	7.0	4.5	4.0	2.5	1.0	9.0	5.0	3.5	Injury Rating: 8/29/03											
False indigo	9.0	5.0	9.0	4.0	6.0	8.5	5.0	8.0	9.0	4.0	4.0	6.0	1.0	9.0	8.5	4.5	Injury Rating: 8/29/03											

LSD @5% =1.6 on all injury and weed control ratings

**Weed control rating: 1=no weed control 9=all weeds killed
 *Injury Rating: 1 = no injury to 9 = dead

Table 9 cont. 2003 Native Grass/Legume Herbicide Establishment Trial- Magnusson Research Farm

Trt.	Common name	Chemical	Rate	Rate lbs/A a.i.	Timing
AA	Basagran	Bentazon	1.5 pt	0.750	Post
A	Aatrex 4L	Atrazine	3 pt	1.500	Pre
B	Command 3E	Clomazone	2 pt	0.750	Pre
C	Callisto 4L	Mesotrione	6 oz	0.188	Pre
D	Raptor 1L	Imazomox	4 oz	0.031	Pre
E	Raptor 1L	Imazomox	16.4 oz	0.125	Pre
F	Plateau 2L	Imazapic	4 oz	0.063	Pre
G	Authority 75DF	Sulfentrazone	4.7 oz	0.220	Pre
H	FirstRate 84DF	Cloransulam	4.7 oz	0.250	Pre
I	Python 80DF	Flumetusan	1.1 oz	0.055	Pre
J	Dual II Mag 7.64E	Metolachlor	2 pt	1.900	Pre
K	Prowl 3.3E	Pendimethalin	2.72 pt	1.120	Pre
L	Pursuit 2L	Imazethapyr	4 oz	0.063	Pre
M	No treatment	none	0	0.000	none
N	Sencor 75DF	Metribuzin	10.7 oz	0.500	Pre
O	Raptor 1L + 2.5% Prefer28	Imazomox	4 oz	0.031	Post
P	Raptor 1L + 2.5% Prefer28	Imazomox	16.4 oz	0.125	Post
Q	Plateau 2L + NIS	Imazapic	3 oz	0.063	Post*
R	FirstRate 84DF+ NIS	Cloransulam	0.305 oz	0.250	Post
S	Harmony GT 75DF+ NIS	Tribenuron	0.085 oz	0.004	Post
T	Pursuit 2L + 2.5% Prefer28	Imazethapyr	4 oz	0.063	Post*
U	Flexstar + NIS	Fomesafen	13.8 oz	0.200	Post
V	Aim 2E + NIS	Carfentrazone	0.5 oz	0.063	Post
W	Callisto 4L + NIS	Mesotrione	3 oz	0.188	Post
X	Aatrex 4L + NIS	Atrazine	2 pt	1.500	Post
Y	Accent + NIS	Nicosulfuron	0.66 oz	0.031	Post
Z	Buctril + Puma	Bromoxynil + Fenoxypop	1 pt + 0.5 pt	0.25 + 0.063	Post

Seeded on Magnusson Research Farm- 5/29/03
 with a forage seeder and packed twice with Brillion cultipacker
 Soil type: sandy loam; Plot size: 5' x 10'
 Pre treatments: 5/29/03 Post treatments: 7/7/03 and 6/25/03*
 Treatments applied with bicycle sprayer @26 psi and 16 gpa

Species	Scientific name	Seeding Rate (lbs)
Canada wildrye	<i>Elymus canadensis</i>	5
Pierre Side-oats grama	<i>Bouteloua curtipendula</i>	5
Bison Big bluestem	<i>Andropogon gerardi</i>	6
Tomahawk Indiangrass	<i>Sorghastrum nutans</i>	6
Appar Perennial Blue flax	<i>Linum perenne</i>	15
False indigo	<i>Amorpha fruticosa</i>	6
Illinois bundleflower	<i>Desmanthus illinoensis</i>	6
Wild senna	<i>Senna hebecarpa</i>	15
Purple prairie clover	<i>Dahlea purpureum</i>	3

Table 10. NF-93 Kura clover-Herbicide screen
Wayne Bicker farm, Roseau, mn. Seeded in 2001

Herbicide Treatment	Herbicide Rate rate/A	Active ingredient lbs/A	Application Date	Flowering Head rating*	
				7/18/03	7/18/03
Raptor	4 oz	0.032	5/31/03	6.5	93
Raptor	8 oz.	0.064	5/31/03	6.0	95
Sencor	1.25 lbs	1.000	10/15/02	5.5	25
Aatrex	3 pts	1.500	5/31/03	3.5	65
Plateau	6 oz.	0.047	10/15/02	5.5	85
Plateau	12 oz.	0.094	10/15/02	5.0	95
FlexStar	.8 pt	0.200	5/31/03	5.5	50
Calisto	3 oz.	0.094	5/31/03	2.0	55
Princep	4 pt.	2.000	10/15/02	6.0	5
No treatment				7.0	0

*Flowering/Head rating: 1=no flowers to 9=best flowering.

**% Weed Control = stand and vigor reduction of entire weed spectrum present

Table 11. 2003 Unique Kentucky Bluegrass Seedling Tolerance to Pre-emergence Herbicides

Herbicide Trade name	Chemical name	Herbicide Rate		Plant Stand/Vigor* 7/9/03	Weed control %		
		p/ac.	lb/a ai		Cinquefoil	Smartweed spp. Lamsquarter	
Prowl 3.3	Pendimethalin	3.0 pt	1.25	7.0	0	98	100
Dual II 7.64	Metolachlor	3.0 pt	3.00	3.7	33	0	10
Harness 7.0	Acetochlor	3.5 pt	3.00	3.0	93	50	25
Frontier 6.0	Dimethanamid	2.0 pt	1.50	4.7	23	0	0
Lasso 4.0	Acetochlor	5.0 pt	2.50	4.3	20	10	10
Untreated				7.0	0	0	0

*Plant Stand/Vigor: 1 = poor to 9=excellent

Experimental Design: RCB with 3 reps

Plot size: 10' x 30'

Herbicide applications: 5/9/03

Growth stage: emerging up to 2 leaf stage

Unique Kentucky bluegrass seeded: 8/02.

Table 12. Tolerance of Perennial Ryegrass to Time of Application of Assure II.

2002-3 St. Paul Campus -Keller block

Entry	Treatment date	Number of reps	Head rating* 6/27/03	Seed yield gm/3ft row
Affinity	0	4	6.5	21.0
NK-200	0	4	4.0	18.0
P101	0	4	6.3	16.0
P201	0	4	6.0	18.0
Affinity	9/26/02	3	0.0	0.0
NK-200	9/26/02	3	0.3	0.0
P101	9/26/02	3	5.3	18.0
P201	9/26/02	3	5.0	14.0
Affinity	9/26/02+5/13/03	3	0.0	0.0
NK-200	9/26/02+5/13/03	3	0.0	0.0
P101	9/26/02+5/13/03	3	7.0	21.0
P201	9/26/02+5/13/03	3	5.7	18.0
Affinity	5/13/03	2	1.5	8.5
NK-200	5/13/03	2	1.0	1.5
P101	5/13/03	2	6.5	15.5
P201	5/13/03	2	7.5	23.5
Affinity	5/13/03(2x rate)	1	0.0	0.0
NK-200	5/13/03(2x rate)	1	0.0	0.0
P101	5/13/03(2x rate)	1	6.0	25.0
P201	5/13/03(2x rate)	1	7.0	30.0

Assure II treatment applied at 10 oz./ac. + 25%NIS with CO2 bicycle sprayer at 26 psi and 12.5 gpa. Head rating and seed yields are means of treatments with no statistical analysis because winter injury eliminated many of the plots.

*Head rating: 1=poor heading to 10=best heading