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 13, 2002

Weather:

Table 1. Monthly precipitation at Roseau, MN 1967-2001.

Variety Performance Trials:

Table 2. Kentucky bluegrass seeded in 1998.
Table 3. Kentucky bluegrass seeded in 1998-peat soil.
Table 4. Kentucky bluegrass seeded in 1999.
Table 5. Timothy seeded in 1998.
Table 6. Perennial ryegrass seeded in 2000.
Table 7. Perennial ryegrass winter hardiness trial seeded in 2000.
Table 8. Birdsfoot trefoil seeded in 2000.
Table 9. Kura clover seeded in 2001.

Other Trials:

Table 10. Effect of Beacon/Tilt on 'Park' Kentucky bluegrass.
Table 11. Effect of herbicides applied to 'Midnight' and 'Minnfine' Kentucky bluegrass.
Table 12. Effect of the growth regulator Palisade on 'Park' Kentucky bluegrass.
Table 13. Effect of the growth regulator Palisade on 'TQ x Spread' perennial ryegrass.
Table 14. Effect of the growth regulator Palisade on 'WHS' perennial ryegrass.
Table 15. Effect of wild oat herbicides on underseeded grasses in spring wheat.

Kentucky Bluegrass Trials

In 1999, the University of Minnesota entered into a joint release program with Rutgers University, which has a premier turf breeding program. Experimental entries with good turf grass potential would be brought to northern Minnesota to evaluate seed production potential. The best entries could then be increased and grown in Minnesota. Royalties from seed sales would then be split between the two institutions. Kentucky bluegrass seed yields from a trial seeded in 1999 (Table 4) shows the first seed yield data for eight of these experimental entries. Three of the top four entries in the trial are from the Rutgers breeding program. More experimentals were seeded in 2000 and 2001 for future evaluation and the 1999 trial will be harvested again in 2002.

Entries from our breeding program at the University of Minnesota yielded relatively less seed than in 2000. Visual estimates of yield of these lines were higher than seed yields actually harvested. There seemed to have been higher than average quantities of light seed and multiples that were removed from these yield samples during cleaning. Powdery mildew may have been one factor as these entries are moderately susceptible to mildew. These variety trials are generally not treated with Tilt as to evaluate entries for genetic disease resistance. Larger increases of these lines treated with Tilt produced good seed yields.

Perennial ryegrass

The perennial ryegrass breeding program has made good progress. P101 is in commercial seed production. This variety has tolerance to the quackgrass control herbicide Assure II. A limited use label is being pursued and should be in place for the 2002 growing season. Three other lines with better winter hardiness and turf quality are being advanced for release and quality growers equipped to rogue quackgrass from fields would benefit from producing these potential new varieties. Crosses of this material with P101 are also being advanced as quickly as possible to incorporate herbicide tolerance with improved winter hardiness and better turf quality. Tables 6 and 7 have seed yield and winter hardiness data for a number of varieties and experimentals.

Growth Regulators – Herbicides

The growth regulator 'Palisade' was again applied to 'Park' Kentucky bluegrass. Inconsistent seed yields and reductions in lodging were obtained with certain fertility levels and application dates. Yield data has been inconsistent over both years and no future trials on Kentucky bluegrass are planned.

Palisade on perennial ryegrass has produced consistently good results, however. Seed yields were increased and lodging decreased in three trials in 2000 and 2001. A restricted use label is in place for Washington, Oregon, and Idaho, but not in Minnesota. Hopefully with this years data and prospects for increased perennial ryegrass acreage, a label will be obtained.

The use of Beacon at low rates alone and in combination with Tilt on newly seeded bluegrass was examined in 2001. The hypothesis was to control volunteer winter wheat and mildew in first year bluegrass stands for seed production. Seed yields were not affected by any of the treatments. Winter wheat, when present, showed good control and seed head suppression with the lowest application rates. Rates of 0.2 oz. appeared to adequately prevent seed heads from forming.

Wild oat and other grass control in wheat interseeded with grasses is of interest to many growers. To begin answering the question of tolerance to some of these commonly used spring wheat herbicides a screening trial was initiated in 2001. Injury data from 2001 is shown in table 15. The perennial ryegrass seemed tolerant to most herbicides applied except Everest. Avenge had the least amount of injury and was better than the checks in some cases because of injury to the wheat crop. Seed yield data will be obtained from these plots in 2002 and another trial will be reestablished in 2002 .

Acknowledgements

We would like to thank our student technician on the plots in 2001, Bryan Curran and our grower cooperators including the Rices, Tveit (Emil) farms, Habstritts, Dean Carlson and Higgins-Eastman for use of their fields for conducting studies in 2001. Assistance from Magnusson farms with some field operations was invaluable. Many other growers also provided valuable input for conducting our operations. We also want to thank Marvins and Norfarm Seed for seed processing and cleaning support.

Table 1. Monthly precipitation and average 'Park' kentucky bluegrass experimental plot seed yields at Roseau ,Mn. From 1967-2000

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Yearly Total	**DEPARTURE FROM NORMAL**	Park' bluegrass test plot yield (#/ac.)
1967	1.13	0.39	0.59	2.89	0.89	2.23	4.95	1.69	0.83	1.11	0.7	1.76	19.16	**-2.13**	
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	**8.64**	650
1969	3.07	0.11	0.05	1.27	3.31	2.29	3.7	4.28	3.29	1.91	0.3	0.73	24.31	**3.02**	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	**3.99**	673
1971	0.54	0.13	0.26	1.5	2.24	2.29	3.58	0.69	3.33	2.97	0.29	0.5	18.32	**-2.97**	492
1972	0.68	0.76	0.5	0.7	1.66	5.03	1.92	1.53	4.22	1.4	0.38	0.32	19.1	**-2.19**	405
1973	0.09	0.17	1.18	0.9	2.46	2.21	4.04	2.09	5.67	1.19	0.67	0.75	21.42	**0.13**	422
1974	0.88	0.87	0.16	2.72	4.12	1.56	2.56	10.97	0.42	0.66	0.15	1.4	26.47	**5.18**	642
1975	1.1	0.29	0.64	1.4	1.52	4.96	2.26	1.75	1.79	1.49	0.2	0.65	18.05	**-3.24**	504
1976	1.13	0.5	1.05	0.77	0.54	5.82	1.52	3.72	0.34	0.07	T	0.37	15.83	**-5.46**	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	**-1.85**	140
1978	0.36	0.26	0.17	1	1.97	1.92	6.25	3.25	3.44	0.23	0.98	0.79	20.62	**-0.67**	507
1979	0.5	1.01	1.06	2.77	1.89	1.91	3.7	1.59	0.45	1.4	1.02	0.16	17.46	**-3.83**	415
1980	0.55	0.82	0.35	0	0.24	1.75	3.35	5.19	4.12	1.66	0.94	0.18	19.15	**-2.14**	62
1981	0.27	0.16	0.66	0.56	2.79	6.85	2.63	2.41	3.63	1.75	0.9	0.99	23.6	**2.31**	625
1982	1.3	0.45	0.74	0.24	1.38	2	5.53	2.71	1.92	2.91	0.46	0.57	20.21	**-1.08**	595
1983	1.31	1.26	1.17	0.53	2.76	4.03	1.62	3.34	2.91	2.26	0.66	0.1	21.95	**0.66**	605
1984	T	0.95	T	0.72	0.72	4.46	3.78	0.99	0.37	4.32	0.1	1.02	17.43	**-3.86**	613
1985	0.12	0.33	0.06	1.07	4.35	4.62	1.08	8.72	1.6	1.04	1.68	0.38	25.05	**3.76**	525
1986	0.3	0.9	0.26	2.96	1.4	2.43	3.59	2.04	2.52	0.65	1.97	0.36	19.38	**-1.91**	488
1987	0.47	0.3	0.1	0.59	4.37	2.25	4.8	2.22	0.82	0.92	0.73	0.35	17.92	**-3.37**	288
1988	0.6	0.09	1.75	0	1.74	1.34	5.53	1.7	2.24	0.12	0.77	1.05	16.93	**-4.36**	152
1989	3.27	0.32	2.86	0.1	2.82	5.46	1.6	2.56	1.24	0.41	0.62	0.45	21.71	**0.42**	320
1990	0.55	0.2	1.12	1.09	0.46	3.19	2.48	0.62	0.91	0.16	0.18	0.72	11.68	**-9.61**	160
1991	0.56	0.64	0.58	2.87	3.19	5.94	3.4	1.99	7.42	1.64	1.36	0.7	30.29	**9.00**	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	**-0.67**	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	**0.50**	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	18.6	**-2.69**	230
1995	0.57	0.59	1.23	0.61	2.5	2.13	4.59	3.59	1.81	1.33	1.54	1.46	21.95	**0.66**	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	**4.70**	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	**-0.62**	350
1998	0.69	1.05	0.21	0.77	4.55	5.39	3.01	2.2	0.31	4.42	1.39	0.95	24.94	**3.65**	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	**1.60**	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	**6.94**	550
2001	0.21	0.52	0.46	1.89	3.27	1.76	4.74	1.4	0.72	1.76	1.5	0.56	18.79	**-2.50**	575
											35 year average		21.29		

Table 2. Heading, height, lodging,harvest date and seed yield for 21 Kentucky bluegrass strains seeded in 1998 on the Magnusson farm. 2000-01 data

		2001							Seed yield (lbs/A)		
		% Heading				Harvest	Lodging at	Harvest	2000	2001	2yr. ave
Variety	msp#	6/2	6/7	6/11	6/13	ht.(in.)	harvest	date			
Abbey	2606	0	4	8	38	23	1.0	7/12	909	212	560
Barmax	2861	12	19	35	73	22	1.5	7/7	599	535	567
Blacksburg	3094	0	0	4	33	23	1.0	7/12	188	67	128
Blackstone	3225	4	8	19	60	25	1.0	7/12	130	78	104
CAS-JC91L II	3164	1	5	23	55	23	1.0	7/7	482	332	407
Lato	2918	8	20	63	75	30	2.5	7/7	413	201	307
Midnight	3153	0	0	7	28	22	1.0	7/12	630	283	457
Minnfine	2794	73	83	100	100	33	6.5	7/5	694	598	646
Moonlight	3226	1	2	13	43	20	1.0	7/12	323	207	265
Northstar	3227	1	5	15	60	15	1.0	7/12	413	279	346
Optigreen	3156	0	2	16	63	26	1.0	7/11	559	363	461
Park	3021	38	58	83	100	32	3.8	7/5	695	455	575
Park	2552	43	63	88	100	32	4.3	7/5	727	410	569
Rugby	3038	1	9	33	53	28	1.8	7/10	391	406	399
Trenton	3047	6	15	30	63	28	1.5	7/9	401	444	423
Unique	2859	0	1	9	43	25	1.0	7/13	595	615	605
484S exp	3232	0	1	10	63	21	1.0	7/11	643	335	489
1628S exp	3233	1	3	10	40	21	1.0	7/12	652	219	435
2073S exp	3234	3	3	15	60	19	1.0	7/12	676	277	476
3073S exp	3236	0	0	8	50	21	1.0	7/12	739	261	500
Washington	3239	35	60	78	90	35	4.3	7/6	369	359	364
LSD @5%		4	10	15	12	2	0.8	2	142	73	87

Lodging: 1=none; 9=flat
experimental design: RCB with 4 reps

Table 3. Percent heading, height, lodging, harvest date and seed yield for 17 varieties of Kentucky bluegrass seeded in 1998 on the Higgins(Eastman) farm north of Roseau on organic soil. 2001 data.

Variety	msp#	% heading 6/6/01	% heading 6/14/01	Harvest height (in)	Lodging at harvest*	Harvest date	Seed yield estimate lbs/A	Seed yield actual lbs/A
Abbey	2606	2	53	25	1.0	7/10	288	513
Barmax	2861	2	65	21	3.8	7/6	250	464
Blacksburg	3094	2	48	24	1.0	7/10	50	174
Blackstone	3225	18	63	24	1.3	7/10	75	78
CAS-JC91L II	3164	0	43	28	1.0	7/10	238	504
Midnight	3153	1	25	27	1.0	7/10	238	386
Minnfine	2794	80	95	31	6.3	7/4	338	477
Moonlight	3226	38	65	29	1.8	7/10	144	279
Washington	3239	43	88	32	3.8	7/4	231	265
Optigreen	3156	6	50	30	1.5	7/10	163	326
Park	3021	70	93	30	4.3	7/4	238	488
Park	2552	63	88	31	3.3	7/4	188	473
Rugby	3038	3	43	30	1.5	7/10	125	330
484S exp	3232	4	48	25	1.0	7/10	294	439
1628S exp	3233	1	43	23	1.0	7/10	281	428
2073S exp	3234	4	50	23	1.0	7/10	212	406
3073S exp	3236	1	48	23	1.0	7/10	300	437
LSD @5%		14	15	3	1.1	1	97	109

*Lodging. 1=none; 9=severe lodging
Experimental design:RCB w/ 4 reps

Table 4. Powdery mildew, percent heading, harvest height, harvest date rating on 30 kentucky bluegrass and seed yields for 30 kentucky bluegrass varieties seeded 8/3/99 on the Magnusson farm.

VARIETY	Seed lot	Powdery* mildew 36683.0	Lodging*** 37076.0	%heading 6/2/01	%heading 6/11/01	Harvest ht.(cm)	Harvest date	Seed yield lbs/A
A97-1523	3317	1.0	1.0	0	31	69	12	776
Abbey	2606	3.4	1.0	0	48	68	12	738
A97-1510	3316	1.1	2.5	0	43	69	12	707
A97-2306	3320	3.4	1.0	0	39	70	12	691
Minnfine	3252	1.8	8.8	55	100	80	4	680
132S	6	3.6	1.8	20	33	74	12	627
3075R	13	2.6	1.0	1	35	66	12	622
A97-1436	3315	1.1	3.0	1	48	70	12	613
1646S	9	3.9	1.0	0	38	65	12	609
484S exp	1	3.5	1.0	1	43	50	10	589
Park	3021	3.6	8.5	24	100	80	4	575
1844S	11	3.1	1.0	0	45	63	12	546
2073S exp	3	3.5	1.0	1	38	65	12	542
490S	15	3.4	1.0	0	28	64	12	522
59R	16	3.9	1.5	0	26	70	12	520
1621S	8	3.1	1.0	0	30	65	12	517
A97-1433**	3314	1.3	2.5	0	33	68	13	513
Midnight	3254	3.4	1.0	0	25	64	12	473
1775S	10	3.1	1.0	0	25	55	12	473
3073S exp	4	3.5	1.0	0	30	60	12	466
2828S exp	5	1.4	1.8	0	35	80	12	457
1628S exp	2	3.6	1.0	0	23	45	11	450
Washington	3239	1.6	8.5	23	80	89	6	433
Trenton	3047	2.0	7.0	1	60	70	12	421
1518S	7	3.8	1.0	0	23	69	10	415
453R	14	2.3	1.0	0	25	68	10	~~415~~ 493
2320S	12	3.3	1.0	0	48	61	12	408
A97-1613	3318	1.8	3.8	17	60	80	5	363
A95-1936	3319	2.5	6.0	9	58	70	11	348
A93-420	3321	2.4	2.8	4	54	80	12	138
LSD @5%		0.9	1.6	16	23	5	1	164

Experimental design: RCB with 4 reps
*mildew; 1=none, 5 =severe
**- cut 2-3 days earlier than maturity
***- lodging; 1=none; 10=severe

Table 7. 2000 Perennial ryegrass winter hardiness trial

Roseau: seeded 8/16/00
St.Paul: seeded 8/23/00

Variety	msp#	Winter injury*	
		St.Paul**	Roseau
		4/24/01	5/16/01
NK-200	3179	2.0	1.0
2 CTL-bulk	3365	1.0	1.3
2 WO bulk	3364	1.0	1.3
Affinity	3030	1.0	2.0
Barspectra annual	3175	9.3	10.0
Brightstar	3024	1.0	1.3
Chaparal	3174	1.0	2.0
K9 bulk	3101	1.3	1.3
K9 C2	3244	1.3	1.3
K9 C3	3302	1.5	1.0
P101	3304	1.3	2.5
P101	3366	1.0	1.5
syn 2CO	3367	1.0	1.8
T.Q. x Spread	3274	1.3	1.5
Tophat	3029	1.0	1.3
W.H. x T.Q.	3275	1.5	1.3
W.H.Sel.	3273	1.8	1.0
LSD @ 5%		0.6	0.7

design: RCB w/4 reps

*winter injury: 1=no injury, 10=dead
**snow blew off parts of 2 reps at St.Paul.
Roseau location therefore has better relative data
although winter injury is minimal at both locations

Table 10. The effect of Beacon and Tilt on 'Park' Kentucky bluegrass.
Rice farms - located east of Magnusson Research Farm: seeded 8/2000

Treatment*	Application rate	Harvest height(in.)	Seed yield lbs/A	Volunteer wheat** control (%)
Beacon	0.1 oz.	21	388	60
Beacon	0.2 oz.	21	376	60
Beacon	0.4 oz.	19	390	70
Beacon+Tilt	0.1 + 3 oz	21	381	na
Beacon+Tilt	0.4 + 3 oz.	19	400	na
No treatment		22	382	na
LSD @5%		2	ns	

*0 .25% Preference used as an adjuvant in all Beacon treatments
Application date: 5/15/01 - CO2 bicycle sprayer at 12 gpa
plot size - 10' x 50' with 30' buffer between plots

Experimental design: RCB w/4 reps
** visual estimate of winter wheat control - 1rep only
na= no winter wheat in these plots.

Table 11. Herbicide applications on Minnfine and Midnight Kentucky bluegrass, Magnusson Research Farm. Seeded: August, 1997.

					Minnfine		Midnight	
Trade name	Chemical name	Rate product/acre	Application date	Adjuvant	Lodging* at harvest	Seed yield lbs/A	Harvest height (in)	Seed yield lbs/A
Beacon	primisulfuron	0.4 oz.	5/15/01	0.25% Preference	5.0	776	22	345
Beacon	primisulfuron	0.2 oz.	5/15/01	0.25% Preference	6.0	764	21	357
Beacon	primisulfuron	0.4 oz.	9/13/00	0.25% Preference	7.0	886	21	223
Express + 2,4 D	tribenuron+2,4D amine	0.25 oz.+ 3/4 pt	9/13/00	0.5% Preference	5.0	690	20	413
Express	tribenuron	0.25 oz.	5/15/01	0.5% Preference	7.7	874	22	372
Distinct	dicamba+diflufenzopyr	6 oz.	9/13/00	1.5 pt Prefer 28	7.3	838	22	378
Clarity + 2,4 D	dicamba+2,4D amine	3/4 pt.+ 3/4 pt.	9/13/00	none	7.0	847	25	315
Clarity + 2,4 D	dicamba+2,4D amine	3/4 pt.+ 3/4 pt.	5/15/01	none	7.3	788	23	315
Distinct	dicamba+diflufenzopyr	6 oz.	5/15/01	1.5 pt Prefer 28	7.3	779	21	348
Express + 2,4 D	tribenuron+2,4D amine	0.25 oz.+ 3/4 pt	5/15/01	0.5% Preference	4.7	705	24	410
No Treatment		none		none	7.3	862	23	369
LSD @5%					2.0	165	NS	117

*Lodging rating: 1=no lodging; 9=severe lodging
Experimental design: RCB w/ 3reps
Plots sprayed with CO2 bicycle sprayer at 27 PSI @ 12.5GPA

Formulations:
Express 75DF
2,4D(Weedar 64) 3.8#/gal.
Beacon 75 WDG
Clarity 4#/gal

Table 12. Effect of the growth regulator Palisade on 'Park' Kentucky bluegrass. Magnusson Research Farm, 2001 data

			Fertilizer rate							
			120 + 40 + 50 + 15 sulfur				170 + 40 + 50 + 15 sulfur			
Product/acre	lbs A.I. per acre	Application Date	Lodging 6/15/01	Lodging at harvest	Harvest height (in)	Seed yield lbs/A	Lodging 6/15/01	Lodging at harvest	Harvest height (in)	Seed yield lbs/A
No treatment	0	0	6	6.3	33	687	7	8.5	33	758
0.75 pt.	0.2	5/15/01	1	1.3	30	693	1	2.3	30	941
1.5 pt.	0.4	5/15/01	1	1	26	627	1	1	26	832
0.75 pt.	0.2	6/2/01	1	1	28	624	1	1	28	709
1.5 pt.	0.4	6/2/01	1	1	24	574	1	1	27	671
LSD @5%			0.8	1	2	74	0.6	0.5	2	109

Plot size - 10' x 50'
All treatments applied with CO2 bicycle sprayer with 8003 xr nozzles at 27 psi and 12.5 gpa
Experimental design-RCB w/ 4 reps

* Lodging rating: 1=no lodging to 9=severe lodging

Table 13. Effect of the growth regulator Palisade on 'TQ x Spread' perennial ryegrass
Magnusson Research Farm

Palisade product/ac.	Application date	Harvest height (in)	Lodging* at harvest	Seed yield lbs/A
no treatment		29	7.8	997
1 pt.	6/2/01	25	4.5	1386
2 pt.	6/2/01	23	2.0	1206
1 pt.	6/9/01	24	5.8	1157
2 pt.	6/9/01	23	4.0	1166
LSD @5%		2	1.3	182

*Lodging rating: 1=no lodging, 10=severe lodging
Application date growth stages: 6/2/01 - boot stage; 7/9/01 - 5% heading
Plots sprayed with a CO2 bicycle sprayer at 28 psi and 12 gpa
Harvest date - 7/25/01
Fertilizer applied 10/11/00 at 120 + 40 + 50 + 15 sulfur
Experimental design: RCB w/ 4 reps, plot size - 10' x 50'

Table 14. Effect of the growth regulator Palisade on
Winter Hardy Select' perennial ryegrass.
Byron Tveit farm - north of Roosevelt, MN - 2001 data

Palisade product/ac	Lodging* at harvest	Seed yield lbs/A
no treatment	9.0	804
1 pt.	4.7	1118
2 pt.	1.3	1122
LSD @5%	0.9	339

*Lodging rating: 1=no lodging to 9=severe lodging
Application date: 6/3/01; growth stage: mid boot stage
CO2 backpack sprayer at 12 GPA
Experimental design: RCB with 3 reps; plot size= 12' x 50'
Harvest date 7/24/01

Table 15. Effect of wild oat herbicides on underseeded grasses in '2375' spring wheat.
Magnusson Research Farm -2001 data

Variety	Seeding rate lbs/A	Wild oat herbicide treatments							
		Control	Assert	Achieve	Everest	Puma	Hoelon	Discover	Avenge
		Grass seedling visual injury rating**: 9/13/01							
Park Kentucky bluegrass	3.5	0	5	3	5	4	3	3	0
Betts x Waldron perennial ryegrass	4.5	0	0	1	9	0*	0*	1*	0***
Colt timothy	3.0	0	7	3	8	8	8	9	0
Chiefton reed canarygrass	4.5	0	3	5	9	6	7	9	0***
LSD @5%		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

*Betts x Waldron perennial ryegrass may carry partial tolerance to these herbicides
**Grass seedling visual injury rating when compared to the control: 0= no injury to 9=all dead
***Grass seedlings more vigorous than control plots due to herbicide injury to the wheat.
Injury rating of 6 or higher is likely to reduce seed yield in 2002

Seeded 6/12/01, RCB with 4 reps, plot size 9' x 10'
Application date: 7/05/01
CO2 bicycle sprayer 12 GPA@ 27PSI
General broadleaf weed control (1 pt. Buctril + 1/2 pt. Bronate) applied 1 hour after wild oat treatments
Wheat was swathed to 10"height on 8/24/01/ and the straw was removed.

Trade name	Chemical name	Application rate/A	Adjuvant
Avenge	difenzoquat	3 pt	.25% Preference
Discover	clodinafop	~~12.8 oz~~ 4 oz.	31.4ml DSV/gal
Hoelon	diclofop	2.5 pt	.25% Preference
Puma 1E	fenoxaprop	.66 pt	
Everest	flucarbazone	.61 oz	.25% Preference
Assert	Imaxamethabenz	1.2 pt	.25% Preference
Achieve	tralkoxzydim	.5#	.5%Supercharge+.5%AMS