FINAL REPORT
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Title: Support of perennial forage variety evaluation at the Elora Research Station.

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Executive Summary

Variety trials of perennial forage species, in conjunction with the Ontario Forage Crops Committee, have been conducted at the Elora Research Station since the inception of the provincial testing system. These trials have been used to provide data for support of varieties for registration, for evaluation of additional attributes (eg. forage quality and persistence), and for generation of independent variety performance information for use by individual producers. Recent budget constraints have resulted in the Guelph forage research group having to limit their activity with respect to variety testing. The funds provided in this research project enabled the Guelph group to maintain their activity for 2002-2004 in forage variety evaluation.

Replicated forage trials were seeded in 2002 and 2003 at the Elora Research Station. A total of 31 variety trials were harvested in 2002 and 25 trials in 2003 for forage yield under a three cut system. Herbage yields, adjusted for moisture content, were analyzed and test summaries were included in the Ontario Forage Crops Committee variety test database for computation of provincial forage variety performance. Each year's performance summaries were distributed to Ontario producers via a brochure (summary over all tests and years) and to companies (individual tests each harvest year). The alfalfa data was also combined with the US data base to allow producers to conduct pairwise comparisons of alfalfa varieties using test data from Ontario and all relevant US states; access to this database is available through the University of Wisconsin web site: www1.uwex.edu/ces/ag/alfalfa/ . These trials were also used as part of the merit evaluation of experimental forage varieties for support of registration for sale by the Canadian Food Inspection Agency.

Studies conducted at the University of Wisconsin have indicated that alfalfa yield is depressed due to traffic injury caused by a mechanical harvesting system. A comparison of a silage system (traffic one day after cutting) and a hay system (traffic five days after cutting) revealed that the hay traffic resulted in significant reductions in forage yield and that there were differences among alfalfa varieties to this stress. At the Elora site in 2003, a comparison of varieties and forage species was conducted to determine if there were species and variety differences in tolerance of traffic injury five days following cutting. This "hay traffic" stress was imposed on a series of OFCC trials following first harvest in 2003. For each test, five days after cutting, two replicates were driven on with a John Deere 6420, two replicates were not. This stress was applied to alfalfa (6 tests involving 95 varieties), orchardgrass (7 varieties), timothy (10 varieties), reedcanary (4 varieties), tall fescue (7 varieties), and red clover (8 varieties). On average, the reduction in yield in alfalfa and red clover was 11 and 13%, respectively. Surprisingly, the reduction in second cut yields were significantly greater for the grasses, the yield reduction for tall fescue, orchardgrass, reed canary, and timothy averaged 15%, 16%, 27% and 32%, respectively. Variety differences were also detected in their tolerance to the stress, the range in reduction for alfalfa was 0 to 25%. It was predicted that varieties with more rapid regrowth, higher yield potential would be most susceptible to this traffic injury. However, there was no relationship between yield performance and the susceptibility to traffic injury. This study has revealed that there is a significant loss in yield in areas that

are driven upon during hay harvest, grasses were more susceptible to the stress, and that there are varieties that have greater tolerance, and varieties that have lower tolerance to this stress.

In 2004, an evaluation of manure effects on alfalfa is planned. This evaluation will be in conjunction with Husky Farm Equipment Ltd. and AerWay who are providing technical support and equipment modifications for the research studies. The objectives of the study are to evaluate the effect of the AerWay injector system and rate and timing of liquid manure on alfalfa. The complete experimental design is not finalized but we anticipate testing application times spanning the period of 1 to 7 days after harvest, and application rates of 3000 to 6000 gallons/acre. A smaller study will use a specific day and specific rate to assess if there are differential variety reponses to the AerWay and AerWay+manure treatments. This study will be part of a proposed producer field day in summer 2004 highlighting animal and forage research.

Project Results and Milestones

1. Report of 2002 varietal performance	Dec 2002	Met
2. Inspection tours, field trials	May 2003	Met
3. Report of 2003 varietal performance	Dec 2003	Met

Replicated forage variety trials were seeded in 2002 and 2003 at the Elora Research station. In 2003 this included a total of alfalfa (23 varieties), tall fescue (6 varieties), timothy late harvest management (5 varieties), timothy early harvest management (4 varieties). An additional alfalfa test was also planted in 2003 in order to evaluate the effect of manure applications in 2004.

Forage variety trials at the Elora Research Station were harvested in seasons 2002 and 2003 for determination of relative forage yield performance. In 2002 there was a total of 31 trials, and in 2004 a total of 25 trials, harvested for forage yield. These involved tests planted through the years 1997 to 2002. Species included alfalfa, red clover, trefoil, white clover, orchardgrass, bromegrass, timothy, tall fescue, and reed canarygrass. Most trials were harvested using a three cut management system; four cuts were taken in the case of white clover and two harvests taken for timothy and red clover. Herbage yields, adjusted for moisture content, were analyzed and test summaries were included in the Ontario Forage Crops Committee variety test database for computation of provincial forage variety performance. Each year's performance summaries were distributed to Ontario producers via a brochure (summary over all tests and years) and to companies (individual tests each harvest year). The alfalfa data was also combined with the US data base to allow producers to conduct pairwise comparisons of alfalfa varieties using test data from Ontario and all relevant US states; access to this database is available through the University of Wisconsin web site: www1.uwex.edu/ces/ag/alfalfa/ . These trials were also used as part of the merit evaluation of experimental forage varieties for support of registration for sale by the Canadian Food Inspection Agency.

Studies previously conducted at the University of Wisconsin have indicated that alfalfa yield is depressed due to traffic injury caused by a mechanical harvesting system. A comparison of a silage system (traffic one day after cutting) and a hay system (traffic five days after cutting) revealed that the hay traffic resulted in significant reductions in forage yield and that there were differences among varieties to this stress. At the Elora site in 2003, a comparison of varieties and forage species was conducted to determine if there were species and variety differences in tolerance of traffic injury five days following cutting. This “hay traffic” stress was imposed on a series of OFCC trials following first harvest in 2003. For each test, five days after cutting, two replicates were driven on with a tractor (John Deere 6420) , two replicates were not. This stress was applied to alfalfa (6 tests involving 95 varieties), orchardgrass (7 varieties), timothy (10 varieties), reedcanary (4 varieties), tall fescue (7 varieties), and red clover (8 varieties). On average, the reduction in yield in alfalfa and red clover was 11 and 13%, respectively (Table 1).

Surprisingly, the reduction in yields were significantly greater for the grasses, the yield reduction for tall fescue, orchardgrass, reed canary, and timothy averaged 15%, 16%, 27% and 32%, respectively.

Table 1: Effect of traffic injury, applied five days after first cutting, on second harvest yield on forage species at Elora in 2003. Trial design was a split-block with two replicates, traffic was a John Deer 6420 driven to give one wheel pass completely over the treated area.

Species	Second harvest yield (kg/ha)				Percent difference		Number			Stand age (years)
	Control	Traffic	Difference	sed	mean	variety range	Tests	Varieties	Observations	
Alfalfa	3555	3164	-391	70.3	-11.0	7.3 to -25.3	6	95	524	2,3,4
Orchardgrass	1368	1146	-222	44.1	-16.2	0.7 to -30.7	1	7	28	3
Timothy, early harvest	2499	1709	-790	119.6	-31.6	-20.7 to -44.6	1	10	40	3
Reed canary	2918	2138	-780	126.5	-26.7	-27.1 to -31.2	1	4	16	3
Tall fescue	3397	2881	-516	72.8	-15.2	-7.3 to -20.2	1	7	28	3
Red clover	3704	3233	-471	164.5	-12.7	-4.4 to -22.6	1	8	32	2

Variety differences were also detected in their tolerance to the stress, the range in reduction for alfalfa was 0 to 25%. Table 2 summarizes the relative reduction for the 95 alfalfa varieties evaluated in 2003.

Table 2. Effect of traffic injury, applied five days after first cutting, on second harvest yield on 95 varieties of alfalfa in 6 randomized-complete block tests at Elora in 2003. Each test was a split-block with two replicates, two with and two without traffic injury. Traffic was a John Deer 6420 driven to give one wheel pass completely over the treated area. Data were analyzed using SAS Proc Mixed using a split-block model combined over tests, tests and blocks within tests set as random effects. First harvest yield was used as a covariate to remove any previous effects that were present on individual plots. * Treated and control means were significantly different at P=0.05; ns= difference not significant.

	Second cut yield (kg/ha)		Yield Difference			No. tests		Second cut yield (kg/ha)		Yield Difference			No. tests
	Treated	Control	kg/ha	% of control				Treated	Control	kg/ha	% of control		
DEEPKROWN	2912	3125	213	7.3	ns	1	PROOF	3584	3221	-364	-10.1	ns	1
GOLD_PLUS_MF	2973	3131	158	5.3	ns	1	POWER_PLANT	3849	3454	-394	-10.2	ns	2
X787	3490	3572	82	2.3	ns	2	NK711MF	3537	3166	-371	-10.5	ns	2
GH750	3465	3539	74	2.1	ns	2	ABI_9142	2921	2604	-317	-10.9	ns	1
CIMARRON3I	2952	2999	46	1.6	ns	1	AMERISTAND40	3263	2904	-359	-11.0	ns	1
M777	2956	2960	4	0.1	ns	1	PERFECT	3988	3528	-459	-11.5	ns	1
53Q60	3209	3181	-28	-0.9	ns	1	SARANAC	3220	2843	-377	-11.7	*	6
TRAILBLAZER3	3279	3238	-40	-1.2	ns	1	ABUNDANCE	3416	3016	-400	-11.7	ns	1
MAGNUM_IV	3440	3381	-59	-1.7	ns	2	CW63002	4052	3577	-475	-11.7	*	2
AC_BRADOR	2821	2769	-52	-1.8	ns	1	WL232HQ	3088	2726	-362	-11.7	ns	1
54V54	3382	3317	-65	-1.9	ns	1	FORECAST_1000	3988	3520	-468	-11.7	ns	3
HORNET	3319	3240	-78	-2.4	ns	1	INTRIGUE	4018	3543	-475	-11.8	*	2
PAR_4338	3952	3851	-101	-2.5	ns	1	SURPASS	3179	2799	-379	-11.9	ns	1
DS026	3766	3666	-99	-2.6	ns	1	ONEIDA_ULTRA	3589	3150	-439	-12.2	ns	1
FQ315	2976	2890	-86	-2.9	ns	1	ARROW	3316	2908	-408	-12.3	*	5
PLATINUM	3369	3248	-121	-3.6	ns	2	SL9903	3338	2919	-419	-12.5	ns	2
ZC9544	3714	3580	-135	-3.6	ns	1	DK121HG	2644	2309	-334	-12.7	ns	1
A9421	2618	2522	-96	-3.7	ns	1	DS9412	4247	3707	-540	-12.7	ns	1
TRAILBLAZER	2473	2382	-91	-3.7	ns	1	ROCKET	4187	3640	-547	-13.1	*	2
A9501	3638	3498	-139	-3.8	ns	1	A9624	4698	4065	-633	-13.5	*	1
SX1005A	3314	3176	-138	-4.2	ns	1	ZG9639	3781	3269	-511	-13.5	ns	1
CW5440	2971	2843	-128	-4.3	ns	1	3R58	4180	3598	-582	-13.9	ns	1
MAGNUM_V-WET	3695	3528	-166	-4.5	ns	2	NSCL_27	3760	3231	-529	-14.1	*	2
DS025	3278	3128	-150	-4.6	ns	1	CW6304	3075	2628	-446	-14.5	ns	1
CW5435	3084	2936	-149	-4.8	ns	1	QS-75	2402	2033	-369	-15.4	ns	1
DS9705	4159	3954	-204	-4.9	ns	1	VALUEPLUS1	4266	3604	-662	-15.5	*	1
STARBUCK	3695	3509	-186	-5.0	ns	1	OAC_MINTO	2958	2495	-463	-15.7	ns	1
FORERUNNER	3790	3577	-213	-5.6	ns	1	SX1002A	3133	2634	-500	-15.9	ns	1
TMF_MULT_III	4344	4097	-247	-5.7	ns	1	CW73038	3944	3315	-630	-16.0	ns	1
SX1003A	3230	3044	-187	-5.8	ns	1	ABT_227LH	2484	2080	-405	-16.3	ns	1
SX1001A	3111	2929	-182	-5.9	ns	1	A9401	3490	2902	-589	-16.9	*	2
A9423	2669	2509	-160	-6.0	ns	1	PICKSD8920MF	3426	2817	-609	-17.8	*	2
FQ314	2779	2600	-179	-6.4	ns	1	A9503	2694	2208	-486	-18.0	ns	1
DS9810	3922	3638	-284	-7.2	ns	1	CENTURION	3317	2713	-604	-18.2	*	5
RELIANCE	4133	3833	-300	-7.3	ns	1	QS-3	4347	3522	-825	-19.0	*	1
5312	3152	2923	-229	-7.3	ns	2	DS101	4186	3373	-813	-19.4	*	1
ZC9854A	3472	3208	-263	-7.6	ns	1	DK124	4421	3557	-864	-19.6	*	1
SX1004A	3160	2920	-240	-7.6	ns	1	5301ML	3525	2790	-735	-20.8	*	1
DK134	4094	3779	-315	-7.7	ns	2	BARALFA	3114	2464	-650	-20.9	*	1
MACON	3913	3587	-326	-8.3	ns	2	TMF_421	2725	2143	-582	-21.4	ns	1
C227	3589	3280	-309	-8.6	ns	2	PICKSD2065MF	4526	3516	-1010	-22.3	*	1
GENEVA	3581	3264	-317	-8.9	ns	2	DS9833	4168	3206	-963	-23.1	*	1
A9502	3809	3469	-339	-8.9	ns	1	A9513	3881	2962	-919	-23.7	*	1
NS0_M5	3185	2896	-289	-9.1	ns	1	C304	4218	3217	-1001	-23.7	*	1
ONEIDA_VR	3238	2942	-296	-9.2	ns	1	C232	3703	2803	-901	-24.3	*	1
ACCEL	3331	3018	-313	-9.4	ns	1	WL_282	3387	2534	-853	-25.2	*	1
DS9920	3793	3425	-367	-9.7	ns	2	X688	4524	3379	-1145	-25.3	*	1
FORECAST_3000	3902	3517	-385	-9.9	ns	2							
			6 tests	5 tests	2 tests	1 test							
lsd 0.05: treated vs control			258.5	283.1	447.2	632.9							

It was hypothesized that varieties with more rapid regrowth, higher yield potential might be those that are most susceptible to this traffic injury. However, there was no relationship between yield performance and the susceptibility to traffic injury. Figure 1 illustrates that the reduction in yield for varieties was not related to their yield performance in untreated plots.

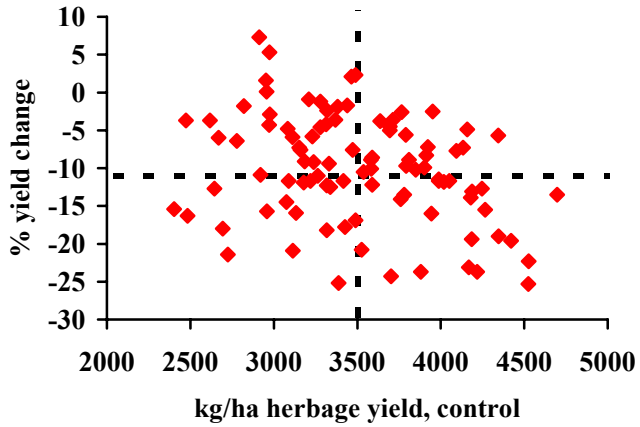

Figure 1 Percent reduction of yield relative to the control of traffic injury, applied five days after first cutting, on second harvest yield on 95 alfalfa varieties at Elora in 2003. Trial design was a split-block with two replicates, traffic was a John Deere 6420 driven to give one wheel pass completely over the treated area.

This study showed that there is a significant loss in yield in areas that are driven upon five days following cutting, that grasses were more susceptible to the stress compared to alfalfa, and that there are varieties that have greater tolerance, and varieties that have lower tolerance to this stress.

In 2004, an evaluation of manure effects on alfalfa is planned. This evaluation will be in conjunction with Husky Farm Equipment Ltd. and AerWay who are providing technical support and equipment modifications for the research studies. The objectives of the study are to evaluate the effect of the AerWay injector system and rate and timing of liquid manure on alfalfa. The complete experimental design is not finalized but we anticipate testing application times spanning the period of 1 to 7 days after harvest, and application rates of 3000 to 6000 gallons/acre. A smaller study will use a specific day and specific rate to assess if there are differential variety reponses to the AerWay and AerWay+manure treatments. This study will be part of a proposed producer field day in summer 2004 highlighting animal and forage research.

Promotional Activities

Bowley, S.R. 2002. Variety testing, Forage Crops. Field Crops Research Coalition Fact-finding Day, South-West Ontario.
Bowley, S.R. 2003 Forage research update. Ontario Forage Council, Elora, ON.
Bowley, S.R. 2004 Summary of OFC sponsored research. Annual Meeting, Ontario Forage Council, Guelph, ON.
Hancock, D. and Bowley, S.R. 2002. Summary of forage varieties under test. OFCC. 136 pp.
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Hancock, D. and Bowley, S.R. 2003. Forage crop investigations 2003 Report on forage crop variety trials. OFCC. 49 pp.
Johnston, J, Hancock, D. and Bowley, S.R. (Eds) 2002 Ontario Forage Crop Variety Performance. OFCC brochure.
Johnston, J, and Hancock, D. (Eds) 2003 Ontario Forage Crop Variety Performance. OFCC brochure.
Alfalfa Variety Field Trial Database: www1.uwex.edu/ces/ag/alfalfa/