

Support of Perennial Forage Variety Evaluation and Wheel Traffic Injury at the Elora Research Station

24 January 2004

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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 responses 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

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, brome grass, 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.

Species	Second harvest yield (kg/ha)				Percent difference		Number			Stand age (years)
	Control	Traffic	Difference	sd	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.

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.

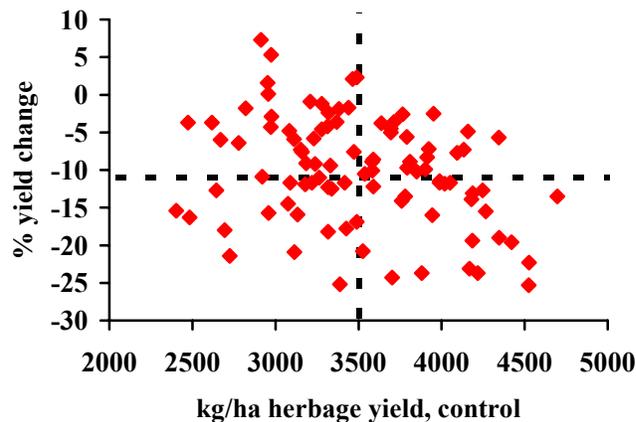


Figure 1 Percent reduction of yield relative to the control of traffic injury, applied five days after first cutting, on second harvest yield on 95 alfalfa varieties at Elora in 2003. Trial design was a split-block with two replicates, traffic was a John Deere 6420 driven to give one wheel pass completely 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 responses 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.
- Hancock, D. and Bowley, S.R. 2003. Summary of forage varieties under test. OFCC. 90 pp.
- Hancock, D. and Bowley, S.R. 2002. Forage crop investigations 2002 Report on forage crop variety trials. OFCC. 79 pp.
- 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/