Evaluation of Two Agricultural By-products for Control of Dandelion in Turf

J.B. Ross and M.A. Anderson

Summary

This trial was initiated in four cities throughout western Canada in order to test corn gluten and soybean meal for the control of dandelion in turf. Application rates were lower in this study than in a previous study which showed high levels of control. In addition, turfgrass quality was measured in order to measure the growth effects of the products on the turf.

Both rates of corn gluten showed a dandelion reduction for the spring and summer rating period, when compared to the untreated control. However, control was not considered to be acceptable (80% or better). There was no significant weed control with the application of soybean meal when compared to the untreated control. For the herbicide treatment, the spring and summer ratings were also considered unacceptable with the highest level of control only being 50%.

Turf quality was only statistically different on one of the four rating periods. At that time, the high rate of corn gluten and soybean meal applied in the fall only, or in spring and fall, had significantly better quality than the untreated control or the herbicide treatment.

It was thought that the herbicide application prior to the initiation of the trial was not sufficiently high to be effective in controlling the dandelion root stock, and only the dandelion leaves may have been 'burned off'. As a result, dandelions recovered which would explain the ineffective control of the pre-emergent bio-herbicides, corn gluten and soybean meal.

Introduction

Recent studies were completed in western Canada that tested various agricultural by-products for their effect on weeds in turf (Anderson and Ross, 2005). Corn gluten meal, soybean meal, mustard meal and sugar beet extract were tested in four western Canadian cities. The three year study examined the effects of the products for their ability to control weeds in turf, particularly dandelion.

Results of the recent tests showed that high rates of both corn gluten and soybean meal were effective in controlling dandelion populations. Mustard meal was generally less effective, due in part to turf damage which left large voids in the turf that were then colonized by weeds. Sugar beet extract did not effectively control dandelions. However, these high rates of application would make the product cost prohibitive to use and it would not receive wide acceptance at these high rates.

Dandelion is the most common turfgrass weed in western Canada and is well adapted to the climatic conditions. Although considerable research has been conducted on control of this weed, the biology of the plant is not well understood. In order for pre-emergent controls to be effective the timing of germination of this plant must be known.

Watson et al (2001) noted that germination could occur between 4-30^{o}C and that the optimum temperature for germination was 23^{o}C, and this was under conditions of adequate moisture. In a recent study conducted in Manitoba, Van Acker and Hacault (2006) found that 96% of plants that germinated in late spring, early summer were from spring seed dispersal. Only 4% of new plants were attributed to the seed bank.

Seed dispersal of dandelion is greatest in spring in western Canada, although it has been observed throughout the growing season. Observations of seed dispersal show that it occurs in early April in White Rock, British Columbia, around the end of April in Kelowna and Penticton, and around the middle of May in Olds, Alberta (Clark et al, 2006).

It was also noted in the previous studies that complete eradication of the weeds prior to the initiation of applications of the products was critical in pre-emergent weed control. Products did not show effective control if all dandelions were not removed with an initial herbicide application.

The objective of this study was to examine corn gluten and soybean meal at rates of application that would more closely approximate normal fertility rates. In addition, the timing of application was examined in this study.

Methodology

Four sites were chosen across Western Canada within the various city parks system. Plots were established at City Park (Kelowna), Kings Park (Penticton), Dover Park (Regina) and at Shouldice Park (Calgary). Sites were chosen that had high infestations of weeds, particularly dandelion. This was done to ensure that there was sufficient seed from dispersal in order for dandelions to germinate.

In 2005, trials located at Kelowna and Penticton were initiated May 10th and 12th respectively. Two weeks later the Regina trial was initiated on May 24th. The start date at the Calgary site was delayed until August 11th due to weather factors that did not allow for the initial spraying of the test area. All of the sites received a single application of a selective herbicide, Killex 500 at the rate of 32ml/100m^2, prior to the application of the treatments in order to eliminate existing dandelion.

From the previous study two agricultural by-products, corn gluten meal and dehulled soybean meal, were selected for further testing on the control of dandelion in turf. Both products were compared with a single fall herbicide application and an untreated control. The test plots were 1x 2 metres in size and were replicated four times within a randomized complete block design. Product information, and rates and timing of application are listed in the table below (Table 1).

During the visits to the various sites, the number of dandelions present within each plot as well as the overall quality of the turf was recorded. In 2005 the sites in British Columbia and Saskatchewan were rated once during the summer and again in the fall. Due to the late start, the Calgary site was rated only once in the fall. In 2006, all sites were rated three times: spring, summer and fall.

Three turf quality factors: colour, density and area coverage was assessed using protocols established by the National Turfgrass Evaluation Program (NTEP). This assessment system uses a visual rating scale where 1 equals a poor rating, 6 equals an acceptable rating and 9 equals a superior rating.

Table 1- Treatment schedule and application rates for dandelion control study.

Treatments	Product		Applied	Rate(s)
Corn gluten meal	Turf Maize Pro	Low rate	Spring	125g/m^2
			Fall	125g/m^2
			Spring & Fall	125g/m^2
		High rate	Spring	250g/m^2
			Fall	250g/m^2
			Spring & Fall	250g/m^2
Dehulled soybean meal	Unifeed Soybean meal	Low rate	Spring	133g/m^2
			Fall	133g/m^2
			Spring & Fall	133g/m^2
		High rate	Spring	266g/m^2
			Fall	266g/m^2
			Spring & Fall	266g/m^2
Control Treatments:				
Selective herbicide	Killex 500	Single rate	Fall	32.5mls/100m^2
Untreated control				

The colour factor is a visual rating of the individual plots where a uniform dark green colour receives the highest rating. Density, the second quality factor, is a visual rating of the turf to determine the number of shoots and tillers. Plots with a tight knit, dense surface receive the highest rating. Treatments associated with a weak or thin turf stand were rated lower.

The final quality factor, area cover, was a visual evaluation of the area covered by turf. Treatments which stimulated a thick competitive turf cover with no bare patches received an area cover rating of 9. Treatments producing a weak turf, affected by weed encroachment and/or the presence of bare patches, were scored lower. To compare the effect of the treatments on the overall turf quality, the average of the combined colour, density and area cover scores for each plot was calculated and statistically analyzed.

Results and Discussion

During the fall of 2005, no treatments were significantly better for dandelion counts than the untreated control (Table 2). For the spring and summer ratings, dandelion reduction was only 50% for the herbicide treatment, which is considered unacceptable. Acceptable control is considered to be 80% or better.

Both rates of corn gluten showed a dandelion reduction for the spring and summer rating period, when compared to the untreated control. However, control was not considered to be acceptable. There was no significant weed control with the application of soybean meal when compared to the untreated control. Both corn gluten and soybean meal are considered to be pre-emergent bio-herbicides that are only effective if they are applied prior to weed seed germination.

Herbicide control prior to the initiation of the study was thought be effective as dandelion counts were between 2-5 weeds/m^2 at all sites at the first rating date. As an example at the Kelowna site, dandelion counts during the summer rating were essentially zero in two of the four replications. However, by the fall, dandelion counts had increased to 30 dandelions per m^2. This was an indication that the population increase was as a result of recovery of the dandelions from root stock (the fleshy tap root that exists on dandelions) rather than from seed germination. From observations in Olds, dandelions germinate soon after spring seed dispersal when moisture and temperature is sufficient. Similar observations were noted at the other sites.

This would indicate that the initial herbicide applications were not effective in controlling dandelion root stock, and may only have 'burned off' the plant leaves. This would explain the ineffective control of the corn gluten and soybean meal.

Table 2- Dandelion counts on three sites throughout Western Canada, 2005-06.

Product & Rate		Applied	Fall 2005	Spring 2006	Summer 2006	Fall 2006
			plants /m^2			
Untreated control			13ab	17bcd	18def	13a
Killex 500	0.3mls/m^2	fall	12ab	10a	9a	9a
Corn gluten	125g/m^2	spring	14abc	20d	20f	13a
Corn gluten	125g/m^2	fall	12ab	15abcd	14abcde	12a
Corn gluten	125g/m^2	spring & fall	10a	13ab	11ab	12a
Corn gluten	250g/m^2	spring	10a	16bcd	17cdef	14a
Corn gluten	250g/m^2	fall	18c	17bcd	16bcdef	13a
Corn gluten	250g/m^2	spring & fall	11ab	13ab	12abc	10a
Soybean meal	133g/m^2	spring	14abc	17bc	16bcdef	13a
Soybean meal	133g/m^2	fall	15bc	14abc	13abcd	10a
Soybean meal	133g/m^2	spring & fall	14abc	18bcd	19ef	14a
Soybean meal	266g/m^2	spring	14abc	19cd	16bcdef	12a
Soybean meal	266g/m^2	fall	14abc	16bcd	15bcdef	9a
Soybean meal	266g/m^2	spring & fall	14abc	16bcd	13acd	11a
		$LSD_{0.05}$ =	4	5	5	n/s

* Values that have the same letter as a suffix are not significant from each other.

Turf quality was only statistically different on one of the four rating periods. At that time, the high rate of corn gluten and soybean meal applied in the fall only or in spring and fall had significantly better quality than the untreated control or the herbicide treatment. Interestingly, there was very little difference on the other rating dates even between and the untreated plots, even though the corn gluten and soybean have a nitrogen component.

Results of the recent tests showed that high rates of both corn gluten and soybean meal were effective in controlling dandelion populations. Mustard meal was generally less effective, due in part to turf damage which left large voids in the turf that were then colonized by weeds. Sugar

beet extract did not effectively control dandelions. However, these high rates of application would make the product cost prohibitive it would not receive wide acceptance at these high rates.

Table 3- Turf quality ratings at four sites in Western Canada, 2005-06.

Product & Rate		Applied	Fall 2005	Spring 2006	Summer 2006	Fall 2006
			1-9 scale			
Untreated control			5.7a	6.0bc	5.5a	5.8a
Killex 500	0.3mls/m^2	fall	5.5a	5.8c	5.6a	5.9a
Corn gluten	125g/m^2	spring	5.8a	5.9c	5.8a	5.9a
Corn gluten	125g/m^2	fall	5.4a	6.1abc	5.6a	5.8a
Corn gluten	125g/m^2	spring & fall	6.0a	6.3ab	5.9a	6.0a
Corn gluten	250g/m^2	spring	5.9a	6.0bc	5.8a	5.9a
Corn gluten	250g/m^2	fall	5.9a	6.4a	5.6a	5.8a
Corn gluten	250g/m^2	spring & fall	5.7a	6.4a	5.6a	5.8a
Soybean meal	133g/m^2	spring	5.6a	6.0bc	5.6a	5.9a
Soybean meal	133g/m^2	fall	5.7a	6.3ab	5.6a	6.1a
Soybean meal	133g/m^2	spring & fall	5.8a	6.3ab	5.7a	5.8a
Soybean meal	266g/m^2	spring	5.8a	5.9c	5.8a	5.9a
Soybean meal	266g/m^2	fall	5.7a	6.4a	5.8a	5.9a
Soybean meal	266g/m^2	spring & fall	5.9a	6.4a	5.6a	5.8a
		$LSD_{0.05}$ =	n/s	0.3	n/s	n/s

References

Anderson, M.A. and J.B. Ross. 2005. The evaluation of agricultural by-products as a control of dandelion in turf. Prairie Turfgrass Research Centre Annual Report pp 60-75.

Clarke, Colin A. and J.B. Ross. 2006. Dandelion germination in turf. Prairie Turfgrass Research Centre Annual Report.

Van Acker, R.C. and Kristin M. Hacault. 2006. Emergence timing and control dandelion (*Taraxacum officinale)* in spring wheat. Weed Science, 54:172-181.

Watson, P.R., Derksen, D.A., Thomas, A.G., Turnbull, G.C., Blackshaw, R.E., Leeson, J.Y., Leger, A., VanAcker, R.C., Brandt, S.A., Johnston, A.M., Lafond, G.P. and McConkey, B.G. 2001. Weed management and ecology in conservation tillage systems: determination of weed community changes in conservation-tillage systems. Weed Community Analysis Series Publication Dow- 2001-01 Agriculture and Agri-Food Canada, Brandon, Manitoba.

Support for this trial was received from the Cities of Regina, Calgary, Kelowna and Penticton, as well as the Western Canada Turfgrass Association. In addition, we would like to acknowledge the facilitators of the project in each of the four cities, Dave Ellis in Regina, Dave Greene in Calgary, Ian Wilson in Kelown, John Penrice in Penticton and Bob Wick and the Research Committee of the Western Canada Turfgrass Association.