Use of Mustard By-Products for the Control of Weeds in Turf

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Summary

This trial was initiated in the summer and fall of 2007. The objective of this study was to test mustard by-products for their pre and post-emergent herbicide effects on dandelion in turf. Data collection will commence in the spring of 2008.

Introduction

Dandelions (*Taraxacum officinale*) are an important problem weed in turfgrass. Historically, they have been controlled largely by herbicide application. Currently, however, some municipal governments in Canada and other countries have proposed a ban on pesticide use in residential and other public areas. In some areas, these bans have already been implemented. Therefore, the development of alternative tools for weed control in home lawns and gardens, school grounds, and municipal parks is needed.

Biologically based weed control methods using agricultural by-products provide a possible alternative solution to chemical herbicides. There are many plants that have allelopathic properties, including: corn gluten, soybean meal, and mustard meal.

Corn gluten (*Zea mays* L.) can, inhibit weed seed germination but has no effect on established root systems (Liu and Christians, 1994). Control of seed germination has been reported with a number of other agricultural by-products including: mustard meal (Petersen et al., 2001). To date there haven't been any studies that have looked at the effect of mustard meal on dandelions.

Mustard meal and other members of the Brassicaceae contain glucosinolates. Both the volatiles (Brown and Morra 1995) and the water soluble products of glucosinolate hydrolysis can inhibit seed germination (Brown and Morra 1996; Mason-Sedun et al. 1986) and can inhibit seedling growth of some species (Brown and Morra 1997). In addition, they can kill a number of fungi (Sarwar et al. 1998) and insect species (Borek et al. 1998). However, mammalian systems metabolize and eliminate these products rapidly so they do not pose a problem to either humans or other mammals (Brown and Morra 1997). Consequently, mustard meal can be used as a feed supplement.

There are many different types of glucosinolates. However, two broad classes of glucosinolates are the aromatic glucosinolates which contain a benzene ring in their chemical structure (referred to as benzyl) and the aliphatic glucosinolates which do not contain a benzene ring (referred to as allyl) (Norsworthy and Meeham 2005).

Different species may contain different types of glucosinolates. For example, yellow mustard (*Sinapis alba*) contains hydroxybenzyl glucosinolate which is one of the benzyl glucosinolates (Borek and Morra 2005). In contrast, oriental mustard (*Brassica juncea*) contains sinigrin which belongs to the allyl class of glucosinolates (Vaughn et al. 2006). Horseradish (*Armoracia rusticana*) also belongs to the allyl class of glucosinolates.

While glucosinolates have been identified as having the potential of controlling seed germination of many different species (Oleszek 1987), they have not been tested on dandelion seeds or

seedlings. If the glucosinolates could control dandelion seed germination and inhibit seedling growth, without causing phytotoxic side effects on the turfgrass, there is potential for using a product with a wider window of application than products that merely inhibit seed germination.

Different sources of glucosinolates were utilized to determine if there were differences in efficacy on dandelions between the allyl and benzyl glucosinolates including:

- yellow mustard (benzyl)
- oriental mustard (allyl)

The objectives of this study were:

- Test mustard by-products for their pre and post-emergent bioherbicide effects
- Test rate and timing of application for mustard by-products
- Test all mustard materials to determine glucosinilate levels
- Test corn gluten for comparison to the mustards as a pre-emergent herbicide

Materials and Methods

This three year field trial was established in parks areas that had a high natural infestation of dandelion in Edmonton, Red Deer, Calgary, Lethbridge and Regina. In Lethbridge, two applications of the herbicide Par 3 were applied at the rate of 55 ml/100m^2 prior to the initiation of the study. In Calgary a single application of Killex 500 at the rate of 32 ml/100m^2 was applied. In Edmonton, Red Deer and Regina plots were not sprayed in order to test the post-emergent effects of the products applied. Plots that were 1.0 by 2.0 meters were established in a randomized complete block design with four replications. Individual weed counts were conducted prior to the first application of treatments within the trials.

The plots were evaluated a single time in the fall and, in future, will be evaluated three times per year for three quality factors, colour density and area cover. These ratings are based on the National Turfgrass Evaluation Program (NTEP) protocols where numeric values are assigned to individual plots where 9 is best and 1 is poorest, and 6 is considered acceptable. Colour was evaluated by 1 is a brown dormant turf and 9 is a very uniform dark green colour. Turf density, a measure of the number of shoots per unit area, was rated based on 1 is a thin, weak turf stand and 9 is a very dense tight-knit stand. The third factor rated was area cover and values ranged from a 1 for a complete absence of turf to a 9 for complete cover with the desired turf. The presence of weeds or voids in the turf reduced this rating.

The treatments for the post-emergent study where no prior herbicide was applied were:

1. Untreated control
2. Herbicide only spring application – Killex 500 32 ml/100m^2
3. Herbicide only fall application – Killex 500 32 ml/100m^2
4. Oriental mustard foots 120 g/m^2 spring application
5. Oriental mustard foots 240 g/m^2 spring application
6. Oriental mustard cake 120 g/m^2 spring application
7. Oriental mustard cake 240 g/m^2 spring application
8. Yellow mustard foots 120 g/m^2 spring application
9. Yellow mustard foots 240 g/m^2 spring application
10. Yellow mustard cake 120 g/m^2 spring application

11. Yellow mustard cake 240 g/m^2 spring application
12. Oriental mustard foots 120 g/m^2 fall application
13. Oriental mustard foots 240 g/m^2 fall application
14. Oriental mustard cake 120 g/m^2 fall application
15. Oriental mustard cake 240 g/m^2 fall application
16. Yellow mustard foots 120 g/m^2 fall application
17. Yellow mustard foots 240 g/m^2 fall application
18. Yellow mustard cake 120 g/m^2 fall application
19. Yellow mustard cake 240 g/m^2 fall application
20. Fertilizer Sustane 5-2-4 200 g/m^2 spring and fall applications

The treatments for the pre-emergent study where herbicide was applied prior to the initiation of the study were as follows:

1. Untreated control
2. Herbicide only spring application – Killex 500 32 ml/100m^2
3. Herbicide only fall application – Killex 500 32 ml/100m^2
4. Oriental mustard foots 120 g/m^2 spring application
5. Oriental mustard foots 240 g/m^2 spring application
6. Oriental mustard cake 120 g/m^2 spring application
7. Oriental mustard cake 240 g/m^2 spring application
8. Yellow mustard foots 120 g/m^2 spring application
9. Yellow mustard foots 240 g/m^2 spring application
10. Yellow mustard cake 120 g/m^2 spring application
11. Yellow mustard cake 240 g/m^2 spring application
12. Oriental mustard foots 120 g/m^2 fall application
13. Oriental mustard foots 240 g/m^2 fall application
14. Oriental mustard cake 120 g/m^2 fall application
15. Oriental mustard cake 240 g/m^2 fall application
16. Yellow mustard foots 120 g/m^2 fall application
17. Yellow mustard foots 240 g/m^2 fall application
18. Yellow mustard cake 120 g/m^2 fall application
19. Yellow mustard cake 240 g/m^2 fall application
20. Corn gluten 240 g/m^2 spring application
21. Corn gluten 240 g/m^2 fall application
22. Fertilizer Sustane 5-2-4 200 g/m^2 spring and fall applications

Results

As this trial was initiated over the summer and fall of 2007, there are no results. Data collection will commence in the spring of 2008 and continue for a full two years.