EFFECT OF MOWING HEIGHT AND FERTILITY ON WEED POPULATIONS IN TURF AND HERBICIDE REDUCTION WITH AN INTEGRATED WEED MANAGEMENT APPROACH, 2007.

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OBJECTIVES

This project was a continuation of part of the demonstration trial carried on in the Municipal Integrated Pest Management Lawn Demonstration Project funded by the Ontario Pesticide Advisory Committee from 2003-2005. The study examined the effect of mowing height, fertility and two natural herbicides on weed cover on turf maintained as a home lawn. It also demonstrated the effect of maintaining turf without herbicides for four years (2003-2007) and provided information on the reduction in herbicide use that can be achieved by implementing integrated pest management (IPM) with an emphasis on spot treatment.

STUDY DESCRIPTION

The study was conducted on research plots located at the Guelph Turfgrass Institute (GTI), Guelph, Ontario, Canada. The soil is a very fine sandy loam and the turf area is a 12 year old mixed stand of Kentucky bluegrass, perennial ryegrass and fine fescues. Plots were 9 x 5.5 m and each treatment was replicated twice. The main treatments are listed below in Table 2.

Table 2. Main Treatments

Treatment	Treatment Description
IPM	Weeds spot treated twice per season with Par III
Alternatives	One application of corn gluten meal (9.8kg per $100m^2$) and four applications of Juicy Lawn at (4.3L per $100m^2$)
No Pesticides	No pesticides

Treatments

The IPM plots were monitored three times a season to determine percent weed cover. Four randomized point quadrats measuring 60 cm x 60 cm with 25 points in each quadrat (points 10 cm apart) for a total of 100 points in each plot were used to record the presence or absence of a weed at each point and give an estimate of % weed cover. If % weed cover was less than 15%, the weeds were spot treated with Par III (2,4 D, mecoprop and dicamba) on July 5, 2006 and Sept. 28, 2006. In 2006, all IPM plots had fewer than 15% weed cover, so all the weeds were spot treated using a backpack sprayer. The volume of herbicide active ingredient used in each plot was recorded.

The alternatives plots received one application of corn gluten meal (8-2-4) at a rate of 9.8 kg per $100m^2$ applied on June 5, 2006 and four applications of Juicy Lawn (15-2-3) on June 20, July 5, 2006, August 8 and 22, 2006. Juicy Lawn was diluted 3 parts Juicy Lawn to 1 part water and applied at a rate of 4.3L per $100m^2$ using a backpack sprayer. The alternative plots were monitored three times per season for percent weed cover using the randomized point quadrat technique described above.

The no pesticide treatment did not receive any herbicide treatment and were monitored three times per season for percent weed cover using the randomized point quadrat technique described above.

Superimposed on these main treatments were mowing height and fertility treatments. Half of the plots were mowed weekly at a 4 cm height and half were mowed weekly at an 8 cm height. Within the two mowing heights, half the plots were fertilized with 2.0 kg of nitrogen per 100 m^2 annually, applied as four applications of 0.5 kg of nitrogen per 100 m on June 5, July 24, Aug. 30 and Nov. 10, 2006 and half did not receive any fertilizer. The exceptions were the alternative plots which did not receive any fertilizer because the two organic weed treatments both contained nitrogen. Corn gluten meal had a N-P-K ratio of 8-2-4 and the Juicy Lawn had an N-P-K ratio of 15-2-3. The plot plan in Figure 1 shows the plot layout at the GTI.

Replicate 1			
4 cm mowing height		**8 cm mowing height**	
Fertility	**No Fertility**	**Fertility**	**No Fertility**
IPM	IPM	IPM	IPM
Alternative	Alternative	Alternative	Alternative
No Pesticides	No Pesticides	No Pesticides	No Pesticides
Replicate 2			
4 cm mowing height		**8 cm mowing height**	
Fertility	**No Fertility**	**Fertility**	**No Fertility**
IPM	IPM	IPM	IPM
Alternative	Alternative	Alternative	Alternative
No Pesticides	No Pesticides	No Pesticides	No Pesticides

Figure 1. Plot Plan at GTI

RESULTS

Weed cover

To compare the effect of the main treatments on percent broadleaf weed cover, only the alternatives and the no pesticide plots were compared because the IPM plots received spot treatments of herbicide that virtually reduced the broadleaf weed cover to zero. The final broadleaf weed cover at the end of each season is seen in Table 1.

Table 1. Percent broadleaf weed cover in plots at the GTI in 2003 - 2007

Plot	Fertility	Irrigation	Mowing Height	Final % Weed Cover 2003	Final % Weed Cover 2004	Final % Weed Cover 2005	Final % Weed Cover 2006
Alternatives	Fertilized	Irrigated	4 cm	25	7.2	13.6	4
Alternatives	Fertilized	Irrigated	4 cm	40	12.8	15.2	9
Alternatives	Fertilized	Irrigated	8 cm	19	4.8	7.2	2
Alternatives	Fertilized	Irrigated	8 cm	48	19.2	5.6	2
No Pesticides	Fertilized	Irrigated	4 cm	29	24.8	11.2	4
No Pesticides	Non-Fertilized	Irrigated	4 cm	64	70.4	37.6	44
No Pesticides	Fertilized	Irrigated	8 cm	25	15.2	7.2	10
No Pesticides	Non-Fertilized	Irrigated	8 cm	72	63.2	40	49
Alternatives	Fertilized	Not irrigated	4 cm	29	24.8	15.2	11
Alternatives	Fertilized	Not irrigated	4 cm	25	24.0	2.4	9
Alternatives	Fertilized	Not irrigated	8 cm	34	32.0	4	14
Alternatives	Fertilized	Not irrigated	8 cm	42	32.0	4.8	9
No Pesticides	Fertilized	Not irrigated	4 cm	48	30.4	19.2	7
No Pesticides	Non-Fertilized	Not irrigated	4 cm	50	65.6	20	60
No Pesticides	Fertilized	Not irrigated	8 cm	50	40.0	8.8	14
No Pesticides	Non-Fertilized	Not irrigated	8 cm	51	62.4	22.4	45

The influence of mowing height on percent broadleaf weed cover was not consistent from year to year and seemed to be influenced by overall rainfall and timing of rainfall during the season (Figure 2). Some years the higher mowing height had more weeds (2003 and 2006) and in 2004 and 2005 the higher mowing heights had fewer weeds. The 2003 had timely rains and turf did not go dormant at all during the 2003 growing season. The 2005 growing season had a wet spring and dry fall and 2005 was dry, with half the plots irrigated almost weekly to deliver 2.5 cm of water per week in the absence of rain. The 2006 season had a wet July and a dry August. In general it is expected that the higher mowing height would have fewer weeds, but this was not consistently the case.

The influence of fertility on percent broadleaf weed cover was consistent of the four years of this study with the addition of fertilizer having a profound effect on weed cover. Even after one year of fertilizing the turf with 2.0 kg of actual nitrogen per $100m^2$ the weed cover was reduced by ~40 %. With each successive year of turf fertilization the turf became more competitive and the weed cover was reduced. By the end of the study, the average % weed cover for the 2006 season was 6.67 %. In the non-fertilized plots there was a downward trend in % broadleaf weed cover from 2003-2005 and an increase in weeds in 2006. There appears to be a large influence that can be attributed to the weather of each particular season. This is probably due to a combination of

rainfall and rainfall timing. Spring 2003 and 2004 were very wet. This could provide good moisture at a time when many weeds would be germinating. May and June 2005 were extremely dry and could have contributed to the fall in percent broadleaf weed cover in the non-fertilized plots in the 2005 growing season. May in 2006 had normal rainfall and this could have contributed to the increase in percent broadleaf weed cover in the non-fertilized plots for 2006.

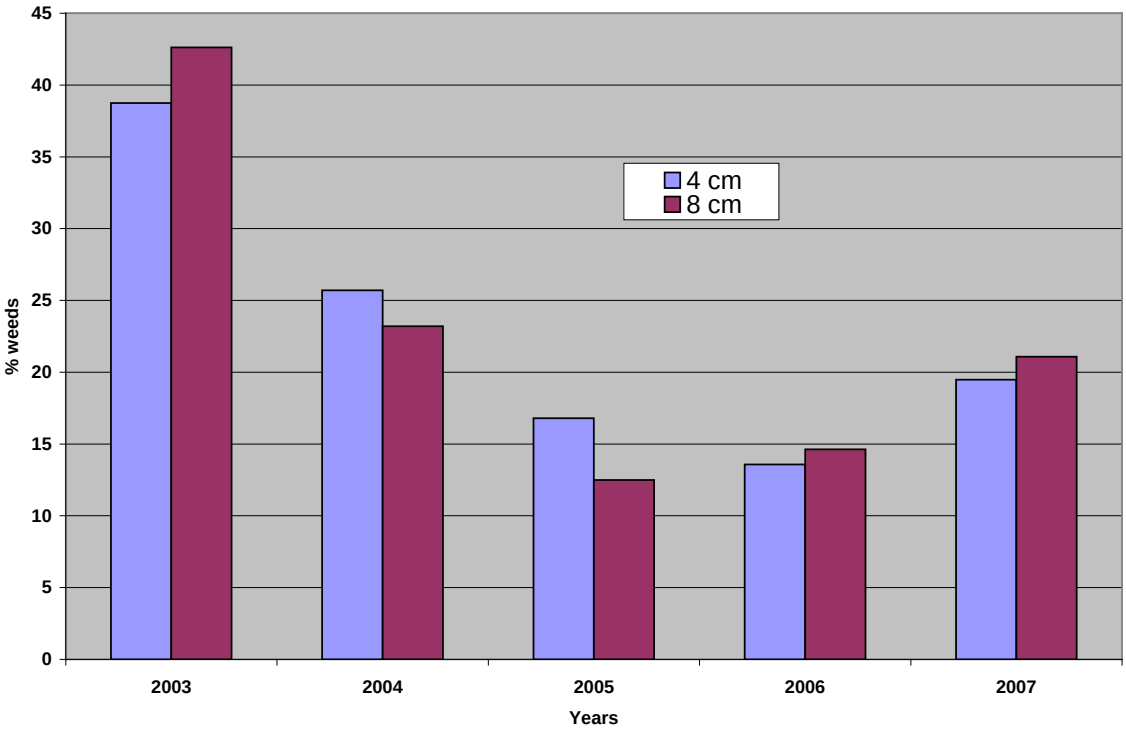

Figure 2. Influence of mowing height on average percent broadleaf weed cover at GTI in 2003 - 2007

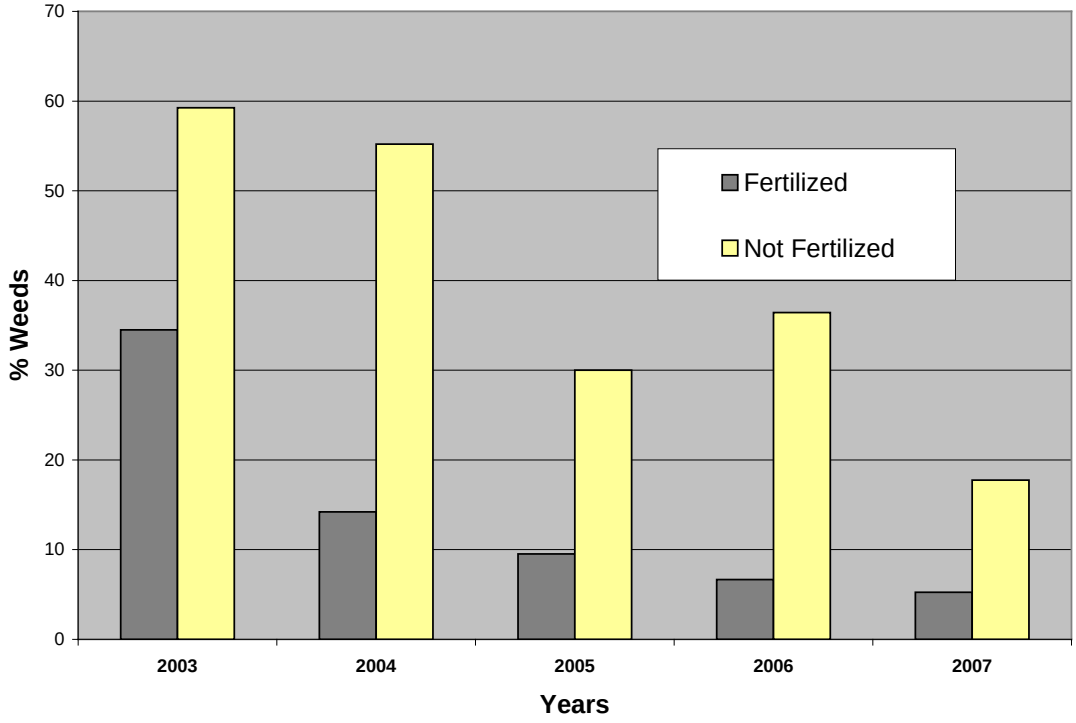

Figure 3. Influence of fertility on percent broadleaf weeds at GTI in 2003 - 2007.

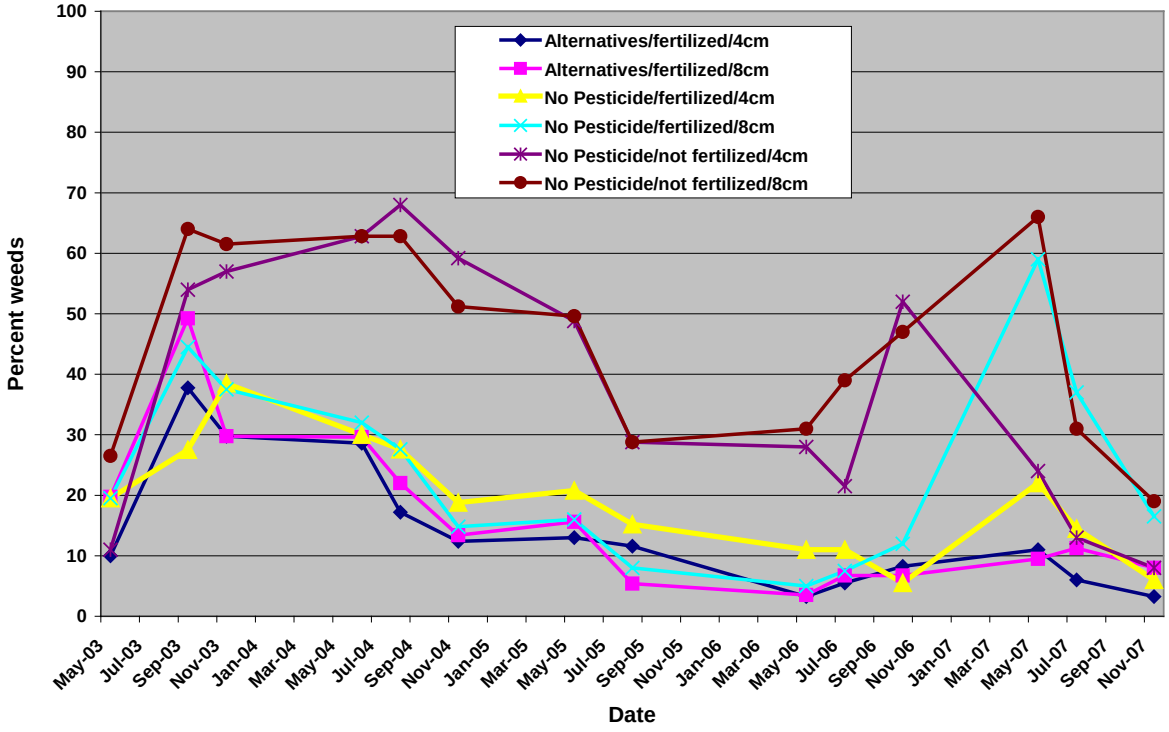

Figure 4. Seasonal weed cover of the alternatives and no pesticide plots at GTI for 2003 - 2007.

Table 4. Percent reduction in herbicide use as a result of spot treatment of weeds, 2006

	Fertility (2.0kg of N/100m^{-1})	***Mowing Height***	***Total Herbicide(mL/50m^2)***	***% Reduction in Herbicide***
IPM	Fertilized	4 cm	2.0625	96.25
IPM	Not Fertilized	4 cm	3.9375	92.8
IPM	Fertilized	8 cm	1.125	98
IPM	Not Fertilized	8 cm	7.125	87
Non IPM			55	

CONCLUSIONS

Weed populations vary from season to season in turfgrass plots that do not receive fertilizer. The variation form year to year is probably due to a combination of rainfall timing and amount. Turf

plots that were fertilized regularly have fewer weeds than plots that were not fertilized. In this study there was a steady decline in weed cover from the start of the projects until 2005. By 2007 the percent weed cover had leveled off for all of the fertilized treatments to levels below 10%. The weed cover of the alternative treatments and the fertilized plots performed similarly and it is conceivable that the weed suppression in the alternative plots was due to the amount of nitrogen that was contained in the alternative treatments.

Pesticide reductions ranging from 87-98% can be achieved in turf by implementing spot treatments for broadleaf weeds. If turf is fertilized regularly (4 times per season at 0.5 kg/100m^2 per application) herbicide reduction of 96-98% can be achieved.