ENTOMOLOGY RESEARCH & TIPS

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We continued testing products for ant control this year at shadow Ridge Golf Course near Ionia, Michigan. At the beginning of the test on June 12th we counted 13 to 24 ant mounds in each 12 ft x 12 ft plot in the fairway. Two formulations and three rates of Dursban, and one treatment of Merit were applied on June 12th (Table 1). As in past years, Dursban proved to be one of the best products available for ants. We did not detect any difference in the activity of the WSP compared with the EC. Higher rates of Dursban 2 EC (3 and 4 lb a.i. per acre) reduced ant activity down to 1.5 mounds per plot at 8 days after treatment compared with 4.7 per plot for the standard rate of 2 lb a.i. per acre, and 36 mounds per plot in the control (Table 1). Merit reduced ant mounding by about 50%, while all of the Dursban treatments reduced mounding by 80-90%. Dursban and Merit remained active for the full 6 weeks of this test.

Merit, Tempo and Dursban were evaluated for control of adult ataenius beetles at The Cattails Golf Course near South Lyons, Michigan. Insecticides were sprayed at the labeled rate in 4 gal of water per 1000 sq ft on May 13th. All three products were effective the first week after application, but only Merit and Dursban reduced the number of ataenius beetles found 2 weeks after application (Table 2). Merit and Dursban reduced the number of beetles trapped by about 75%. This test confirms that insecticides applied to fairways in the middle of May can be used to prevent ataenius grubs from injuring turf in July. However, most golf course superintendents prefer not to treat fairways with insecticide until a threshold level of grubs are found. With ataenius larvae, at least 50 grubs per sq ft (5 per cup-cutter sample) are necessary to cause significant injury. On most golf courses this threshold is never reached. Most superintendents check for ataenius grubs in July, and treat fairways or portions of fairways that are above threshold with Dylox, Oftanol, Sevin, or Turcam. Dylox and Sevin should not be used if the pH of the irrigation water is above 7.5.

Other than June beetle grubs, European chafer is the most difficult grub to control with insecticides. At Jackson Country Club we tested Merit, Mach2, and sumithion applied in June or in July. Merit and Mach 2 were most effective when applied in July. Merit provided 88% control and Mach2 50% control in this test. In previous tests Mach 2 has performed as well as Merit. Mach2 is an insect growth regulator that disrupts molting. It is a very safe product, almost non-toxic to mammals.

In the last two years we have found ataenius and aphodius grubs to be much more abundant in fairways than in the adjacent irrigated rough. This year we conducted two experiments at The Cattails to learn more about why this is happening.

In the first experiment 16 plots were defined in the fairway and 16 in the irrigated rough. Half of the plots were sprayed once every two weeks with Daconil. At the end of this test we found an average of 31.3 ataenius larvae per plot in the fairway and only 7.5 larvae per plot in the rough (Table 5). Daconil had no effect on the number of ataenius larvae that we found. We collected all the grubs that we found and dissected them to determine how many were infected with the naturally occurring milky spore disease. We found that 20% of the grubs in the fairway were infected compared with 51% of the grubs in the rough. Clearly, milky spore disease is much more active in the rough. Daconil did not have any effect on the proportion of larvae infected with milky spore disease, and it did not effect the number of predators found (Table 6). After this test we do not believe the use of Daconil is causing the build-up of grubs in the fairway.

In a second experiment, the line between the fairway and rough was altered from the previous year by curving back and forth across the old border. This created plots that were fairway in 95 and rough in 96, rough in 95 and fairway in 96, rough both years, and fairway both years (Figure 1A). The new mowing arrangement was started in April. The plots were sampled for grubs in the middle of July when aphodius grubs were most

abundant. The distribution of grubs followed the line of the old fairway. Regardless of how the turf was mowed or fertilized in 1996, grubs were most abundant in plots that were fairway in 1995 (Figure 1A). The average number of grubs found in plots where the old fairway was located, was 21, compared with 7 grubs per plots where the old rough was located. It did not make much difference whether the plots were maintained as fairway or rough in 1996.

These results eliminated several proposed explanations of why we have so many more grubs in the fairway compared to the irrigated rough. Daconil use on the fairway has been eliminated as a cause by the Daconil spray plots in 1996. The preference of Ataenius beetles to lay eggs in the fairway has now been eliminated by altering the old border between fairway and rough as just described. Differences in grass species has been eliminated because the same grass type (perennial ryegrass) is grown in the fairway and rough at The Cattails where our research was done this year. Fertility and pesticide history are still a possibility, although no insecticides have ever been used at The Cattails where our plots were located, and almost no fungicide has been used. The best explanation at the end of last year, the predation of grubs by adult rove beetles, has been eliminated because large numbers of adult rove beetles were found in plots with high numbers of grubs for the first time this year; in the plots that were fairway in 95 and rough in 96. Two possible explanations of these results will be tested in 1997: First, more predators of grubs reside in the rough than the fairway, and we did not sample them because it is the rove beetle larvae, living in the soil that are the best predators of grubs, not the adult rove beetles that spend more time on the soil surface and in the thatch. If the rove beetle larvae are causing most of the predation, you would expect a one year delay in grub predation after changing fairway plots to rough plots because the rove beetle larvae were already in the soil in April when we started our experiment , and they would not be able to move that far in the soil. Or, secondly, the role of milky spore disease could be critical. We know that twice as many infected grubs are found in the rough than in the fairway. It is possible that the level of infection is based on the amount of spores in the soil, carried over from the previous year. If this is true, you expect a year delay in the amount of infection after changing fairway turf into rough turf.

We expect to be able to determine the importance of rove beetle larvae and milky spore disease in causing the skewed distribution of grubs in the fairway and rough next year, the second year of our altered fairway study. If rove beetle larvae and milky spore disease are delayed one year in activity after changing the fairway, we will see much greater activity from them in the second year in plots that were changed from fairway to rough.

Table 1. Ant test at Shadow Ridge Golf Course 1996.

Treatment	Formulation	Rate (lb AI/acre)	6/12	6/20	6/26	7/2	7/9	7/19	7/25
Dursban	50 WSP	2	16.7	5.2	1.3	5.0	6.7	1.3	0.8
Dursban	50 WSP	3	17.2	2.8	4.2	4.5	7.2	1.7	1.7
Dursban Pro	2 EC	2	23.8	4.7	2.7	7.3	10.5	2.5	3.2
Dursban Pro	2 EC	3	14.0	1.0	1.5	2.7	3.2	0.3	0.5
Dursban Pro	2 EC	4	13.5	1.5	1.2	3.3	2.7	0.3	0.2
Merit	75 WP	0.3	14.5	19.7	10.5	13.7	17.0	7.3	4.7
Control			13.3	35.7	20.7	36.0	29.7	21.3	11.7

Table 2. Ataenius adult test at the Cattails Golf Course.

		Ataenius adults	
Treatment	Rate	20 May	28 May
Merit 75 WP	0.3 lb ai/a	0.0 a	1.0 a
Tempo 20 WP	0.144 lb ai/a	0.5 a	2.5 ab
Dursban Pro	1 lb ai/a	0.8 a	1.0 a
Control		3.2 b	4.2 bc

Table 3. European chafer test: insecticides applied in June.

Treatment	Rate	Grubs per 2 sq. ft.
Merit 75 WP	0.3 ai/a	2.0 a
Sumithion 1.67 EC	.1 lb ai/k	3.2 ab
Sumithion 1.67 EC	.2 lb ai/k	4.3 bc
Control		5.3 bc
Mach 2 SC	1.0 lb ai/a	6.3 bc
Mach 2 SC	0.5 lb ai/a	7.5 c

Numbers followed by the same letter are not significantly different. Data were converted by log (x+1) prior to ANOVA/Fisher's LSD (P<0.05). Untransformed data are presented.

Table 4. European chafer test: insecticides applied in July.

Treatment	Rate	Grubs per 2 sq. ft.
Merit 75 WP	0.3 ai/a	1.2 a
Mach 2 SC	1.0 lb ai/a	4.5 b
Mach 2 SC	0.5 lb ai/a	5.3 bc
Sumithion 1.67 EC	.2 lb ai/k	7.7 cd
Sumithion 1.67 EC	.1 lb ai/k	9.5 cd
Control		10.0 d

Numbers followed by the same letter are not significantly different. Data were converted by log (x+1) prior to ANOVA/Fisher's LSD (P<0.05). Untransformed data are presented.

Table 5. Ataenius larvae found in the fairway and rough and in Daconil or control plots.

Treatment	Ataenius larvae per plot
Fairway	31.3
Rough	7.5
Daconil-fairway	19.3
Control-fairway	43.3

Table 6. Activity of natural milky spore disease (B.p.) in the fairway and rough, and where Daconil was applied.

Treatment	% ataenius infected with B.p.
Fairway	20.4
Rough	51.4