Efficacy and Longevity of Merit 75 WSP for Control of Black Turfgrass Ataenius Grubs.

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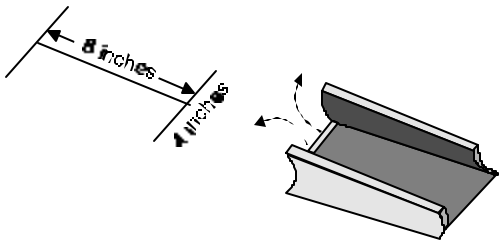
Summary: When applied at the recommended rate of 0.15 oz/1000 square feet, Merit 75 WP provided significantly better control of black turfgrass ataenius (BTA) grubs than no treatment for at least 35 days after treatment, and continued to show a non-significant trend towards improved grub control for four months. However, by six months after treatment, there were few differences between plots treated with Merit and those that were not treated. During periods of heavy grub pressure and high turf stress, control with Merit was insufficient to avoid some damage to greens. Merit treatments did not result in reduced damage from bird feeding.

Biological data on the BTA collected during this trial indicated that five or more generations occurred April and December, 1995. The highest density and most damaging grub generations occurred between July and September, 1995. Grub populations were found to be heavily aggregated, or clumped in their distribution. BTA grubs appeared to be more likely to occur on collars, or where soil was wet and water drainage was a problem. When BTA grub population data was compared with BTA adult population data obtained from a black light trap study also conducted at Los Coyotes Country Club, it was determined that grub infestations peaked 11 - 14 days after each adult peak.

Background: Commercially introduced for the first time in 1995, Merit Insecticide (active ingredient, imidacloprid) is a lower toxicity, increased residual product with activity against white grubs including black turfgrass ataenius, masked chafer, June beetles and Japanese beetles. This experiment was designed to evaluate the efficacy and longevity of Merit for control of BTA grubs and to gain more information on the relationship between adult BTA populations (as determined by black light trap counts) and grub populations.

Materials and Methods: Plots consisted of three greens that were divided into treated and untreated areas. Treated areas were 500 square feet in area or more. Treated plots received an application of Merit 75 WP on 6/21/95 at the 0.15 oz/1000 sq ft (6.4 oz/A) rate. Product was applied through a backpack sprayer with 8004 flat fan nozzles, 30 psi (at the boom) and delivering 1.2 ga solution per 1000 square feet.

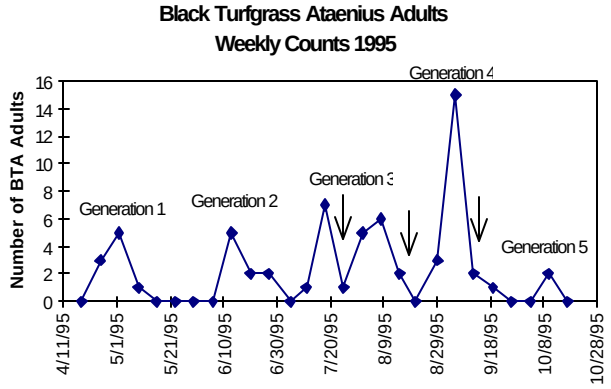
The sampling procedure consisted of identifying signs of early turf decline (small patches of yellowing or thinning turf) and making a 6" long and 2" deep incision with a knife through this area. Perpendicular lines 4 inches long were cut to form a "T" at either end (diagram below). Turf was peeled back to examine soil for grubs.



Sampling dates were determined by examining adult BTA population trends from black light trap data and selecting sampling dates 1 -2 weeks after the peak adult populations had occurred. Peak adult populations occurred on 7/15/96, 8/5/96, 9/2/96 and 10/8/96 (Figure 1). As a result, grub sampling dates occurred on 7/26/95, 8/21/95, 9/6/95, 9/14/95, 10/26/95 and 12/12/95 (see arrows in Figure 1 below). On 9/6/96 no data was taken due to the fact that the majority of grubs present were all newly hatched, and therefore the peak population had not been reached. On 8/21/96 no data was taken due to the fact that the large majority of grubs present were in the pupal stage, and the peak population had been missed by approximately 1 week. On each sampling date, a minimum of three (7/26) and a maximum of 10 areas (9/14 and 10/26)

per treatment, per green were sampled for grubs.

Figure 1. BTA Adult Weekly Counts from Black Light Trap Samples. Arrows indicate grub sampling dates.



Results and Discussion: Sampling Procedure: Analysis of the distribution of grub populations on three sampling dates (Table 1) indicates that grub populations are heavily clumped. This observation was not terribly surprising, given that BTA adults are known to lay eggs in groups of 11 - 12 (Wegner and Niemczyk, 1981). Confirmation that grubs populations are indeed aggregated presents a special challenge in the design of sampling procedures that will accurately reflect the numbers and distribution of grubs actually present. During 1996, we will continue to develop and improve our sampling procedures towards this end.

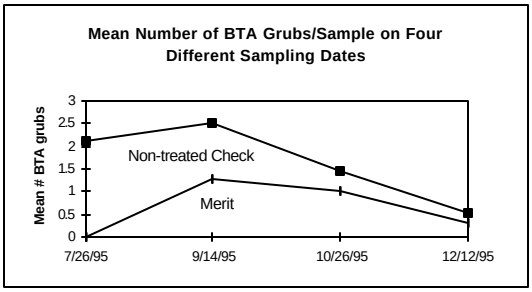
Table 1. Statistical indicators of BTA grub population aggregation.

	Sampling Date		
Parameter	7/26/95	9/14/95	10/26/95
Variance to mean ratio	5.5	6.8	2.8
Negative binomial k[b]	0.26	0.29	0.76
Lloyd's index of mean crowding[c]	5.7	7.5	3.2
Lloyd's index of mean patchiness[c]	4.9	4.4	2.4

[a]Variance to mean ratios greater than 1 indicate an aggregated population.
[b]The lower the k value, the more aggregated the population.
[c]Lloyd's index of mean crowding and mean patchiness are both measures of aggregation.

Merit Efficacy and Longevity: As the data below shows (Figure 2 and Table 2), Merit showed the highest level of control on the first sampling date (7/26/95), 35 days after it was applied. As time elapsed, however, the differences between Merit plots and non-treated check plots became smaller, indicating that as expected, Merit activity may slowly have degraded during the 6 month trial.

Figure 2.



Based on this information, it is recommended that Merit applications be deferred until June if possible, so that it is most active during the time when grub populations are highest (July - September), and turf is most stressed. Alternatively, superintendents may want to consider using two applications of Merit at a reduced rate, and spaced approximately 8 weeks apart, to achieve longer residual control of BTA grubs.

Table 2. Mean number of BTA grubs per sample on four sampling dates. Merit was applied on 6/21/95.

	Mean # BTA grubs/sample	
DATE	**Merit 0.15oz/1000**	**No Treatment**
7/26/95	0	2.11*
9/14/95	1.30	2.52
10/26/95	1.0	1.47
12/12/95	0.33	0.53

* significantly different from the non-treated check (LSD, p<0.05)

Effect of Merit on Reducing Bird Damage:

Data recently reported by Shetlar et. al. (personal communication) indicates that BTA adults and grubs are frequently the preferred food for starlings and crows. To help confirm this information, we examined the turf and soil underneath bird damage spots, and found a variety of insects there including BTA grubs, sod

webworms, wireworms (larvae of click beetles) and rove beetles (beneficial insects). Surprisingly, no cutworm larvae were found underneath bird damage spots. Based on this information, it seems feasible that applications of a product that controls BTA grubs such as Merit, could help reduce damage due to bird feeding on greens. Unfortunately, this was not the case. On September 14, we examined three different greens at Los Coyotes Country Club, and counted the number of bird feeding damage spots on non-treated plots and plots treated with Merit. We found that the average number of spots on Merit treated greens was 32, while the average number of spots on the non-treated greens was 30. Therefore, Merit had no impact on bird damage, perhaps due to the fact that there were still BTA grubs present on the Merit plots (although the numbers were reduced), and that birds seek many insects other than grubs, upon which Merit has no efficacy. Alternatively, birds may just randomly peck on greens until they encounter an insect, in which case Merit would also have no impact.

Correlation of black light trap and grub sampling data: Black light trap data on adult BTA was effectively used to predict the appearance of BTA grubs. We found that during the summer months, peak BTA grub populations (where the majority of grubs were in the 2nd instar) were most likely to be found 11 - 14 days after a peak adult population. When grub sampling occurred only 4 days after the adult peak (9/6/95), very few grubs were present, and those that were present were newly hatched. When grub sampling occurred 16 days after the adult peak (8/21/95), the majority of grubs had already pupated. Later in the season, the length of time between adult and grub peaks began to increase due to cooler temperatures and longer developmental cycles for BTA grubs.

Other Insects: Adults of *Aphodius lividus,* a beetle closely related to the BTA, were commonly seen on the greens and in the thatch. However, all grubs examined were identified as BTA grubs. At this point, our observations still support conclusions of other researchers that despite their high numbers, *Aphodius* beetles are not pests on turf.

Risk Factors: The most severe BTA infestations were observed to frequently occur under a consistent set of conditions. These are identified below:

Turf Risk Factors for BTA Damage

1. Wet spots (particularly where black layer occurs) in low areas, near sprinkler heads, or in poorly draining soil
2. Stressed turf due to prolonged periods of high temperature
3. Stressed turf due to high soil salinity
4. Stressed turf due to heavy traffic, particularly around collars
5. Stressed turf due to low mowing height
6. Cool season turf varieties, particularly poa, bentgrass and bluegrass

References:

Wegner and Niemczyk, 1981. Bionomics and phenology of *Ataenius spretulus.* Ann. Entomol. Soc. Amer. 74:374-384.

