

## Can Merit™ or Mach 2™ be Justified in an IPM Program?

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Two of the insecticides used most commonly on white grubs in New England are imidacloprid (usually sold as Merit™) and halofenozide (often sold as Mach 2™). Because both of these products remain active for several weeks, they are often applied just as beetles begin laying eggs in July or early August. Many people believe that such a strategy (essentially a preventive application) is contrary to the backbone of an Integrated Pest Management (IPM) program. So turf managers have been asking whether either of these products could be justified in an IPM program. To answer that question, we need to review a few of the concepts of IPM.

While the traditional definitions of IPM center on “pest management”, IPM could also be considered to stand for “Intelligent Plant Management”, recognizing that plants can handle one or two stresses but not three or four. So if agronomic conditions are being optimized (i.e., fertilizers are applied at the right rates and times of year, turfgrass is mowed at a height suitable to its adaptation, soil is not compacted by traffic, and shade is not a major problem), turfgrass often can withstand attack by a pest and not show any obvious signs of damage. For example, we have seen golf course turf that had as many as 35 Japanese beetle grubs per square foot and no evidence of damage. But that site had an unlimited water supply, was out of play from golfers, and there were no skunks or raccoons in the area. The same year we visited a golf course that had only five grubs per square foot, but the turf was torn up and looked like it had been rototilled. That site was on a public course with very heavy play, the irrigation system was sporadic at best, and the soil was very gravelly. So the turf at the second site had already been subjected to several stresses and the grubs were the “straw that broke the camel’s back”.

IPM is a pest management strategy that depends on monitoring pest activity and only taking action to “control” a pest population when that population is higher than can be tolerated. The “tolerance levels” for pests depend on many things. One factor is the inherent ability of the turfgrass to recover from damage. In other words, how many other stresses are present at the same time? For example, if damage from a pest is most severe in July or August, the tolerance level probably will be lower than it would be for a similar pest that is active in May or June

because the turf is already under many other stresses in July and August (e.g., high temperatures, lack of water, disease pressure), and is less able to handle additional stresses. Tolerance levels are site-specific, and may vary with different times of the year. And on golf courses tolerance levels will be different from roughs to fairways to greens. In the example mentioned above, the tolerance level for grubs at the first site (the one with irrigation and few golfers) was much HIGHER than the second site, because the turf was not under as many other stresses.

In an IPM program, a scouting program is established and the activity of each pest is monitored regularly. Once it becomes apparent that a tolerance level (or “action threshold”) is going to be exceeded, the turf manager considers management strategies that could be used to reduce the pest population below the tolerance level. In most definitions of IPM, several control strategies are considered, and often used in combination to reduce populations below tolerance levels. Normally cultural strategies are considered first, followed by biological control options. Only then are pesticides considered as one of the options. Unfortunately, with some of the insect pests we encounter in New England, there are very few cultural or biological control strategies that work consistently and reduce pest populations significantly. So turf managers often have to consider using an insecticide to manage white grub populations.

If pesticides are used in an IPM program, it is understood that they should be applied after a pest population has become apparent (“curative applications”), in circumstances where it appears the population will exceed the tolerance level. In the perceptions of many people, preventive applications (those made before a pest population can get established) do not fit in an IPM program under any circumstances.

However, there are several other things to consider as well when pesticides are used in an IPM program. Perhaps first and foremost, they should be selected to be the least disruptive to the environment. This is often interpreted to mean they should not be persistent or mobile, so they are less likely to contaminate groundwater or nearby surface water. Pesticides that are used should have minimal impact on non-target organisms such as springtails, spiders, and mites that are active in the thatch. Pesticides that are used in an IPM program should not be toxic to

vertebrates. And finally, most IPM programs try to minimize the number of pesticide applications made in a growing season.

So where does Merit™ or Mach 2™ fit in these parameters? Merit™ is used widely in New England to control various species of white grubs. It is relatively slow-acting and long-lasting, so to be most effective, it should be applied when the adults are laying eggs. (This is from late June to early August in most parts of southern New England, for the European chafer, Japanese beetle, or oriental beetle). But such an application would seem to be contrary to the basic tenets of IPM – the application must be made before the grub populations have a chance to become established, so it is impossible to scout the area and confirm the presence of grubs or whether a threshold has been (or will be) exceeded.

Similarly Mach 2™ is often applied at about the same time. It acts as a molt accelerating compound so it interferes with the ability of a grub to molt successfully from the first instar to the second instar or from the second instar to the third instar. It needs to be in place before the grubs make their final molt, to the third and largest instar (usually in early September). It has enough persistence that it can be applied in July or early August, before grub populations are obvious and before damage occurs. It is difficult to monitor grub activity in July or early August because any grubs that are present will be very small and difficult to see.

So at first glance, it would seem that neither product could be defended as an appropriate material to use in an IPM program, because most applications are made on a preventive basis. But it turns out that grub activity often can be anticipated. Grub activity often is quite consistent from one year to another in a given location, so if there was a “hot spot” in the spring, that same area is likely to be infested again later that summer. Once European chafers become established in a given location, they often remain active in that area for several years. In about eight years out of ten, grubs tend to be found in the same general locations. The exceptions arise in unusually wet years (when beetles lay eggs in drier sites) and unusually dry years (when beetles lay eggs in moister sites). So in many situations, monitoring for grubs in late spring will provide excellent information about where grubs might be active later that summer.

Meanwhile there are only three insecticides (four if you count Arena™, which is a close cousin of Merit™ and just received EPA registration in 2005) that are labeled for use against grubs in New England and work consistently. Those are Merit™, Mach 2™, and Dylox™ (trichlorfon).

Dylox™ is a very mobile compound that works very quickly and breaks down quickly. It is considered a cornerstone of many IPM programs because it is ideally suited to controlling grubs after they become active (cleaning up “hot spots”). But Dylox™ is an organophosphate, which means it is a cholinesterase inhibitor that impacts the nervous system of insects and vertebrates. And because it is very mobile, sometimes it can move beyond the target area. (Usually it breaks down chemically before it gets to nearby surface or groundwater.) In any case, Dylox™ has its own drawbacks. Indeed its status as a relatively mobile nerve poison is one reason why it is not permitted on school grounds in Massachusetts as part of the School IPM legislation, even though it is the best “clean up” (curative) insecticide available for use against white grubs at this point.

The irony here is that people who are managing turf in Massachusetts in settings that fall under the School IPM legislation are being forced to apply grub insecticides such as Merit or Mach 2 because they do not have access to a curative product. When the law was passed initially, there were some other insecticide options available, but most of those registrations were cancelled at the end of 2004 as a result of changing regulations brought about by the Food Quality Protection Act.

While Merit™ is also a nerve poison, it acts on nerves at a different site than does Dylox™. And insect nerves are much more sensitive to the disruption of the nicotinic receptor site, so Merit is less toxic to vertebrates than is Dylox. Also, Merit™ received federal registration in the 1990s, after the Environmental Protection Agency made its environmental requirements much more stringent. So Merit is not nearly as disruptive to non-target organisms (e.g., fish, birds, or earthworms) as most older organophosphates. And normally a single application of Merit, properly timed, will control grub populations at an acceptable level. So in all these regards, Merit™ certainly can be defended as an appropriate choice in an IPM program.

Mach 2™ is even easier to defend in an IPM program, because its mode of action is specific to certain kinds of insects. As a result it is much less toxic to vertebrates (including fish, birds, dogs, cats, and people!) than any of the older organophosphates. Field studies confirm that it is not harmful to most beneficial insects that are active in the turf, nor is it harmful to earthworms. Its “toxicology profile” is just the sort of profile that fits IPM – a reasonably specific compound that is minimally harmful to other organisms.

So even though both Merit™ and Mach 2™ must be used as preventive applications against white grubs to maximize their effectiveness, it is my opinion that their use can be defended in an IPM program. They are much less toxic to other non-target organisms than the older organophosphates (such as Turcam™, Mocap™, or Triumph™) that were used for many years. And finally, a single properly timed application should provide very acceptable levels of control.

**One caveat must be mentioned here** – Merit™ can be effective against the three primary grub species (Japanese beetles, oriental beetles, and European chafers) when applied at the right time, but Mach 2™ is markedly less effective against oriental beetles than Japanese beetles. So once again it is crucial to know the species of the grubs in a given location.

**Disclaimer** – Pesticide registration status is subject to change and varies from state to state; therefore the authors, UMass Extension, and the University of Massachusetts cannot assume liability for recommendations. It is the responsibility of the applicator to verify the registration status of any pesticide BEFORE applying it. THE LABEL IS THE LAW: ALWAYS READ AND FOLLOW THE LABEL WHEN APPLYING PESTICIDES. Use of product names does not imply endorsement.



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