1) Immediately irrigate after applying a grub control with at least ½ inch of water.
2) If an insecticide is warranted – apply the highest labeled rate.
3) Proper timing of the application is essential.
4) Preventive chemicals are far more effective than curative controls.

Natural Biological Control of Japanese Beetle

Previous research at MSU supported by MTF and Project GREEEN indicates that survival of Japanese beetle larvae in the soil from October to May is reduced by as much as 50% when the pathogen, *Ovavesicula popilliae*, is established. We have successfully established this pathogen at several golf courses in the Detroit and Kalamazoo areas. At golf courses where the pathogen has been detected for 10 years or longer, populations appear to be declining. As a result, grub damage to turf is unusual and defoliation of linden trees, rare. The good news is that we have some dead infected beetles for you to take home to your own golf course to get *Ovavesicula* established there. The bad news is that it may take 5 – 10 years from when *Ovavesicula* is first introduced until populations begin to decline. If you are located in Kalamazoo/Battle Creek area there is no need to introduce more infected beetles because the pathogen is already well-established in that area. If you have introduced infected grubs or beetles in the past, it is not necessary to do it again.

Directions of how to implant infected beetles:
Find an area of irrigated rough on the golf course where you usually have grubs. Use a screw driver to punch a hole into the soil about 1.0 inch deep. Enlarge the hole enough so that you can place the beetle 1.0 inch deep. Cover the hole and step on it after the dead beetle is placed in the ground to prevent birds from finding it. Repeat this for each dead beetle in the bag. Space the dead beetles about 5 paces apart. Do not place dead beetles where any insecticide has been used. Only choose irrigated turf sites where it is likely to find Japanese beetle grubs in the fall. Do not use insecticides in the introduction area for 3 years.

Stop 12. Postemergence Crabgrass Control

Nick Binder, Aaron Hathaway, and Dr. Thomas A. Nikolai

2013 has been yet another year when preemergence herbicides have failed and crabgrass has been able to break-through and become a problem in lawns. It seems like increased temperatures over the years is enabling crabgrass, a warm season plant, to out-compete our cool season turfgrasses. If crabgrass is not controlled after it has germinated it is left to produce more and more seed giving it increased potential to be an even bigger problem the next year. The list of products that provide postemergence crabgrass control is ever increasing and the list of combination products with these differing active ingredients seems to grow by the minute.

Two trials were conducted in an area with high crabgrass pressure on June 26, 2013 when crabgrass was in the 1-2 tiller stage. Mesotrione (Tenacity) and topramezone (Pylex) are newer herbicides on the scene that not only provide excellent crabgrass control, but show great versatility by providing control of many broadleaves and some other warm season grasses, both perennial and annual. Quinclorac (Drive) is another product that can provide control of many broadleaf weeds as well as excellent crabgrass control as seen in this trial. Because quinclorac can give such a boost in broadleaf control, it is often combined in a premix with other specialty active ingredients to be applied for a combination of pest types. Although many plots in these trials had up to 75% crabgrass cover, quinclorac and fenoxaprop-ethyl (Acclaim Extra) provided excellent control as the "go to" products, but the newer herbicides (mesotrione and toprammezone) showed that they could compete and provide excellent crabgrass control as well. It is often the other weeds that some of these herbicides can control and their differing turf safety ranges that set them apart or make them more appropriate for certain situations.

Stop 13. Spray Nozzle Dynamics and Selection for Optimal Pesticide Efficacy

Dr. David Gilstrap

A spray nozzle is the least expensive yet the most important part of a sprayer. Nozzle technology has its origins in the development of fuel injectors and paint sprayers. Significant innovations have also occurred is in automatic car wash industry. In essence, a spray results when a flowing liquid is forced under pressure through an orifice than constricts the flow and causes the creation of spray droplets. Atomization is the proper term for this phenomenon. All nozzles produce a range of droplet sizes. Nozzles are characterized according to the range of droplet sizes that each emits within its particular range of operating pressures. While every spray tip emits a range of droplet sizes (including driftable fines), at any given pressure there is a median diameter droplet, i. e., half the droplets are larger and half the droplets are smaller. Thus, every spray has a volume median diameter (VMD) droplet that is determined and noted by nozzle company technicians. Another parameter is the percentage of "driftable fines" (less than 200 micron in diameter) that a nozzle produces.

There are three basic types of nozzles classified as to the spray patterns they exhibit: full cone, hollow cone, and flat fan. Spraying Systems claims to have marketed the first agricultural nozzle in the late 1040s to mainly facilitate the application of 2,4-D herbicide. The nozzle had a V-shaped notch in the orifice that created a flat-spray pattern with the greatest amount of liquid applied toward the center of the pattern and less and less toward its edges. Thus, nearly all nozzle patterns must be overlapped in order to provide uniform distribution of a spray volume across a given area.

The advent of wettable powders (WP), mainly insecticides and fungicides, tended to clog up the tiny orifices of the first teejet nozzles. Thus, flooding nozzles were introduced in the early 1950s where a coarse stream of liquid is directed against an impingement that breaks up the liquid and redirects in downward in a flat spray pattern. The distribution with these nozzles was not very uniform across a spray boom, but the effectiveness of pesticides containing things like DDT, arsenic, cadmium, and mercury more than made up for it. Later models, such as Teejet's Floodjet series have shown improved distribution when their overlap is set correctly.