EVALUATING NEW TURF PRODUCTS

Gail L. Schumann, Monica L. Elliott, and Paul Vincelli

University of Massachusetts, University of Florida, and University of Kentucky, respectively

---

Anyone who had the opportunity to visit one of the trade exhibits at the turf conferences last winter could not help but be amazed by the variety of biological or organic turf products that purport to help grass grow better and relieve pest problems. Dozens of new products become available each year, and intelligent consumers want to know if they really work.

Turf managers who buy chemical pest control products are familiar with the extensive university testing most chemicals have undergone. They may be assuming that similar testing has been done for all new products. However, many new products have little or no independent testing completed before they are introduced to the turf market. Many biological/organic product claims are based on non-scientific testimonials, non-turfgrass evaluations, or simply unproven theories. How does one evaluate a new product to determine if it works and if it is cost-effective?

HERE ARE SOME QUESTIONS TO ASK THE VENDOR:

1. **Has the product ever been evaluated by independent researchers, that is, by people with no financial interest in the product? Ask for names and a copy of their reports.**

   There are two reasons that university results are usually reliable. Most university studies include side by side evaluations of products from many companies in their trials to see how they perform under local conditions. Each company typically pays a modest fee for each treatment in the study. Most of these studies are conducted on public lands where anyone can arrange a visit and see the results for themselves. Many of the experiments are featured at research field days, and most researchers indicate which companies sponsored which studies. Because the salaries of researchers have traditionally been paid by the public, the financial incentive to obtain favorable results for a particular product is reduced. This is an excellent reason for the turf industry to continue strong support for these research programs in the face of continuing university cuts as it helps to keep researchers financially independent of individual companies and products.

   A second and equally important reason for confidence in university results is that faculty researchers receive career rewards for work that can be published in scientific journals. We have a strong incentive to conduct sound and unbiased studies. Scientific journals typically require results from at least two seasons or from two different sets of research plots before a paper can be considered for publication. Anonymous peer review of the experimental protocol, results and analysis of data is also a requirement for publication. Peer review allows other scientists to evaluate the quality of both how the study was designed and how the results were interpreted. Many single year studies are found in the *Fungicide and Nematicide Tests* and the *Biological and Cultural Tests* published annually by the American Phytopathological Society. These reports are also subjected to peer review and require replicated treatments, randomization, controls, and statistical analysis, all of which are hallmarks of proper experimental design.

2. **Has the product ever been evaluated in turfgrass field experiments? For what problems is this product recommended?**

Many biological/organic controls show great promise in the laboratory and greenhouse, but fail to be effective in field trials. Many products may also be successful in one kind of cropping system, such as annual crops of corn or potatoes, and not work well in perennial turfgrass. Finally, most biological controls are relatively specific in their mode of action and may work well for one disease or pest but not all problems. The same is true, of course, for many chemical products. A product that claims to reduce all pest problems and improve turfgrass quality should be regarded with suspicion.

3. **Has the product been tested in your area?**

   There are many examples in which products perform well in some soil types, at some soil pH levels, on some turfgrass species, and/or some climates, but not others.

4. **If experimental data are available, look for these features when judging the results:**

a. **Nontreated plots:**

   These are necessary to determine how much stress or pest pressure (weeds, diseases, insects, nematodes) was present. These pressures are difficult to predict from year to year and even from area to area. Some disease trials require inoculation with a pathogen to ensure uniform disease in each plot. Ask what steps were taken to decide what pest or disease was present and how uniform the problem was. This same concern applies to any experiments with "growth stimulants."

   It is always important to leave nontreated areas. Consider what happens if you don't. Suppose you are seeing less dollar spot pressure this year than last. Could it be due to a change in your fertility practices, different weather patterns, the new product you applied to all 18 greens, or some undetermined factor? Or suppose you have a brown patch outbreak. Did the turf recover from the disease this week because of a change in the weather or because of that new product you applied? Turf managers may think that they know the answer to these questions, but without nontreated areas for comparison, *no one can be sure, not even the most highly respected turfgrass pathologist in the world*.

b. **Replications:**

   Field trials should include replications of all treatments. For example, if you are testing five new products, you would need 6 plots - one for the nontreated control and one for each new product. You would then need 3 to 4 more sets, or replications, of these 6 plots for a total of 18 or 24 plots. There are several ways to do this, but typically we have the five treatments plus the control randomized within each row. As the season progresses, you can see if the same results occur in each of the 3 or 4 replicated plots that received the same treatment. This helps separate out real differences among treatments from variation simply due to the turf environment. The same reasoning is used for the World Series which is settled by the best-of-seven and not just a single game.

c. **Statistics:**

Statistical analysis can be simple or complex, but it is an important way to determine how sure you are that an effect is due to a treatment. Here is a simple example:

Imagine two different experiments where you are testing two new products: "Bio-Sure" and "Eco-OK" for dollar spot control. In each experiment, there are 4 replications of the three treatments: 1) the nontreated control, 2) Bio-Sure, and 3) Eco-OK. The data numbers in the table refer to the number of dollar spot infection centers in each plot. Note that both experiments have the same average results: 103 dollar spots in the nontreated control, 23 dollar spots in the Bio-Sure plots, and 10 dollar spots in the Eco-OK plots. The data look pretty convincing that both products are giving significant control compared to the nontreated plots,

but can you also conclude that Bio-Sure gives better control than Eco-OK? A statistical analysis can answer that question.

	Experiment A		Experiment B	
	Number of dollar spot infection centers		Number of dollar spot infection centers	
Treatment	**In each of four plots**	**Average of all 4 plots**	**In each of four plots**	**Average of all 4 plots**
Nontreated Control	105	103 a	107	103 a
	97		97	
	100		105	
	110		110	
Bio-Sure	27	23 b	35	23b
	25		34	
	19		10	
	21		13	
Eco-OK	11	10 c	10	10 b
	9		7	
	12		5	
	8		18	
	LSD (p = 0.05) for Experiment A 7.5		LSD (p = 0.05) for Experiment B 16.0	

Even though the averages are the same in both experiments, look at the variation in the numbers in the four plots. Which set of results is more convincing? In Experiment A, the numbers are similar in all replications of each treatment. This gives you more confidence that both products gave disease control, and that Eco-OK reduced disease better than Bio-Sure. In Experiment B, there is more variation and overlap between the numbers in the various replications. It is not so clear that Eco-OK worked better than Bio-Sure even though the average numbers are identical.

Statistical analysis tells you how to interpret the average numbers because most reports list only the average (or mean) of the replications. If they are "statistically significant" they are more like the numbers in Experiment A and you can have more confidence in them.

The two common ways to indicate statistical significance are shown in the table. The first is to report the Least Significant Difference (LSD). If you subtract two averages from each other and the difference is greater than the LSD, then the difference between the treatment averages is probably real and not an artifact of the experiment. For example, the LSD in experiment A is 7.5. The difference between the averages of Bio-Sure and Eco-Ok (13) is more than 7.5, so you can be 95% sure that the difference is real. In Experiment B, the LSD is 16.0 and the difference between the averages is still 13, so the difference is not statistically

significant. You cannot be confident that Bio-Sure works better than Eco-OK from the data in Experiment B. (Most LSDs are calculated at the 90% or 95% confidence level which is indicated by p = 0.1 or p = 0.05, respectively.)

Another way to indicate differences is by placing letters next to the average numbers. If the two averages have no letters in common, the differences are statistically significant. In the table, you can see that the letters are different for the averages of the Bio-Sure and Eco-Ok treatments in Experiment A but are not different in Experiment B because there was no statistically significant difference between them. Next time you attend a field day or read a research report, look for the statistical analysis to help you determine how confident you can be in the results.

1. **If the product is for pest or disease control, does it have an EPA registration number?**

This is important for several reasons, not the least of which is your own liability. There are many unanswered questions about the efficacy and safety of many of the new products, just as there are with traditional chemical controls. There is some concern about potential allergy problems, especially with fungal formulations. Some bacterial biocontrol agents, such as *Burkholderia (Pseudomonas) cepacia*, are secondary human pathogens that could be a serious health threat to people with compromised immune systems. Be aware also that contamination of many biologicals with unknown organisms is common and difficult to control. Thus, even if a biological product has an EPA registration, it is important to conform to all safety regulations for application and use, with particular attention to inhalation protection.

EPA registration is required for a product if it claims to directly control a pest. Registration means that the safety of the product has been determined and is acceptable to the EPA. Be aware that some well known biological products are being sold without EPA registration. Some companies are avoiding EPA registration by claiming that disease and/or pest control is due to an improved microbial environment of the turfgrass that reduces the chances of disease or pest problems. The safety questions listed above apply to any microbial application.

Conclusions

By this time, you might be feeling that this is a lot of detail that may not be worth your time or concern. The purpose of this article to demonstrate what it takes to determine if a new product really works as it claims, and why it is not easy to conduct such tests on a working golf course or on a customer's lawn. Nontreated areas, replications and statistical analysis are time-consuming and best left to people whose job it is to evaluate such things. That is the philosophy that led to the founding of the land-grant universities and the Cooperative Extension Service. Unfortunately, year by year, support for this unbiased source of research results has been whittled away to a fraction of its former level.

What if you can't find any reliable research and you want to try a new product?

1. Try new products on a small area first.
2. Try them where they are least likely to cause serious problems if they injure the turf or don't do what they claim. For example, try new products on fairways rather than greens, on nursery turf areas, or on one green rather than all of them at once.
3. Find a way to leave a nontreated test area for comparison so you can better judge the results you obtain. Buy a piece of plywood and place it in the center of an area to be treated before you spray. Remove the plywood and you have a nontreated test area. If you treat a lawn or golf course wall-to-wall and then proclaim that "it worked great," you will never really know what would have happened had you done nothing at all.
4. Network with your colleagues. Ask those who have evaluated new products if they followed the guidelines outlined above: replications, nontreated controls, etc. The more of this that they have

done, the more confident you can be in their comments. Watch out for "testimonials," and exercise some healthy skepticism.

---

posted 22 July, 1998