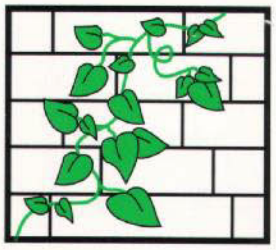

Pesticide Fate Research: *Always More Questions!*

By Darin W. Lickfeldt
Department of Horticulture
University of Wisconsin-Madison

Many scientists will tell you how good research will lead to more questions than answers and this can be frustrating to turf managers and to those who provide research dollars. I am going to use pesticide fate research as an example of how this works.

When a pesticide is applied to a turf, the active ingredient(s) will first come into contact with the surfaces of the leaves. The leaves of all turfgrass plants are covered with a wax layer called the cuticle, which protects the leaves from desiccation, injury and disease. The waxy surface will repel water just as any waxy surface will, but when the water solution contains an active ingredient that will not dissolve in water (nonwater-soluble) the pesticide is attracted (adsorbed) to the similar leaf surface. Many of our active ingredients are relatively nonwater-soluble (less than 300 ppm), and they must be mixed with surfactants to get them into an emulsion (EC) that can be sprayed. If these compounds are nonwater-soluble, why would irrigation or rainfall be effective for moving them off of a waxy leaf to which they are strongly adsorbed? Why do pesticide labels recommend "watering-in" applications? An even more important question is why would the pesticide move off of the waxy leaf, through a thatch layer that is comprised of nonwater-soluble organic plant tissues, through a soil that is rich in nonwater-soluble organic matter and all the way to the groundwater?

My Master thesis research conducted at Michigan State University under the direction of Dr. Bruce Branham demonstrated how readily organic compounds will adsorb to leaves and thatch but this research led to even more questions. The inactive ingredients in a pesticide (emulsifiers, surfactant, solvents, etc.), which improve the efficacy and spreadability of the pesticide, suspend the active ingredient in water to form an emulsion. The active ingredient will be surrounded by many of the inactive ingredient's molecules making the whole complex (micelle) water soluble. How long following an application to a turf does this water solubility enhancement end? Once the material has dried on the leaf? We may never know because the inactive ingredients in the pesticides are usually proprietary (trade secrets). Once manufacturers are forced to reveal their recipes, competition for better products will diminish. Are the manufacturers going to reveal what makes their product better than all of the rest?

Now we have established how well compounds will absorb to leaves and thatch, but then what happens to them? The active ingredients in pesticides are usually very large organic compounds that are easily degraded by sunlight or microorganisms and they may be volatile. The abundant turfgrass leaves will intercept the compounds and expose them to sun, wind, traffic, etc., and the thatch is a great environment for microorganisms. Therefore, future research will probably demonstrate that our pesticides are quickly degraded under normal turf management conditions.

What is degradation? Many turf managers are led to believe that once degradation has occurred the entire compound is no longer in existence, but that is not the case. Many of you have small children who have a set of building blocks. Their creative little minds will often throw some conglomeration of blocks together into a structure that we as "grown-ups" really do not understand (i.e. chemistry). The child will be satisfied with their creation for awhile until they either destroy it altogether, or they rearrange certain pieces. Let's assume our children are not so destructive, and they decide to swap a red block for a blue block. The structure still maintains its identity even though a small change has been made. Now let's think of the structure as a single molecule of active ingredient in a pesticide. If one swap is made

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to the structure of the compound we can say degradation has occurred since it is no longer the same compound. The compound still looks very similar and it is probably just as toxic as it was originally, but the efficacy and water-solubility of the compound changed drastically. This is dependent upon what was rearranged on the structure, and where on the structure the rearrangement occurred. How many possibilities do you think exist? As you can see, scientists will be busy for some time to come.

Obviously a pesticide's efficacy for its intended pest is very important, but today's educated turfgrass managers must be just as concerned with maintaining a healthy environment as they are for "keeping it green". In conjunction with integrated pest management programs, we can choose pesticides based on their effectiveness and cost, but we can also consider the water solubility, half-life and toxicity of the active ingredients. This information may not be on the product label where it should be, but you can retrieve it from a reference library or the company that manufacturers the product. With this information, you will have some very specific/scientific answers for those who ask you those uncomfortable questions.

Editor's Note: *Darin Lickfeldt has recently joined the turfgrass research team at the University of Wisconsin-Madison as a Research Assistant/Ph. D. Candidate for Dr. Frank Rossi and he will be a regular contributor to future issues of Grass Roots with his column "Ivy Covered Walls". Ivy Covered Walls will focus on explaining recent advances in basic research, and drawing a closer link between the scientific community and turfgrass managers.*

Darin comes to us from his home state of Michigan where he was raised in the very small town of Stockbridge. Darin was a student athlete in high school and he took his first position on a golf course maintenance crew at the age of 15 (Barton Hills C.C., Ann Arbor, MI) where he worked for a total of four seasons. Upon graduation from high school in 1984, he entered the United States Army for a total of 3 years, and served at Fort Sill, Oklahoma, and in Germany as an artillery surveyor. After his term in the service, Darin enrolled at Michigan State University as a student of turfgrass management. While at MSU he worked 3 more years at Walnut Hills C.C. in E. Lansing until graduating with honors from MSU in 1991. Darin immediately entered graduate school at MSU under the direction of Dr. Bruce Branham and he completed his MS in May 1994 (Organic Compound Sorption by Kentucky Bluegrass Leaves and Thatch). While studying for his MS, he served as the Research Technician for Dr. Branham. As a technician, Darin evaluated many aspects of herbicide and plant growth regulator use in turfgrass, pesticide fate issues and bentgrass conversion strategies. In his free time Darin enjoys hunting, fishing and spending time with his family.

Darin, his wife Jodi, and their son Jason are very pleased to be a part of Wisconsin's turfgrass industry and they look forward to future interactions with you.