

Utilizing Preemergence Herbicides With and Without Fertilizer Carriers

Should you spray or should you use a granular carrier?

by FRED YELVERTON, Ph.D.

THE USE OF preemergence crabgrass/goosegrass herbicides as sprays versus impregnated or coated on a fertilizer carrier continues to be a much-debated topic among turfgrass managers and distributors of the products. Research on herbicide performance and an understanding of the behavior of the various preemergence herbicides in the environment indicate that each method of delivering preemergence herbicides has potential advantages and disadvantages. The purpose of the following discussion is to outline various factors that affect herbicide performance with the two types of application and to point out where one method may be favored over the other method.

To cover the pros and cons of using preemergence herbicides with and without fertilizer carriers, it is necessary to discuss this topic in three sections: 1) herbicide performance, 2) timing of application, and 3) environmental implications. The herbicides involved in this discussion are the major products utilized for crabgrass and goosegrass control: dithiopyr (Dimension), pro-diamine (Barricade), oryzalin (Surflan), pendimethalin (various trade names), benefin + trifluralin (Team), and oxadiazon (Ronstar). These herbicides represent three herbicide families: 1) dinitroanilines or DNAs (Barricade, Surflan, Team, and pendimethalin), 2) pyridines (Dimension), and 3) oxadiazole (Ronstar).

Herbicide Performance

To compare and contrast herbicide performance when applying as sprays versus a dry carrier, it is important to have a clear understanding of how preemergence crabgrass/goosegrass herbicides work. The preemergence herbicides in question do not prevent seed germination; they kill the weed as it grows through the herbicide treated zone (1, 2). The DNAs and pyridines are absorbed by roots and shoots of germinating weeds and inhibit cell



Drop spreaders and sprayers can be used in banding areas around impermeable surfaces and water resources to help reduce off-target movement of products.

division in the growing points, and the weeds fail to emerge. Ronstar is absorbed in emerging shoots (not roots) and affects photosynthesis, and the emerging shoot dies (1). The fact that Ronstar is not absorbed by roots explains why it can be safely used when sprigging many warm-season turf species.

Once a product is applied and watered in, a herbicide barrier is established in the soil/thatch layer. Therefore, uniform coverage with a preemergence herbicide, whether applied as a spray or granular, is necessary for optimum control. Large gaps in the

herbicide-treated zone can result in weed escapes. Small gaps in this treated zone, such as those caused by aeration, generally do not adversely affect herbicide performance (5, 10).

When the herbicide application is on a granular carrier, once the treated turfgrass area is watered, the granule dissolves, and the herbicide barrier is established. Because the herbicides in question are readily adsorbed by soil organic matter, they do not move very far from the granule. Therefore, coverage with a granular product (whether coated on a fertilizer or on an inert dry carrier) must be uniform and dense enough to prevent large gaps in the herbicide barrier. When comparing coverage with a granular product versus a properly applied spray, coverage is usually better with a spray application. This does not necessarily mean control will be better with a spray.

From a coverage standpoint, a certain density of granules per unit area is necessary for adequate herbicide performance. On a granular carrier, particle size and uniformity of particle size are very important components of herbicide performance. As particle size decreases, the density of particles per unit area increases. This has been demonstrated by Kelly and Coates (9). In their research, southern crabgrass control increased to a point and then leveled off with decreasing particle size of the granular product. Uniformity of particle size is important because when spreading granular products, small and large particles can travel different distances from the application equipment.

The effects of coverage with various granular formulations on smooth crabgrass control is demonstrated in Table 1. In this experiment, Barricade applied as a 0.29G or as a spray provided better smooth crabgrass control than when applied as a 0.5G formulation. The most likely reason for these differences can be attributable to better coverage with the sprayable or 0.29G Barricade.



Bulk fertilizer and herbicide applications need to be carefully managed, especially on impervious surfaces. Some materials cannot bind to soil particles and are free to move with the water. Remove products from these areas before irrigation or rainfall. It's also very important to maintain a safe distance from wetland areas.

indicator of how easily a chemical (in this case a herbicide) changes from a liquid to a gas. Herbicide loss can occur due to volatility losses. In addition, preemergence crabgrass/goosegrass herbicides vary in their volatility. The relative volatilities of the various pre-emergence herbicides are listed in Table 2. Volatility losses also increase with increasing temperature. This is why pesticides have a stronger smell when temperatures are warm in the summer than in the winter.

Table 2
Vapor Pressure and
Relative Volatility Ratings
for Preemergence
Crabgrass/Goosegrass Herbicides
(Measured as mm of HG @ 25° C)

Herbicide	Vapor Pressure	Relative Volatility Rating
benefin*	7.8×10^{-5}	Moderate
trifluralin*	1.1×10^{-4}	Moderate-High
Barricade	2.5×10^{-8}	Very Low
pendimethalin	9.4×10^{-6}	Low
Surflan	2.5×10^{-8}	Very Low
Dimension	4×10^{-6}	Low**
Ronstar	7.8×10^{-7}	Very Low

*Team is a combination of benefin and trifluralin
**Dimension has low volatility, but one of the carriers in the EC formulation is volatile

Table 1
Preemergence Smooth Crabgrass
Control with Various Barricade
Formulations
Yelverton and Hinton, 1996 (14)

Treatment	Rate (lbs ai/a)	% Control
Barricade 65WG	0.75	98
Barricade 0.29G	0.75	91
Barricade 0.5G	0.75	81
LSD \approx 0.05		9.3

Hidden Valley Golf Club, Angier, NC. Applications made March 4 and final evaluations made September 26, 1996.

When bulk spreading granular products using large equipment, there are some areas on the golf course that are hard to reach, and coverage can sometimes be difficult. An example is a severe slope on the back of a tee. Control in these areas is sometimes less than in fairways due to difficulty in obtaining good coverage. In these areas, it is a good idea to make applications with smaller granular applicators, or to utilize sprays.

Coverage is only one aspect of obtaining adequate control with pre-emergence herbicides. Volatilization losses from herbicides also can impact herbicide performance. Herbicide volatility (as measured by vapor pressure) is a measure of the intramolecular bonding forces of a chemical, and it is an

One way to help control volatility losses is by utilizing a herbicide on a granular carrier. When a spray application is made, the foliage intercepts some of the herbicide. The herbicide is subjected to volatilization losses and herbicide performance can sometimes be decreased. One way to help minimize volatility losses from spray applications is to water the herbicide in immediately after application. This will help remove the herbicide from the foliage and move it down in the canopy where the herbicide barrier is established. Higher wind speeds have also been shown to increase volatility losses (7). The effect of post-treatment irrigation was demonstrated by Gasper et al (8). They showed that pendimethalin efficacy on smooth crabgrass was reduced when irrigation was delayed later than the day of treatment. Volatility losses of pesticides have also been demonstrated by Cooper et al (7).

An example of how volatility may be important is demonstrated in Table 3.

While Dimension is not volatile, one of the carriers in the emulsifiable concentrate formulation is suspected of being volatile. In this case, the herbicides were not watered immediately after treatment. Rainfall was relied upon for herbicide activation. This delay in activation resulted in the lower rate of Dimension providing as good or better crabgrass control than the sprayable (EC) formulation.

Table 3

Preemergence Smooth Crabgrass Control with Dimension Formulations

Yelverton, Lewis, and Hinton, 1995 (13)

Treatment	Rate (lbs ai/a)	% Control
Dimension 1EC	0.5	90
Dimension 0.25G	0.38	98
LSD \approx 0.05		NS

Thorndale Golf Club, 1995. Herbicides applied March 16 and final evaluations were September 19, 1995.

Photodegradation, or degradation by UV light, and dislodgeable foliar residues also may play a role in herbicide performance. When a herbicide application is made, sunlight may start to degrade the herbicide. If a product remains on the foliage for extended periods of time, degradation by sunlight may occur. Again, irrigation soon after a spray application can help minimize any of these potential losses. Following pesticide applications, especially when applying liquid materials, there remains some residue of that pesticide on the turfgrass foliage. Research has shown that some pesticides applied without irrigation had foliar residue levels four times higher than for irrigated turf (7). These residues of pesticides are known as dislodgeable residues.

To summarize herbicide performance, maximum control with a granular product is dependent on achieving a minimum density of particles per unit area. Particle size and uniformity of size are important considerations when considering a granular product. Coverage is usually better with a properly applied spray application. Most spray applications need to be watered in soon after application to

prevent volatility and other losses. By impregnating or coating a herbicide on a granular carrier, volatility losses potentially can be minimized.

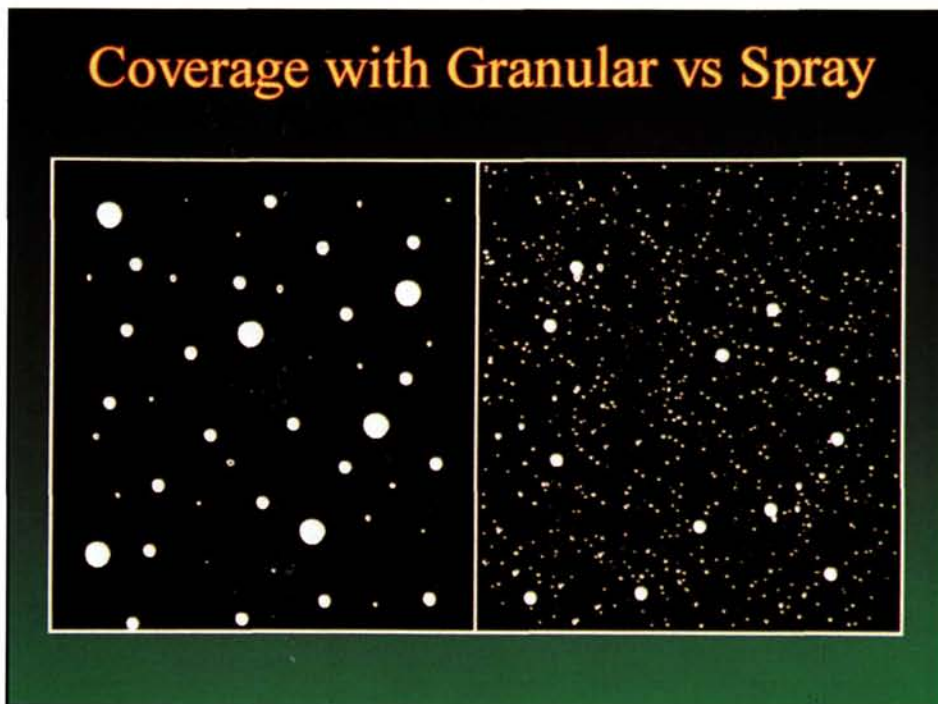
Timing of Application of Herbicides Applied on Fertilizer Carriers

When applying herbicides on a fertilizer carrier, consideration must be given to the timing of herbicide and fertilizer application. If it is the correct time to apply a preemergence crabgrass/goosegrass herbicide and the turfgrass needs fertilizing, then obviously

with perennial ryegrass, the timing may be compatible because the cool-season turf may be in need of fertilization at this time.

Environmental Implications

As previously mentioned, if the timing of a herbicide/fertilizer application occurs when the turf is not actively growing, the possibility exists of nutrient leaching through the soil profile. The extent of nutrient loss depends on soil texture, soil type, type and amount of fertilizer applied, and how well established the turf is. Brown et al (6)



When comparing coverage between a granular product versus a properly applied spray, coverage is usually better with a spray application. This does not necessarily mean control will be better with a spray.

applying a herbicide on a fertilizer carrier can be advantageous. However, many times the two applications are not compatible. An example is non-overseeded warm-season grasses in the southern United States. Large and smooth crabgrass can germinate when soil temperatures reach about 55 degrees near the soil surface (11). Pre-emergence crabgrass herbicides need to be applied in many areas of the southern U.S. in late February through March. At this time, warm-season grasses are still dormant and will not be actively growing for another 4 to 8 weeks. Depending on the soil texture, soil type, and type of fertilizer, this can lead to nutrient losses because the turf is not actively growing. However, in the case of warm-season turf overseeded

showed various levels of nitrogen leaching losses through a "Tifdwarf" bermudagrass putting green when fertilized with either ammonium nitrate in mid-February or ureaformaldehyde in late January. These researchers concluded that decreasing fertilizer rates during periods of slow growth could reduce nitrogen leaching losses. Bowman and Cherney (4) showed that nitrogen leaching losses were greatest on warm-season turf species soon after sodding, and leaching losses declined to very low levels once the turfgrass became established. It is clear from both research projects that nitrogen leaching losses can be minimized by fertilizing warm-season turf species only when they are well-established and actively growing.

The preemergence herbicides discussed in this article are strongly adsorbed to soil colloids (primarily organic matter) and also have low water solubilities. As a result, they do not leach through the soil profile and are not subject to runoff unless the soil particle moves (12). However, when these products are inadvertently applied to asphalt, concrete, and other impermeable surfaces that may be found on the golf course, they are free to move with water. While certain nutrients such as nitrogen are more mobile than the herbicides in question, most research indicates little runoff occurs when products are properly applied to well-established turf. But as with herbicides, when they are applied to impermeable surfaces, they are free to move with water, and contamination of water resources may occur.

It is important that these materials (all pesticides and fertilizers) be applied only to established turfgrass areas. When applying granular materials, particularly when applied with large equipment, it is difficult to keep off these impermeable surfaces. If they inadvertently land on these surfaces, care should be taken to remove these products before irrigation or rainfall. To prevent placement on these surfaces, banding with drop spreaders or making a pass with a sprayer (10-15 foot band) next to concrete, asphalt, or ponds, lakes, etc., can be helpful. This will allow the larger bulk spreading equipment to stay further away from these areas and lessen the likelihood of off-target movement of pesticides and nutrients. Another helpful tool is to utilize buffer areas around ponds, lakes, and streams. Baird et al (3) demonstrated the buffer areas can reduce surface runoff losses of certain

pesticides and phosphate-phosphorus from bermudagrass turf.

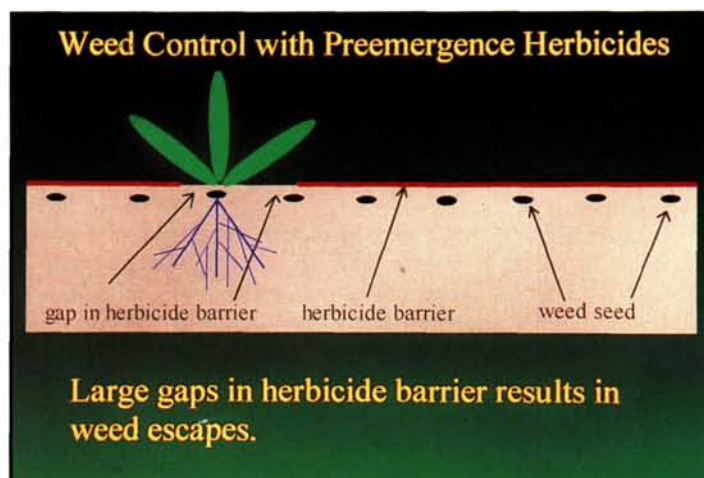
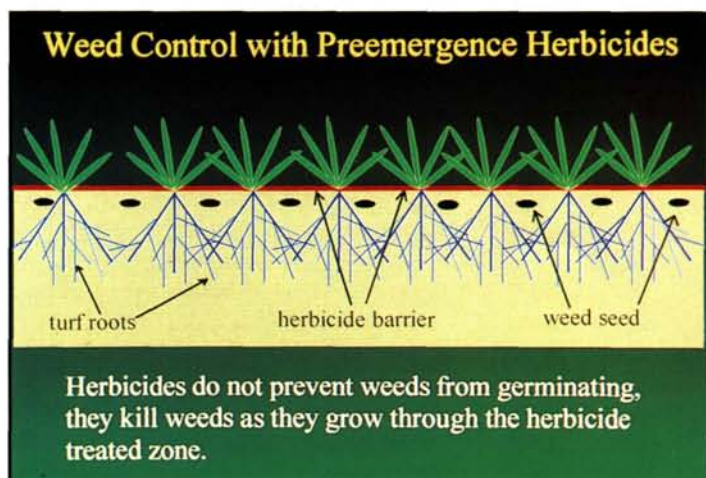
In summary, there are advantages to applying herbicides either as sprays or on granular carriers. Performance of the herbicide is dependent on the quality of the granular carrier and application. While better coverage is usually obtained with sprays, proper spray application is also important for optimum performance. Volatility losses from pesticides can be reduced by utilizing a granular carrier or by irrigating very soon after a spray application. This is more important for certain herbicides than others. Some herbicides have such low volatility, immediate irrigation is not necessary. Utilizing drop spreaders or spray applications to band around impermeable surfaces and water resources can help reduce off-target movement of pesticides and fertilizers on the golf course. There is increasing evidence that buffer areas around water can also help reduce potential soil runoff of pesticides and nutrients.

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Preemergent herbicides create a barrier in the soil to kill weeds as they grow through the barrier zone. Uniform coverage is critical for optimum control.