

## How preemergence herbicides work and why they fail

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Application of a preemergence herbicide is often the most desirable method of weed control for two reasons. First, if the weed is killed prior to emergence, it is never seen and therefore doesn't compromise the aesthetics of the turf. Second, the weed never becomes established to compete with the turf for water and nutrients.

Application procedures for preemergence herbicides are straightforward and are listed on the pesticide label, which also sets forth recommended rates, sensitive turf species and other considerations that may alter herbicide performance. Preemergence weed control may sometimes be less than adequate even when label directions are strictly followed. An understanding of how preemergence herbicides work is essential in understanding why they sometimes don't.

### Conditions Affecting Herbicide Performance

When a preemergence herbicide is applied to the turf and properly watered in, the chemical moves down through the turf and thatch where it comes in contact with the soil. The herbicide then becomes tightly bound to the soil particles in the upper soil surface where the majority of weed seeds germinate. As these weed seeds germinate, they come in contact with the herbicide-affected soil, which inhibits the growth of the shoots or roots, eventually killing the susceptible weed. Naturally, the success of the preemergence herbicide application depends on applying the chemical prior to germination. What is less obvious is the fate of the herbicide after application.

The herbicide's concentration in the soil is the critical factor in determining the extent and duration of its control. Once the herbicide has been applied, a variety of processes take place that may reduce this concentration. For instance, the herbicide may miss the proposed target due to conditions that cause the spray solution to drift. Also, if the herbicide is not watered in within 72 hours, photodegradation – the degradation of the chemical by light – can contribute to reduced herbicide effectiveness. In addition, the longer the time span between application and irrigation or rainfall, the greater the potential for photodegradation of the herbicide. Once the herbicide is watered in, microbial degradation occurs. Microbes use the herbicide as a food source, causing a breakdown of the chemical to a non herbicidal component. The herbicide's effectiveness also can be affected by the location at which the chemical is retained by the turf ecosystem. The retention of herbicide by organic or mineral matter is called "adsorption." Herbicides can be adsorbed on the turf, thatch or in the soil. Preemergence herbicides can be retained by the turfgrass that is not in contact with weed seeds, and therefore overall efficacy is reduced. On the other hand, herbicide retained in the thatch may be in contact with some weed seeds, but its effectiveness on the turfgrass leaves and in the thatch may be lost by photodegradation and volatilization. Preemergence herbicides need to be adsorbed near the soil surface for successful weed control. Leaching loss is a concern about many pesticides, but less so with preemergence herbicides. The

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majority of preemergence herbicides of tightly bind to soil particles in the top few inches of soil. Leaching losses, except under extreme conditions, are minimal.

### **The Effect of Weather on Herbicide Performance**

Microbial populations increase when conditions are warm and moist. As a result, the loss of herbicide control is greater under these conditions because the herbicide is being broken down faster. Herbicides are also less tightly adsorbed in moist soils than in dry soils. This, the weather conditions of a particular year may markedly affect preemergence herbicide performance. When herbicide concentrations drop below the threshold level, continued control is only possible by reapplying the herbicide to bring its concentration back above that level. Consequently, some preemergence herbicides require a second application for season-long control. The second application, however, does not need to be applied at the full rate and can still be effective at one-half to three-quarters of the original application rate. The timing of the actual application depends on the weather. When spring is dry and hot, weed seed germination may be delayed. In years with these conditions, repeat applications of preemergence herbicides could be performed later than during years with cool, wet spring seasons. If mid- to late-summer rains occurs, a flush of grassy weed seed germination may occur after the herbicide has degraded below the threshold level. Being aware of the weather and understanding its effect on preemergence herbicides, performance can help anticipate timing of reapplication – or the need for an unseasonably late application or the use of a postemergence product.

### **Application Misconceptions**

Research looking at conditions affecting preemergence herbicide performance has refuted some commonly held beliefs. For instance, it was widely thought that herbicide application created a “blanket” of chemical in the soil – and that any turf cultivation practice such as core aeration or verticutting disrupted or “tore” the herbicide blanket. Work in Michigan and Georgia has shown that cultivation practices did not significantly reduce preemergence herbicide control of weedy grasses. It seems that the herbicide doesn’t form a blanket, but instead adsorbs tightly to soil particles. Most cultivation practices only move the soil around so that herbicide is not lost, only redistributed. Exceptions to this process are possible when the turf is core aerified and the cores are removed or if a turf is excessively thatchy and power raked and the thatch removed. Any herbicide bound to the soil cores or thatch is also removed, which ultimately reduces the concentration of the herbicide in the cultivated area and may reduce annual weed control.

Preemergence herbicides are an effective tool in weed control when used properly. Although primarily used for the control of grassy weeds such as crabgrass, foxtail and goosegrass in turf, there are numerous products with preemergence activity on broadleaf weeds as well. Their use need not be restricted to turf because preemergence herbicides in landscape plantings can be very effective, and many products are labeled for this use.

By following label directions, paying attention to the weather and understanding how these products work, success with preemergence herbicides is virtually assured.

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