

The Fate of Herbicides

by A. ROBERT MAZUR, Agronomist, USGA Green Section

With the widespread and repeated use of chemicals for the control of weeds in turfgrass, several questions often arise:

(1) What happens to the herbicides we apply year after year?

(2) How often can we apply these materials without apparent injury to the turfgrass?

(3) What effect does the long term use of these materials have on established turf and the establishment of new seedings?

(4) What can we do to modify any deleterious effects which may occur?

In general, herbicides may disappear from the soil in three ways: by chemical means such as hydrolysis, oxidation, and photodecomposition; by physical means, such as volatilization, leaching and absorption; and by biological degradation.

Under field conditions, rate of application, type of soil, nature of the material, weather, and cultural practices all have a direct bearing on the life of herbicides in the soil.

Microorganisms

The single most important factor leading to the breakdown of herbicides is soil microorganisms. Biological degradation is hastened by those factors favoring the activity of the soil microorganisms. Environmental factors such as temperature, moisture, oxygen supply and organic matter content determine the rate at which biological decomposition takes place. The optimum temperature range for most soil organisms is between 75 and 90°F.

The principal microorganisms in the soil are algae, fungi, actinomyces and bacteria. As the pH of the soil varies, the activity of certain groups of organisms is enhanced and others is retarded. Bacteria and actinomyces are favored by pH's above 7.0 while fungi are most active at pH's below 5.5. The pH, however, seems to have little effect on the total microbial population. Those microorganisms most favored by conditions increase rapidly, and therefore the population is in a constant state of fluctuation.

It has been shown that organic soils require higher application rates of herbicides for effective weed control than mineral soils.

The larger microorganism population and the greater degree of internal surface area have been found to be responsible for this reduction in activity.

Enzymatic capabilities of microorganisms are wide and varied; however, soil microorganisms are not infallible. Although resistance to biological decomposition means a greater period of weed control, it also presents the potential hazard of residue accumulation following repeated use. The resistance of organic materials to decomposition is evidenced by the present accumulation of detergents in drinking water sources. This should be a caution to us on the use of our turfgrass herbicides in excess.

Chemical Breakdown

The nature and properties of chemicals affect such characteristics as vapor pressure, water solubility, and melting point, which are all important factors in determining the length of time that the herbicide will be effective in the soil. Those materials which are volatile or readily leached are only effective for short periods of time. An effective preemergence herbicide must remain in the top one-half inch of the soil in sufficient concentration to inhibit the development of weed seedlings. This means that the chemicals should be somewhat immobile and stable so as to cover the entire period of weed seed germination.

One of the common misconceptions is that preemergence herbicides suppress germination. Actually, preemergence herbicides do not stop germination, but are phytotoxic to the newly developed weed seedlings. One of the newer chemicals (siduron) is so specific that it can be used in the seedbed to eliminate weed seedlings; however, it is not deleterious to the germinating turfgrass.

Proper Application

Herbicide placement is one of the most influential factors governing effectiveness. In the case of the preemergence materials, we want to create a seal in the top half inch of the soil. This can best be accomplished with the granular formulations which have shown

more favorable results than either the emulsifiable concentrate or the wettable powders. It is important to make the application in at least two directions to insure uniform distribution.

Once the material has been applied, this seal should not be broken with any operation such as thatching or aeration which could bring untreated soil and weed seeds from a lower depth into the germination zone. Aeration should be accomplished in the spring prior to application of the chemical, or else delayed until after the period of weed seed germination in the fall.

In weed control, we have to discount the adage; "If a little bit is good, a whole lot is even better." Many serious problems have developed when this adage has been applied to selective weed control with herbicides.

Bensulide, DCPA and siduron all have shown effective crabgrass control. Studies also indicate that there appears to be no accumulation of these materials in soil receiving four annual applications. However, bensulide and siduron were shown to move downward in the soil profile after several weeks. Bensulide was found to persist in the soil several years from one application at the recommended rates.

Always Some Injury?

All of the preemergence crabgrass materials have been shown to cause some degree

of injury to established turfgrass. In some cases injury was associated with only a particular grass or grass species, but in general they all suppressed the development of roots and stolons to some degree. Therefore, it is advisable to use herbicides only when necessary, and then never more than two years in succession.

Charcoal Cancellling

After applying a herbicide a situation often develops in which it becomes necessary to overseed. This could normally delay your operation anywhere from 12 to 16 weeks. It has been found that an application of 200 pounds of activated charcoal per acre during the seeding operation will nullify this residual effect of the herbicide.

Charcoal is available in many forms. It can be applied as a granular material, or the dust can be mixed with water and sprayed on the seedbed. In order to realize its full value the charcoal should be thoroughly incorporated into the seedbed by raking in at least two directions.

In conclusion, we must say that weeds are primarily a problem in those areas which lack good turfgrass coverage. As in the past, the most reliable weed control program is still one that concentrates on the maintenance of good turfgrass cover.

Where do all the seedies go? To my course, every one!

