TIMING, RATE ARE CRITICAL FOR PREEMERGENCE HERBICIDES

by Robert C. Shearman, Ph.D.

Premergence herbicides play an important role in turfgrass maintenance programs. Timing of application is critical in their effectiveness. They must be applied prior to weed germination or emergence. An application two weeks prior to anticipated emergence of the target weed is generally suggested. This allows sufficient time for the preemergence herbicide to form a chemical barrier at or near the soil surface. Susceptible weeds germinate, absorb the herbicide, and are killed.

Preemergence herbicides are commonly used to control weedy, annual grasses like crabgrass, goosegrass, and foxtail. Some are also effective in controlling annual, broadleaf weeds such as prostrate or spotted spurge. Effectiveness and longevity of control depends upon the (a) preemergence herbicide, (b) application rate and timing, (c) weed species, (d) environmental conditions, (e) soil type and reaction, (f) cultural practices and (g) microorganism activity. Before selecting a preemergence herbicide turfgrass managers should check with local researchers and specialists for the chemicals that perform well in their area, and for the appropriate rates and timing of application.

Preemergence herbicide application rate and timing are critical aspects for effective weed control. A threshold level of herbicide activity must be maintained past the period of germination for the target weed to obtain satisfactory results. Figure 1 illustrates this point. Herbicide I maintains a soil concentration above the threshold level past the period of weed germination. Herbicide I would give effective weed control, while, Herbicide II fails to maintain a satisfactory concentration throughout the germination period. Herbicide II would require more than one application to give effective control of the target weed. When weed pressure is heavy or the germination period is extended weed control is more difficult. A heavy initial application rate or more than one herbicide application may be necessary under these conditions. If herbicides are applied too early, the chemical barrier may break down and allow weed infestation to occur. In turn, if the herbicide is applied too late germination will have already occurred and ineffective weed control will result.

Preemergence herbicides offer definite advantages to turfgrass managers. They are beneficial in maintaining the integrity, quality, and function of the turf; while they give effective and relatively safe selective control of emerging weeds. Preemergence herbicides, like other pesticides, have limitations and should be used appropriately. They cannot substitute for ineffective cultural systems, and must be incorporated with sound mowing, fertilizing and watering practices. Along with the advantages of using preemergence herbicides there are some potential disadvantages that should be considered. Some are rather obvious in nature. For instance, applications at the recommended rates for crabgrass and annual bluegrass will reduce germination of overseeded, cool-season turfgrass species. Reduced rates of siduron (Tupersan) is an exception, since it is recommended for seedbed application of certain turfgrass species and cultivars.

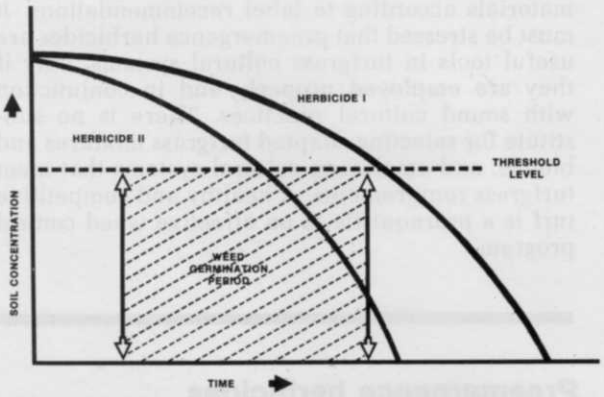

Figure 1. The preemergence herbicide must remain at sufficient concentration in the soil throughout the germination period of the target weed.

Other detrimental effects of preemergence herbicide applications appear to be more subtle in nature than the influence on seedling emergence. Almost every preemergence herbicide has been reported to influence some aspect of turfgrass growth, development, and performance. Successive annual applications or repeated applications within a year are particularly suspect. Decreased root and rhizome production, reduced sod strength and transplant rooting, reduced low temperature tolerance, increased high temperature and drought stress, and increased incidence of disease on susceptible turfgrass species and cultivars have been reported for the various preemergence herbicides commonly used in turf. However, these reports are contradictory and confusing since a particular herbicide may cause injury in one case and not another.

Turfgrass injury resulting from preemergence herbicides can usually be related to factors such as: (a) the species or cultivar treated, (b) herbicide used, (c) herbicide concentration or application rate, (d) soil type (e) cultural practices, and (f) amount of thatch present. These factors should be

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given careful thought and equal consideration to the efficacy of the product, when reviewing a preemergence herbicide for use in a maintenance program.

The turfgrass manager should select the materials that appear safest and most effective based on research in his area, and apply these materials according to label recommendations. It must be stressed that preemergence herbicides are useful tools in turfgrass cultural systems, only if they are employed properly and in conjunction with sound cultural practices. There is no substitute for selecting adapted turfgrass mixtures and blends, and employing cultural systems that meet turfgrass requirements. A healthy and competitive turf is a prerequisite to an effective weed control program.

Preemergence herbicides and their effect on thatch

Dr. Al Turgeon in the Department of Horticulture at the University of Illinois has reported extensively on the development of thatch due to preemergent herbicides and also the effect of thatch on the control of annual weedy grasses with preemergent herbicides. While some preemergent herbicides do induce thatch, it is more because of their effect as a pesticide on the earthworm and soil microbial balance.

Thatch results, according to Dr. Turgeon, because of an imbalance between opposing processes of accumulation and decomposition of organic material. He suggests that where any chemical that induces thatch is used, a cultural program should be adjusted to compensate for the loss of earthworms and other organisms that are important in decomposing the thatch and generally improving soil physical conditions.

This may involve periodic verticle mowing, aeration, topdressing, or other practices to overcome the adverse effects of the chemicals on the turfgrass ecosystem.

In an experiment to determine the effect of thatch on preemergence herbicide activity in Kentucky bluegrass, Dr. Turgeon found that, while preemergence control was excellent on thatchy plots, there was some amount of turfgrass injury that was not as severe as on thatch-free plots. This may be due to at least two factors: Herbicides are more mobile in thatch than in soil, thus, as more herbicide enters the rootzone, more injury results; and since there were no observations of differences in mobility between benefin and DCPA, the selectivity of preemergence herbicides may be due to biochemical as well as mobility differences. The following chart indicates a comparison of crabgrass control on thatchy and thatch-free Kentucky bluegrass. Herbicides were applied April 24, 1976 and April 21, 1977.

Injury ratings were an average of observations made July 21, 1976 and July 18, 1977. They are based on a scale of one to nine, with one indicating no injury and nine indicating necrosis of turf.

The percentage of crabgrass cover is an average of visual observations made August 13, 1976 and September 8, 1977. The sites were overseeded with crabgrass each year.

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Effect of Thatch on Preemergence Herbicide Control

			Injury to Turf		Percent Crabgrass Cover	
Treatment	Form	Kg/ha[1]	Thatch-free	2-3cm Thatch	Thatch-free	2-3cm Thatch
benefin	2.5G	2.2	1.0	3.0	5.3	1.1
		3.4	1.0	3.6	5.7	0.7
		4.5	1.0	4.6	2.0	0.1
bensulide	4E	11.2	1.0	1.1	4.7	0.1
		22.4	1.0	1.6	10.3	0.1
	3.6G	11.2	1.0	1.6	1.6	0.1
		22.4	1.3	2.1	0.3	0.4
	12.5G	11.2	1.0	1.0	2.0	0.6
		22.4	1.0	1.6	3.0	0.1
DCPA	75WP	11.8	1.0	1.0	2.6	1.1
		23.5	1.0	1.3	2.6	1.3
	5G	11.8	1.0	1.1	3.7	1.3
		23.5	1.0	1.1	3.0	1.1
oxadiazon	2G	2.2	1.0	4.6	9.0	2.3
		3.4	1.0	5.6	2.8	0.0
		4.5	2.0	6.3	4.3	0.0
prosulfalin	50WP	2.2	2.0	2.1	6.0	0.2
		3.4	3.0	6.5	5.0	0.8
untreated			1.0	1.0	29.0	11.5
LSD 0.05[2]			0.3	0.9	8.0	2.7

1. Kg/ha multiplied times 1.12 equals lb./A.
2. Level of Significant Difference, i.e. under Injury to Turf, Thatch-free, observation figures must differ by 0.3 to be significant, by 8.0 under Percent Crabgrass Cover, Thatch-free.

Goosegrass control with preemergence herbicides

Dr. Wayne Bingham, professor of plant physiology at Virginia Polytechnic Institute and State University, included some aspects of his research on goosegrass control at the recent Virginia Turfgrass Conference in Williamsburg, Virginia. While treatments for crabgrass control should go on in early March or early April, he said, goosegrass treatments should be delayed until May or even early June, when goosegrass germinates.

Dr. Bingham felt that his preemergent herbicide tests should be carried on for more than one

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Goosegrass Control in Common Bermudagrass Fairway

	Kg/ha					Percent Goosegrass Control		
	1974		1975		1976	1974	1975	1976
Herbicide	4/16	9/5	4/3	8/20	4/12	9/5	6/22	8/26
Oxadiazon	3.4		3.4	3.4	3.4	100	100	100
Butralin or Prosulfalin	4.5	4.5	3.4	3.4	3.4	38	88	100
Bensulide or Butralin	11.2	11.2	11.2	11.2	4.5	0	0	38
Benefin	3.4	3.4	3.4	3.4	3.4	0	88	100
DCPA	16.8	11.2	17.9	11.2	17.9	50	38	62
Check	——	——	——	——	——	0	0	0

[1]Prosulfalin was applied 9/5/74 at 3.4 kg/ha.

year for a good evaluation of control. Variability between locations became a factor.

When the new herbicides began to show up and their effect on goosegrass control showed them to be important, they were looked at and critically compared to find which had the best results. Dr. Bingham found that if he split application, control was better.

Oxadiazon, however, seemed to work just as well whether it was applied all at once or split. With DCPA, bensulide and benefin, better results were achieved with a split application.

The following charts show a comparison of goosegrass control over a three year period, the first indicating control and the second indicating the amount of bermudagrass filling the plots back in.

Goosegrass Control in Common Bermudagrass Fairway

	Kg/ha[1]					Bermudagrass ground cover[2]				
	1974		1975		1976	1974	1975		1976	
Herbicide	4/16	9/5	4/3	8/20	4/12	4/16	5/30	7/22	6/14	8/26
Oxadiazon	3.4		3.4	3.4	3.4		104	132	137	144
Butralin or Prosulfalin	4.5	4.5	3.4	3.4	3.4		108	127	122	143
Bensulide or Butralin	11.2	11.2	11.2	11.2	4.5		69	79	117	132
Benefin	3.4	3.4	3.4	3.4	3.4		115	127	131	144
DCPA	16.8	11.2	17.9	11.2	17.9		108	104	115	138
Check	——	——	——	——	——	33	43	72	83	122

[1]Kg/ha multiplied times 1.12 equals lb./A.
[2]144 square feet = complete coverage of the plot.