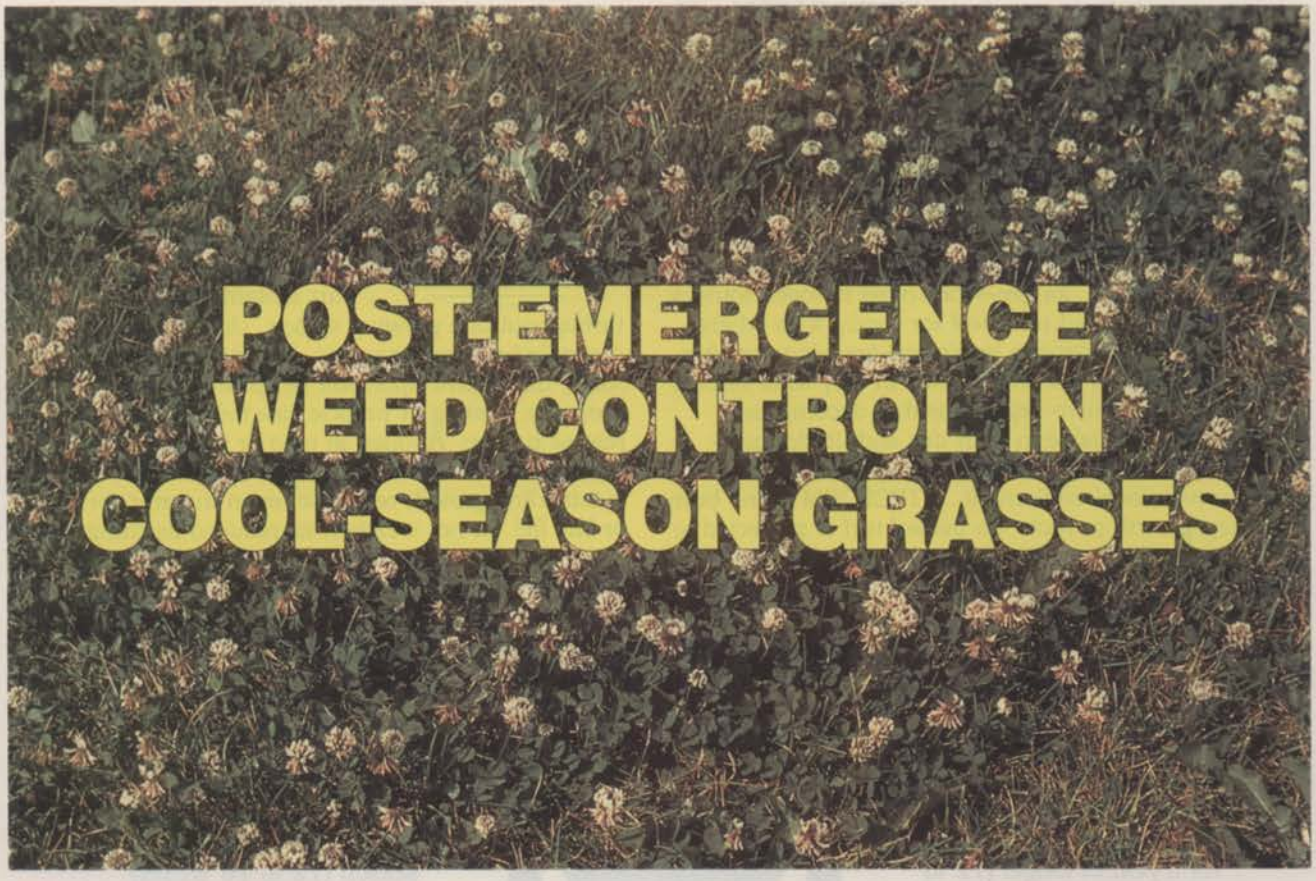

POST-EMERGENCE WEED CONTROL IN COOL-SEASON GRASSES

The effectiveness of soon-to-be-released post-emergence control products depends largely on an understanding of the plant's physiology.

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Weed control is the cornerstone of most landscape management. In golf course operations, knowledge of weed control is important; however, disease management often requires more time and money for the average golf course superintendent than does weed control.

Regardless of the type of turf you manage, it is important to understand weed control principles, so that the decisions you make are economical, environmentally sound and produce good results.

No new products for post-emergence weed control in cool-season grasses have been introduced in the past year, although we are still waiting on the EPA to approve three turf herbicides. Two of those products are pre-emergence herbicides (dithiopyr/Dimension and prodiamine/Blockade) while the other is a post-emergence grass and broadleaf herbicide (quinclorac/Impact) from BASF Ag products.

Impact of Impact

Impact is an excellent post-emergence grass herbicide with good activity on a number of broadleaf weeds as well. Data in Table 1 shows the effectiveness of this product when compared to other commonly used post-emergence grass herbicides. Impact controls crabgrass effectively at all growth stages and quickly by providing rapid initial burndown of the crabgrass. Impact also has some rapid initial burndown of the crabgrass. Impact also has some pre-emergence activity as demonstrated by the date from the two- to three-leaf application.

The Impact treatments provided excellent control (99 to 100 percent) at eight weeks after treatment (WAT), while the Acclaim treatment provided good initial control—87 percent at four weeks after treatment, which fell to only 51 percent by eight WAT.

This loss of control with Acclaim indicates that new germination of crabgrass had occurred to reinfest the treated area which occurs because Acclaim does not have pre-emergence activity.

Evidently, Impact had enough pre-emergence activity to provide control for the rest of the growing season. However, applications of Impact applied at the normal time for a pre-

TABLE 1. Effect of Impact on post-emergence crabgrass control in Kentucky bluegrass turf.

Treatment	Rate (1bs AI/A)	% Control	
Growth Stage: 2-3 leaf		4 WAT	8 WAT
Appl. date: 6-14-90			
Impact + BAS 090	0.75 + 1qt/A	100 a	99 ab
Impact + BAS 090	1.0 + 1qt/A	100 a	100 a
Dimension	0.38	90 a-d	94 a-c
Acclaim	0.18	87 a-e	51 d-h
Control		0	0
Growth Stage: 2-3 tillers		4 WAT	9 WAT
Application Date: 7-10-90			
Impact + BAS 090	0.75 + 1qt/A	100 a	97 ab
Impact + BAS 090	1.0 + 1qt/A	100 a	100 a
Acclaim	0.18	96 a-d	77 b-d
Daconate 6	2 + 2	93 b-d	88 a-d
Dimension	0.38	72 ef	82 a-d
Control		0	0

emergence herbicide have not given season-long crabgrass control. Impact has also been shown to provide effective control of broadleaf weed species such as white clover, black medic, field bindweed, spurge, and some veronica (speedwell) species.

Currently available herbicides for post-emergence control are shown in Table 2. Impact is not expected to be available until at least 1992.

Dimension's residual

Dimension is an excellent pre-emergence herbicide. But as the data in Table 1 shows, it also has excellent early post-emergence crabgrass activity. However, Dimension's ability to control crabgrass falls off rapidly after crabgrass starts producing tillers.

Formulations of MSMA provide effective weed control if two applications spaced 10 to 14 days apart are made. This product has fallen out of favor with lawn care operators because of the necessity to make repeat applications and because the potential for turf injury is high.

Acclaim: the standard

Acclaim is still the standard to which other post-emergence crabgrass herbicides are compared.

This product will provide very effective crabgrass control when applied on crabgrass with four tillers or less. As crabgrass grows beyond four tillers, control declines. In addition, crabgrass that is drought stressed is also more difficult to control with Acclaim, although this is generally true of all herbicides.

Few non-selectives

The list of herbicides available for non-selective weed control is a short one. Non-selective herbicides are used to control all vegetation and therefore are not normally used in a turf weed control program. These are, however, useful in a variety of situations.

Non-selective herbicides such as Roundup are used to renovate poor quality turf areas. In this situation, Roundup would be applied to the entire area; a seven-day waiting period should be sufficient to kill all vegetation. The area can then be re-established to a more desireable turf species. Non-selective herbicides are useful for edging around trees to prevent mower damage to the trees and for controlling weeds in the cracks of sidewalks, where it is often combined with a pre-emergence herbicide such as Surflan to provide long-term residual weed control. Non-selective herbicides can also be used to control weeds in mulched planting beds or gardens by directing the spray only on the weeds present.

Paraquat, a non-selective contact post-emergence herbicide, does not translocate. It kills only vegetation that it comes in contact with. Thorough spray coverage is required to achieve good control, but because the herbicide does not translocate, it will only kill the green vegetation of the plant. Some plant species can regenerate from the surviving roots and meristems. In addition, paraquat is moderately toxic, with an LD_{50} of 120 mg/kg.

Roundup is translocated throughout the plant. The LD_{50} of Roundup is 7200 mg/kg and is classified as almost non-toxic. Both Roundup and paraquat are inactivated once they contact the soil surface, so reseeding operations can begin very shortly after application.

TABLE 2. Post-emergence broadleaf weed control herbicides used in turf.

2,4-D - 2,4-dichlorophenoxy acetic acid
2,4-DP - 2-(2,4-dichlorophenoxy) propionic acid
MCPA - 2-methyl-4-chlorophenoxy propionic acid
MCPP - 2-(2-methyl-4-chlorophenoxy) peopionic acid
dicamba - 3,6-dichloro-o-anisic acid
triclopyr - 3,5,6-trichlow-2-pyridinyloxy acetic acid
clopyralid - 3,6-dichlow-2-pyridine carboxylic acid

Some commonly used broadleaf herbicide mixtures and the ratio of each product in the mix:

2,4-D + MCPP
2 plus 2 (1/1) Fermenta
Lescopar (1/2) Lesco
2,4-D-MCPP (2/1) Cleary's

2,4-D + dicamba
Phenaban 801 (8/1) Gordons
Eight-one selective herbicide (8/1) Lesco
Riverdale 81 selective weed killer (8/1) Riverdale
Riverdale 101 weed killer (10/1) Riverdale

2,4-D + MCPP + dicamba
Three way selective herbicide (1/0.5/0.009) Lesco
Trimec (1/0.5/0.1) Gordons
Trimec Bentgrass Formula (0.3/1/0.13) Gordons
Trexsan (1.0/0.53/0.13) (Sierra)
Trexsam Bent (0.3/1.0/0.13) (Sierra)

2, 4-D + 2,4-DP
Chipco Weedone DPC ester (1/1) Rhone-Poulenc
Chipco Weedone DPC Amine (1/1) Rhone-Poulenc
Turf D + DP (1/1) [ester] Riverdale

2,4-D + 2,4-DP + MCPP
Weedestroy Triamine (1/1/1) Riverdale
Weedestroy Triester (80.7/1.0/0.7) Riverdale

MCPA + MCPP + 2,4-DP
Weedestroy Triamine II (1/1/1) Riverdale

MCPA + MCPP + dicamba
Trimec Encore (1.0/0.46/0.1) [amine] Gordons

2,4-D = 2,4-DP = dicamba
Super Trimec (1.0/1.0/0.25) [ester] Gordons

2,4-D = tricopyr
Turflon D (2/1) [ester] Dow
Turflon II (2.6/1) [amine] Dow

tricopyr + clopyralid
Confront (3/1) [amine] Dow

Broadleaf options

The list of currently available post-emergence broadleaf herbicide combinations has not changed appreciably from last year. In post-emergence broadleaf weed control, manufacturers tend to sell mixtures of two to three herbicides. Thus, when you are applying an herbicide for post-emergence broadleaf weed control, you are usually using at least two different herbicide products.

The only single herbicide product currently sold is MCPP, which has excellent safety on bentgrass and for that reason is used by many golf courses

TABLE 3. Post-emergence grass and sedge control herbicides.

Common Name	Trade Name	Manufacturer
MSMA	Daconate 6	Fermenta
	Drexar 530	Drexel
	MSMA 6.6	Drexel
DSMA	DSMA Liquid	Riverdale
	DSMA Liquid	Drexel
	Methar 30	W. A. Cleary
	Broadside, DSMA 81%	Vertac
AMA	Super Methar	W. A. Cleary
fenoxaprop	Acclaim	Hoechst-Roussel
bentazon (sedges only)	Basagran	BASF

TABLE 4. Difficult to Control Broadleaf Weeds

Weed Problem	Herbicide	Comments
Wild violets (viola spp.)	Turflon Turflon D Turflon II Weedone DPC Super Trimec	Very difficult to control; usually requires follow-up application 1 to 4 weeks after first application.
Creeping speedwell (veronica filliformis)	Dacthal 75 WP Dacthal 6F Turflon D Super Trimec Weedone DPC	Dacthal is an effective control, as are other products listed. There are 12 other speedwell species and difficulty of conrtol varies. These are beginning to become serious turf weed pests.
Ground ivy (Glechoma hederacea)	Turflon D Super Trimec Weedone DPC	Very difficult to control in summer.
Spurge (supina)	Same as above plus Dacthal, PreM, Team	Can control with spring Euphorbia applications of preemergence herbicides.
Oxalis (stricta)	Same as above except Dacthal	Can control with spring Oxalis applications of preemergence herbicides.
Prostrate knotweed (Polygonum aviculare)	Same as ground ivy	Difficult to control in summer.

Esters and amines

Ester and amine control products have different herbicidal properties which are important to know. Amines are soluble in water; esters are oil-soluble. Esters are generally better herbicides than the corresponding amine product. Esters tend to penetrate into the leaf more effectively than do amines.

The reason that esters are not used exclusively is that they are slightly volatile. This volatility can result in non-target injury to susceptible plants in the landscape. Amines, on the other hand, are non-volatile but not as good as herbicides as the esters.

Thus, you use an amine to avoid the risk of injury that comes when you use an ester. Amines should always be used in the spring when plant material is breaking dormancy, actively growing, and very susceptible to these broadleaf herbicides. Esters can and should be used in the summer when weeds are starting to harden off and are less susceptible to the herbicide, and in the fall when non-target plants are hardening off for the winter and are much less susceptible to injury from volatile broadleaf herbicides.

Effectiveness principles

The factors affecting post-emergence weed control are:

- spray deposition;
- absorption;
- translocation.

Spray deposition and retention are very important factors in getting good post-emergence weed control. Several factors are important in determining spray intention, including spray volume, surface tension of the spray solution, the angle of the leaf and the composition of the cuticle.

Higher sprayer volumes tend to generate larger spray droplets which often may not be retained on leaves. Low spray volumes produce smaller droplets which are more readily retained by plant leaves. However, production of smaller droplets increases the likelihood of the spray drifting onto non-target plants.

Spray solutions with high surface tensions, such as water, may bounce off the leaf surface at impact. Spray solutions that have very low surface tensions may run off the leaf surface and result in little spray retention. Thus, an intermediate surface tension is desirable.

Leaf movement

Nyctinasty is the folding movement of leaves with decreasing light intensity and unfolding with increasing light intensity. Nyctinasty could result in decreased weed control from early morning or late evening applications due to a decrease in spray retention by weed species showing this kind of leaf movement.

Another factor which affects spray retention is the composition of the cuticle. The cuticle refers to a layer of wax, cutin and pectin deposited on the leaf surface. The more lipophilic (i.e. waxier) the leaf surface, the more difficult it is to retain water droplets.

Caution with surfactants

Some applicators always add a wetting agent to a herbicide to improve performance. However, this practice is not advised since unexpected results often occur. For starters, most herbicide manufacturers have some kind of wetting agent in their formulation and you don't need to add one.

The label will tell you under what conditions to add a surfactant. For instance, the Acclaim label suggests adding a wetting agent when the crabgrass is under drought stress. Based on the above discussion, one can see that always adding a wetting agent to Acclaim could result in unacceptable injury to the turf by increasing the absorption of the herbicide to phytotoxic levels under non-drought conditions. Thus, always follow label recommendations. **LM**

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