

SUCCESS AND FAILURE IN CONTROLLING CRABGRASS WITH HERBICIDES

Peter H. Dernoeden
University of Maryland, College Park, MD

Crabgrass (*Digitaria* sp.) is one of the most troublesome weeds in turf. The success of crabgrass, as a weed, can be attributed to several factors including the following: the ability of each plant to produce large numbers of seed; the ability of plants to persist through hot, dry environmental conditions, the same conditions which induce summer dormancy in many cool season turfgrasses; an efficient metabolism that enables plants to increase photosynthate production during periods of high temperature and high light intensities, while the capacity of cool season turfgrasses to produce photosynthate decreases; and the ability to rapidly colonize open areas in turf created by the injurious effects of disease, insects, compaction, wear and environmental stress.

Any discussion of weed control should be prefaced by a consideration of how weed problems develop. Perhaps the most significant factor contributing to crabgrass encroachment in turf is poor management, which causes a reduction in turf density. Sunlight is required for germination of crabgrass seed, and also accelerates the germination process by warming soil. Therefore, turfs having poor density are likely to develop crabgrass problems because sunlight will more easily penetrate a thinned canopy of leaves. This is corroborated by the general absence of crabgrass in dense, high cut turfs or turfs grown in shaded environments. Among the most prominent managerial abuses are: mowing too closely; light and frequent irrigation; and late spring-early summer fertilization.

Mowing a turf too closely leads to deterioration of stand density. Observations in a University of Maryland study have shown that tall fescue plots mown at 1 inch contained 70% weeds; whereas, plots mown at 3 inches had only 12% weeds. Hence, by increasing mowing height, weed encroachment can be greatly reduced. Light and frequent irrigations enhance crabgrass seed germination by ensuring that soil remains moistened for extended periods. By allowing soil to dry out between irrigations, crabgrass seed germination is inhibited. Application of fertilizer during late spring and early summer provides nutrients that may benefit weeds more at this time than the turfgrass. Also, application of high levels of nitrogen during this period may predispose turf to injury from heat and drought stress during summer. Other factors such as disease, insects and stress, which cause or contribute to loss of density, promote crabgrass encroachment.

In spite of hard work and strict adherence to sound cultural practices, crabgrass frequently becomes a serious problem. For this reason, use of preemergence herbicides often becomes a necessity. Spring application of a preemergence herbicide is the most effective and easiest approach in controlling crabgrass. Postemergence control involves repeated applications of methanearsonates, e.g., DSMA and MSMA, on critical 5-10 day intervals. These compounds can be phytotoxic, especially when applied during hot weather. A new alternative to the methanearsonates is the herbicide fenoxaprop (trade name = Acclaim). Siduron also provides postemergence control, but only when crabgrass plants are seedlings in the 1 to 3 leaf stage. These herbicides will be more thoroughly discussed below.

PREEMERGENCE CRABGRASS CONTROL

Crabgrass seeds begin germinating when soil temperatures rise above 60°F, and when air temperatures rise above 65°F for five consecutive days. Germination in northern regions generally begins mid- to late May; however, in the transition zone, it can occur as early as mid-March. For a preemergence herbicide to be effective, it must be applied 1-2 weeks prior to germination. Most crabgrass seeds germinate during a 6-8 week period in late spring and early summer, but germination may continue in open or disturbed sites as late as September. Preemergence herbicides kill crabgrass seedlings shortly after germination of the seed. Once substantial populations of seed have germinated, and first leaves have emerged, it is too late, except for siduron, to apply a preemergence herbicide.

Preemergence herbicides provide effective control for several weeks or months, depending upon dosage and product, by forming a continuous herbicide barrier in the soil. Once the barrier has been disturbed, efficacy of the herbicide is reduced or lost. It is therefore essential that cultivation practices, e.g. verticutting, aeration, dethatching, etc., be performed prior to application of a preemergence herbicide. Summer aerification after most crabgrass seed has germinated for the season, however, does not appear to reduce the effectiveness of preemergence herbicides. Overseeding, like cultivation, must be completed and turf established before the herbicide is applied. A notable exception to this rule is Siduron. Siduron, because of its selectivity, can be safely used in the seedbed or on seedling, cool season turfgrasses.

Occasionally, overseeding becomes necessary before the preemergence herbicide has broken down and its activity lost. In this situation, it is better to seed into grooves using a slicer seeder than to broadcast the seed. The grooving operation will help disrupt the herbicide barrier and place the seed below, and out of contact with the herbicide. Some manufacturers recommend applying powdered activated charcoal 7 days prior to overseeding to help deactivate the herbicide.

All preemergence herbicides have been reported by several University researchers to provide good to excellent season-long control of crabgrass using a single application. In Maryland, however, crabgrass seed germinates 3-6 weeks earlier than in more northern regions. For this reason, preemergence herbicides must be applied weeks earlier than in many other regions and higher use rates or a second application are often recommended. The common names, trade names, formulations, recommended rates, minimum time before reseeding and other pertinent information regarding commercially available preemergence herbicides are listed in Table 1. The major reasons for preemergence herbicide failures are listed in Table 2. The procedure and other information relative to application of these herbicides are listed in Table 3.

POSTEMERGENCE CRABGRASS CONTROL

The herbicides and recommended use rates, registered for postemergence annual grassy weed control are listed in Table 4. Test results from Maryland have shown that MSMA controls crabgrass at reduced rates when applications

begin in July. Two applications of MSMA on a 14-day interval at the recommended rate of 2.0 pounds active ingredient per acre (ai/A) effectively controlled crabgrass (99 percent), but caused unacceptable levels of discoloration. Half rates of MSMA (1.0 pound ai/A) applied twice on a 14-day interval provided good crabgrass control (89 percent) without injuring turf appreciably. Half rates of MSMA applied three times on 7-day intervals gave excellent control (99 percent), but turf was badly discolored following the second application. The one-fourth rate (0.5 pound ai/A) applied three times on 7-day intervals gave excellent control (99 percent), but turf was badly discolored following the second application. The one-fourth rate (0.5 pound ai/A) applied three times on 7-day intervals provided a fairly good level of control (79 percent) without causing an objectionable level of discoloration. Overall, the half rate (1.0 pound ai/A) applied three times on 7-day intervals was just as harmful to turf as the recommended rate applied twice on a 14-day interval.

Experience from other studies has shown that MSMA or DSMA applied twice at one-half rate beginning the first week of July is generally very effective because crabgrass is younger and more susceptible to these herbicides. Performance of MSMA and DSMA is erratic, and effective control is often the exception rather than the rule. The key factor in obtaining successful control is to apply these herbicides twice on a 10 to 14 day interval when there is adequate soil moisture to sustain vigorous crabgrass growth. Other very important control factors are listed in Table 6. Ignoring any of these factors will likely result in failure to control and/or severe injury to the turf.

In recent years, Acclaim has been evaluated extensively and has been an effective post-emergence crabgrass and goosegrass herbicide. An important attribute of Acclaim is that complete control of tillered crabgrass can be obtained in a single application as long as weeds are actively growing. The methanearsonates (e.g., DSMA and MSMA) normally control only immature, non-tillering crabgrass in a single application. In most years in the transition zone and northern regions, most crabgrass seed that is going to germinate in a given year has done so by the first week of July or a few weeks earlier in southern regions. It is conceivable that a well-timed herbicide application after most crabgrass seed has germinated, may eliminate crabgrass as a problem for the remainder of the season. To test this possibility, single applications of MSMA and Acclaim were made on three dates in 1984 (Table 5).

When Acclaim was applied on June 13, the 0.18 pound ai/A (i.e. 23 fluid ounces per acre) rate controlled existing crabgrass, but only 62 percent control (determined in September) shows up in Table 5 because more seed germinated after herbicide application. The low rate of Acclaim (0.12 pound ai/A) and both rates of MSMA (1.0 and 2.0 pounds ai/A) were ineffective against young crabgrass because sufficient levels of herbicide failed to contact the crabgrass, which was below the turfgrass canopy (and therefore protected) on June 13. When Acclaim was applied on July 2 and July 16, excellent crabgrass control was obtained (91 to 100 percent) when plots were rated in September. This showed that no significant levels of crabgrass seed had germinated after July 2, despite frequent periods of rain in July and August of that year.

Other tests have shown that single applications of Acclaim will control

crabgrass in August if there is adequate soil moisture. MSMA applied only once on July 2 or 16, rather than in multiple applications, did not effectively control crabgrass. Acclaim has reduced effectiveness on heat- and drought-hardened crabgrass, and effective control is dependent on the control factors listed in Table 6.

Table 1. Rate, formulation and other information about preemergence herbicides.

Common Name	Trade Name(s)	Recommended Rate (lb ai/A)	Formulations	**Minimum Time Before Reseeding (weeks)	Comments
Benefin	Balan	2.0 - 3.0	G	6	Not recommended for use on fine fescues or bentgrass turf. Use on established turf only.
Bensulide	Betasan Pre-san Lescosan Betamec Others	7.5 - 10.0	G, EC	16	Safe to use on all turfgrasses. Use on established turf only. Performance may be erratic, especially in transition and southern regions.
DCPA	Dacthal	10.5	G, WP	8	Not recommended for use on fine fescues or bentgrass turf. Use on established turf only.
Oxadiazon	Ronstar	3.0 - 4.0	G, WP	16	Not recommended for use on fine fescue or bentgrass turf. Use on established turf only.
Pendimethalin	Lesco PreM Turf Weedgrass Control	1.5 - 3.0	DG, G	16	Do not use on bentgrass or where <u>Poa annua</u> is the desired species. On new seedings, wait until grass has been mowed at least 4 times and has filled in. Do not apply more than twice per year. Keep off cement, stone, clothing and shoes.
Prodiamine	Blockade	0.50 - 0.75	WDG	16	Not recommended for use on bentgrass turf. Use on established turf only.
Siduron	Tupersan	2-6 for Seedling turf 8-12 for Established turf	G, WP	N/A	Not recommended for use on bermudagrass or on several cultivars of bentgrass. May be applied at time of seeding or on seedling turf. Provides postemergence control of crabgrass in the 1-3 leaf stage.

Table 2. Major reasons for the failure of preemergence herbicides.

Herbicide applied after weed seed had begun to germinate.

Herbicide was not watered-in within 72 hours of application and efficacy was reduced by light or microbial decomposition of the active ingredient.

Failure to re-apply short residual herbicides such as Balan, Dacthal and Team six to seven weeks following the initial application in transition of southern regions.

Spring drought, which delays weed seed germination, followed by rain in late June, July or August after herbicide residual has dissipated.

Improper sprayer or spreader calibration and poor uniformity in herbicide application.

Disruption of the soil surface, especially divots. Disruption of the soil surface by summer aerification does not appear to reduce herbicide effectiveness.

Table 3. The procedure for applying a preemergence herbicide and other information.

Apply at the recommended rate and be aware of sensitive turfgrass species (Table 1).

Apply 1-2 weeks prior to crabgrass seed germination. Early spring, when soil temperature rises above 60F. Consult extension specialist from your region for best timing.

For uniformity of coverage, apply half the needed material in each of two directions at right angles.

Apply prior to a rainstorm or irrigate with 1/4" of water within 2-3 days of herbicide application.

After application, do not disturb the soil surface by cultivation practices. Sporting events that result in divots in the soil surface may contribute to reduced efficacy of a herbicide.

Reapplication of some products (e.g., benefin, DCPA, and pendimethalin), 5 to 7 weeks after the initial application, may be necessary to provide season-long control of crabgrass in transition and southern regions. This may also apply when a two to four week drought follows a herbicide application.

Table 4. Herbicides for postemergence control of annual grass weeds in cool season grasses.

Common Name	Trade Name(s)	Recommended Rate (lb ai/A)	Formulations	Comments
DSMA	DSMA Slurry, Methar 30, Versar DSMA-LQ Weed-E-Rad 360	2.0 - 3.8	L	Methanearsonates are primarily used to control crabgrass, but may provide good control of immature dallasgrass, goosegrass and nutsedge. Do not use on bentgrass, St. Augustinegrass or centipedegrass. Other methanearsonates include CMA (Calar) and AMA (Super-Dal-e-Rad). Use lowest rate listed and apply twice on a 7-14 day interval.
MSMA	Daconate 6 Dal-E-Rad Versar 600 Weed-E-Rad Weed-Hoe	1.0 - 2.0	L	Methanearsonates are primarily used to control crabgrass, but may provide good control of immature dallasgrass, goosegrass and nutsedge. Do not use on bentgrass, St. Augustinegrass or centipedegrass. Other methanearsonates include CMA (Calar) and AMA (Super-Dal-e-Rad). Use lowest rate listed and apply twice on a 7-14 day interval.
Fenoxaprop	Acclaim	0.12 - 0.50	EC	Controls crabgrass, fall panicum, foxtails and goosegrass. May stunt or discolor Kentucky bluegrass if applied prior to July. Safe to use on perennial ryegrass, tall and fine fescues, and zoysiagrass. Must have good soil moisture and actively growing weeds to be effective in a single application. Apply Acclaim with flat-fan nozzles. Acclaim applied with flood-jet nozzles or in back-pack sprayers may provide erratic levels of control.
Siduron	Tupersan	2.0 - 6.0 for seedling turf; 8.0 - 12.0 for established turf	WP, G	Provides postemergence control if crabgrass is in the 1-3 leaf stage.

Table 5. Effectiveness of Acclaim and MSMA in post-emergence control of crabgrass in a single application.

Herbicide	Rate (lb ai/A)	Date Applied* (day)	Crabgrass Control** (%)
Acclaim	0.12	June 13	37
Acclaim	0.18	June 13	62
MSMA	1.0	June 13	18
MSMA	2.0	June 13	7
Acclaim	0.18	July 2	91
Acclaim	0.25	July 2	98
MSMA	2.0	July 2	44
Acclaim	0.25	July 16	99
Acclaim	0.40	July 16	100
MSMA	2.0	July 16	42

* On June 13, crabgrass was in 1- to 3-leaf stage and below the canopy; on July 2, crabgrass was in the 2- to 4-leaf stage and above the canopy; and on July 16 crabgrass was in the 4-leaf to 2-tiller stage.

** Control was based on crabgrass cover in each treated plot divided by the mean crabgrass cover in untreated plots on Sept. 11, 1984.

Table 6. Factors necessary to obtain effective control of annual grasses with post-emergence herbicides.

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1. Adequate soil moisture is necessary before and after herbicide application.
 2. The weeds in the turf must be actively growing.
 3. The first application should be made when weed leaves are above the turf canopy.
 4. Apply methanearsonates (i.e., DSMA, MSMA, etc.) on 7- to 14-day intervals.
 5. Be sure no rainfall is to occur and do not irrigate for 24 hours after applying a methanearsonate. Do not irrigate before Acclaim dries on the leaf surface.
 6. Do not mow 48 hours before or after herbicide application.
 7. Apply MSMA or DSMA when air temperatures range from 85 to 90F. Acclaim is effective when air temperature ranges from 70 to 95F.
 8. Herbicides will not provide effective control when weeds are under heat or drought stress or in late summer after weeds have matured and have begun to produce seed.
 9. Post-emergence herbicides (other than siduron, which has some post-emergence activity against crabgrass) have no pre-emergence activity and repeat applications are necessary as long as weed seed continued to germinate.
 10. Properly calibrate the sprayer and never exceed the recommended rate.
 11. Acclaim should be applied in 30-60 gallons of water per acre with flat-fan nozzles. Flood-jet nozzles or application in backpack sprayers may result in erratic levels of control.
 12. Do not tank mix Acclaim with a broadleaf herbicide. Do not apply Acclaim within five days of a broadleaf herbicide.
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