

The WEED CONTROL GUIDE is updated and published each March. This year Dr. Euel Coats, associate professor of weed science at Mississippi State University, and Dr. Elton Smith, professor of horticulture at Ohio State University, improved the Guide from last year. Considerably more attention has been given to weed control in non-turf areas and to warm-season turf weed control. O.M. Scott & Sons contributed the use of its weed identification drawings. The Weed Control Quiz illustrations are courtesy of the New York State Turfgrass Association.



In this Guide, the focus will be on the primary target weeds and the products or practices that most effectively control them. It is a collection of current herbicide usage information as reported by two weed scientists. A separate section on landscape weed control follows the section on turf weed control. Herbicide labels, as well as your university weed control specialists, are sources of additional specific information.

Weeds

Proper identification of weed species enables the landscape manager to time preemergence and postemergence applications correctly and use the most effective herbicide for that particular weed.

Many of the weed problems a landscape manager faces are solved by knowing the weed history of the area. Records should be kept to show what weed species are indigenous to the area and, consequently, what weed seeds are present in the soil and are likely to appear year after year in problem proportions.

If a weed problem develops which doesn't conform to the history, the weed seed was brought into your area in soil, seed, or another carrier. By using identification illustrations, the new problem weed can be classified for control.

All plants can be classified as either annual, biennial or perennial.

Annuals complete their life cycle in one growing season. They are further subdivided into summer annuals and winter annuals. Summer annuals germinate in the spring or summer and complete their life cycle during the warm growing season. Winter annuals germinate in the fall, complete their life cycle during the winter, and die in the early part of the next growing season. Annual bluegrass, henbit, and common chickweed are examples of winter annuals. Large crabgrass and goosegrass are summer annuals.

Efficiency and economy are two very important factors in landscape weed control today. Understanding the details of each part of a weed management program contributes to the efficiency of the whole program.

Rarely do herbicides alone completely eliminate, or maintain at acceptable levels, the weeds in turf or landscape. Chemical control without adequate fertilization, disease control, irrigation, and soil conditions is ineffective and very short term. The best aid to control is a healthy, vigorous turf and landscape.

Weed control with herbicides in warm season turf is rather complex primarily because the number of species and cultivars. There are at least six turfgrasses used in the Southern United States; bahiagrass, bermudagrass, carpetgrass, centipedegrass, St. Augustine, and zoysia. Two of these, bahiagrass and carpetgrass, are often weed problems in the other Southern turfgrasses.

Dichondra can be added to the list but it is limited to areas of the Southwest that are irrigated. In the Southeast, dichondra is almost exclusively a weed problem.

A few species of cool-season

turfgrasses are used in the South, maintained for the most part as annuals and used in overseeding programs for color during the dormant season. These include annual and perennial ryegrass, rough bluegrass, creeping bentgrass and red fescue. The Southern landscape manager may require weed control programs for both warm season turf and the overseeded cool-season turf.

Turfgrass species are often mixed in cool-season turf. Mixtures of Kentucky bluegrass, perennial ryegrass, and red and chewings fescues are standard. Tall fescues, including dwarf and fine-leaved tall fescues, are the backbone of many utility turfs. The bentgrasses (creeping and colonial) are used primarily for specialty turf such as golf greens. Chewings fescues and an increasing degree of sheep fescue are working their way into cool-season turf programs.

Woody ornamentals and annual plantings are even more complicated than turfgrasses owing to the large number of species and varieties. It is important to consider the effects of soil amendments, particularly organic matter, on herbicide effectiveness in ornamentals.

Turf Weed Identification

Germination of weed seed will occur only if the necessary environmental conditions exist; moisture, temperature, light, oxygen, etc. One significant aspect of the control mechanism of germination is each particular weed species has a definite and predictable pattern of germination. This is known as periodicity. Few species germinate freely throughout the year.

Characteristically, a large percentage of the seed of a given species will germinate when the conditions for germination are first met, with subsequent lower germination throughout the remainder of the growing season. Annual bluegrass, henbit, common chickweed, and clovers usually fit this category. Other species such as large crabgrass and goosegrass tend to germinate freely after the initial flush of seed germination.

Biennials and perennials germinating from seed also exhibit periodicity. They are treated as annuals when preemergence control is applicable.

Biennials require two years to complete their life cycle. In the first year, plants of this type form rosettes (radial clusters of leaves growing close to the soil) and during the second year they send up flower stalks and produce seed.

Perennials live for more than two years and are especially difficult to control because they reproduce by vegetative means as well as by seed. Dallisgrass, torpedograss, dandelion, wild onion, wild garlic, and nutsedges are among the more commonly occurring perennial weeds.

Once established, control of perennials becomes increasingly difficult. Perennials germinating from seed are not significantly different from annuals. However, perennials are established before the problem is usually recognized.

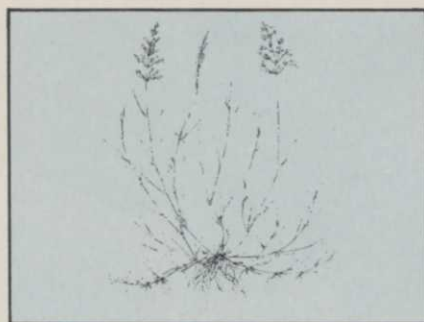
Perennials spread from specialized vegetative structures both above and below the soil surface. Effective selective control of established plants can be obtained only

with postemergence herbicides that will translocate to these reproductive structures.

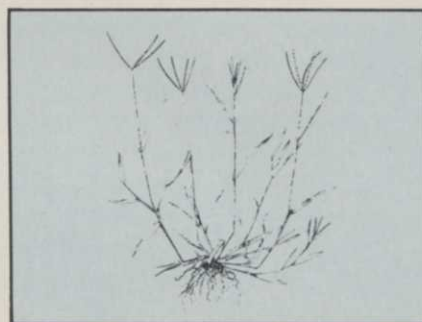
A second distinction important to weed control is whether the weed is a grass (monocot) or broad-

leaf (dicot). Herbicides are often selected by how they disrupt the life processes of either grasses or broadleaf weeds. The effectiveness of these herbicides depends greatly upon this distinction.

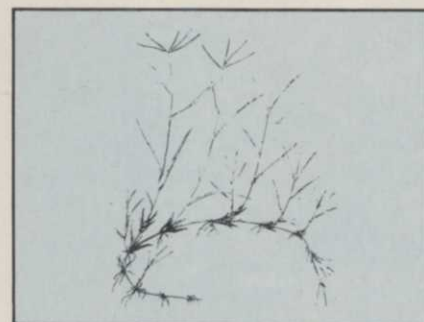
Grasses



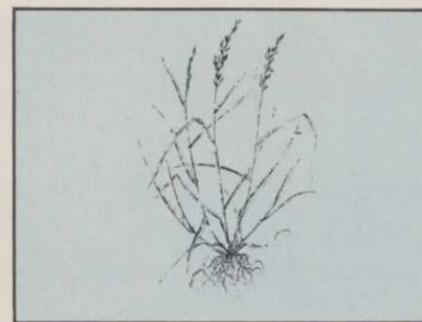
Bentgrass - A desirable grass in certain locations, creeping bentgrass can encroach on cool season turf consisting of Kentucky bluegrass, perennial ryegrass, and fine fescues. Bentgrass has extremely small seed and is a major target of seed producers during seed cleaning for certification. It is extremely difficult to treat lawns to remove bentgrass.



Crabgrass - The predominant target of many turf weed control programs, crabgrass spreads by seed and by rooting at lower nodes (where stem and leaf join). This pale green grass forms dense patches damaging the appearance of a lawn. This annual grass can be controlled to great degree with preemergence herbicides.

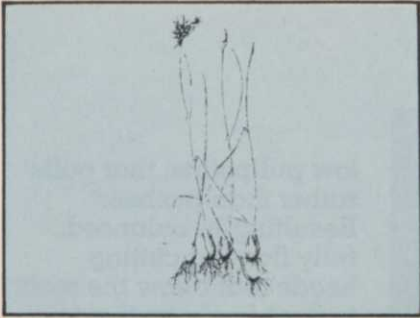


Bermudagrass - Like bentgrass, bermudagrass encroaches on other desired turfgrasses. A desirable turfgrass for the South, bermudagrass can be a problem in cool-season turf. This extremely hardy grass can outperform other warm-season turfgrasses. It spreads by stolons and rhizomes. Bermudagrass turns brown early in the fall in cooler climates while other grasses remain green.

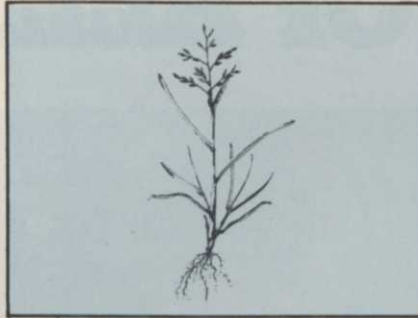


Tall Fescue - A coarse, hardy bunch grass often planted for utility turf. This perennial sends down roots far below other cool-season turfgrasses and consequently exhibits drought tolerance. Tall fescue can withstand poor soils and has a low fertilization requirement. These characteristics have caused researchers to develop finer bladed selections for lower maintenance lawns. It is difficult to eliminate from stands of other turfgrasses.

Turf Weed Identification



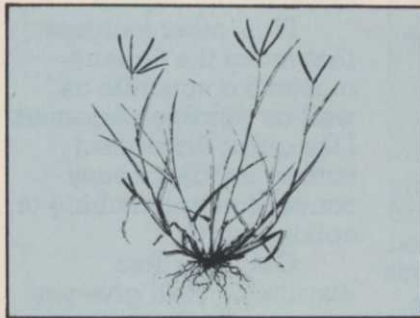
Wild Garlic - This perennial monocot is not a grass and spreads not only by seed, but from above and below ground bulbets. Control must stop germination of seed AND kill the bulbets.



Poa annua - Persistent seed-heads and blotches of summer-killed annual bluegrass make this a weed in the summer in the north and in the winter in the South. This weed thrives in well-fertilized, irrigated, and low cut turf. Its light green color and white seedheads are easily spotted.

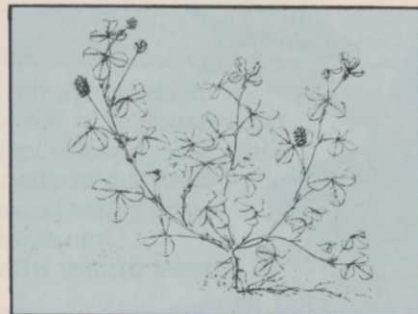


Quackgrass - This perennial grassy weed spreads vigorously by rhizomes and is extremely hard to control. Spot treatment with nonselective herbicides is often the only solution. Quackgrass is usually present when topsoil came from rural areas, such as in new lawns.



Goosegrass - This annual grass takes advantage of exposed areas with compacted soil. Postemergence treatments work best on this wiry grass.

Broadleaf Weeds

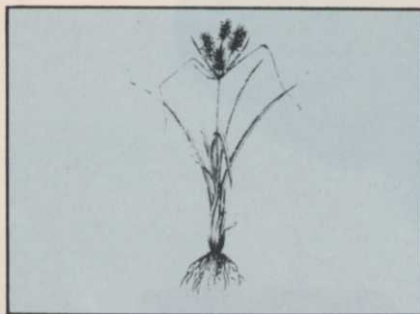


Black Medic - Occasionally confused with clover, black medic is an annual legume. It is common throughout the U.S. and has small yellow flowers.

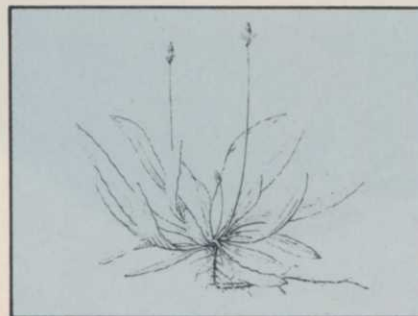
This perennial resembles plantain.



Common Chickweed - This annual spreading weed of shady, moist areas has a white flower and light green foliage.



Nutsedge - Yellow nutsedge is a major weed problem of turf. The perennial weed reproduces both from seed and underground tubers. The yellow color makes it stand out. Systemic herbicides are required to kill the tubers.

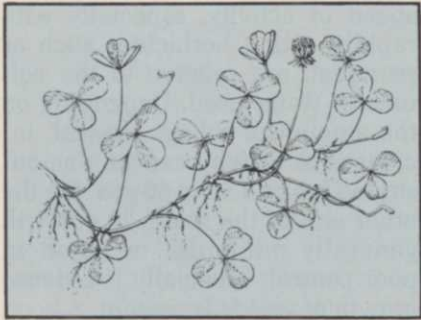


Buckhorn - Present in many low budget lawns and mow-only turf areas of parks. Buckhorn has a tap-root that defies hard weeding.



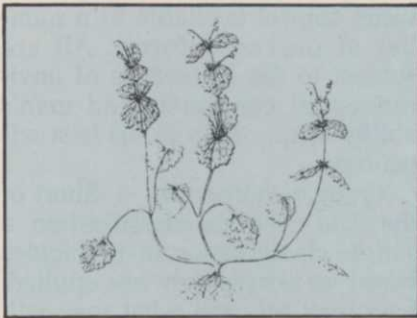
Mouse-Ear Chickweed - The

perennial version of chickweed prefers open sun and also has white flowers.

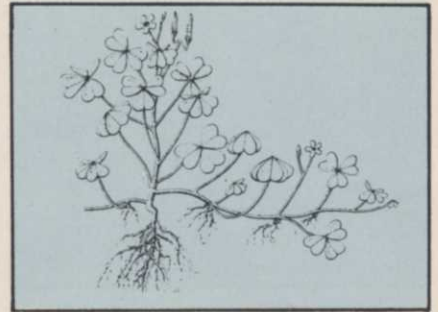


Clover - This perennial broadleaf embarrasses turf managers with large pink flowers in the spring and tan patches of dead foliage in the summer.

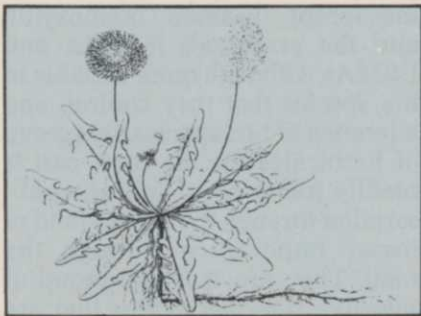
gressive spreader hugs the ground and produces a purple flower.



Henbit - Taller than ground ivy, despite purple flowers and scallop-shaped leaves, henbit is a winter annual most noticeable in early spring.



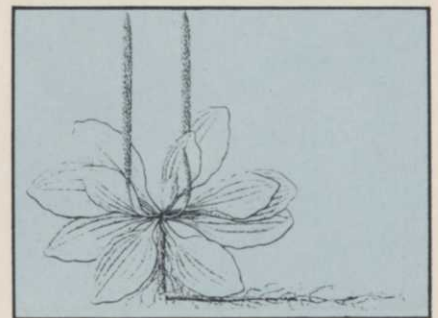
Oxalis - This perennial broadleaf spreads by rooting at the nodes and by seed from pods following flowering. Small yellow flowers mature into long, narrow seedpods. Selective control is ineffective.



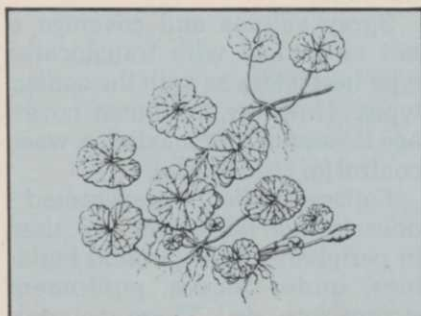
Dandelion - This perennial is famous for its taproot and yellow flower which later becomes a puffy seedhead in late spring.



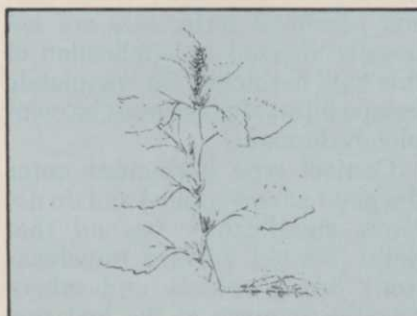
Heal-All - This hairy-leaved perennial is common in new and poorly maintained lawns throughout the U.S. It can spread beneath the level of mower blades.



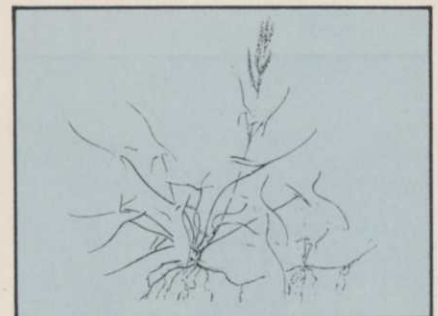
Plantain, broadleaf - Hosta-like leaves of this perennial surround tall purple stalks containing seeds. The leaves, unlike hosta, lay flat on the surface of the soil.



Ground Ivy - This perennial can dominate in poor, shady soil. A member of the mint family, this ag-



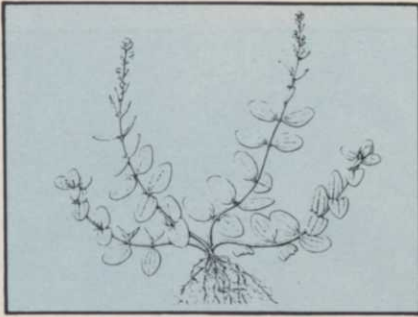
Lambsquarter - A summer annual of large size if not mowed. Foliage is bright light green.



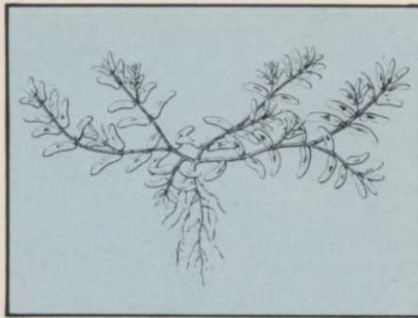
Red Sorrel - This tenacious perennial has arrow-shaped leaves and spreads by roots and rhizomes. It can quickly overtake desirable turf weakened by acid soil. Alkaline soils can discourage Red Sorrel from getting established.

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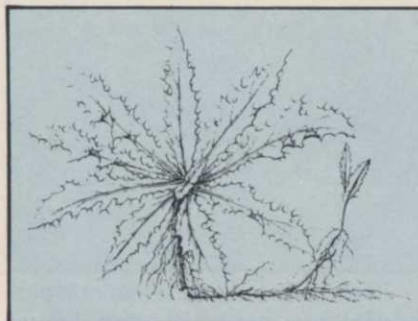
Turf



Speedwell - There are both annual and perennial members of this weed family. White to purple flowers bloom above heart shaped seedpots. Spot treatment is often the only control once established.



Spurge - The leaves of spurge contain a spot in the center of the upper surface. The seed of this heavy producer germinates in early spring. The spreading branches of this annual contain a milky substance.



Sow Thistle - This annual has flowers similar to dandelion but its leaves have spines on the edges and deeper indentations. Selective control is effective.

Herbicides

Herbicides are chemicals used to kill or inhibit the growth of plants. There are many kinds of herbicides for general and specific weed control available in a number of packaged forms. All are subject to the influences of environmental conditions and man's ability to use them to his best advantage.

Types of herbicides — Short of the rigid chemical classification, a simple classification of herbicides based on where they are applied, how they act, and what they will control is perhaps most useful.

I. Foliage Applied

A. Contact

1. Selective
2. Nonselective

B. Translocated

1. Selective
2. Nonselective

II. Soil Applied

A. Short residual

1. Selective
2. Nonselective

B. Long residual

1. Selective
2. Nonselective

Foliage applied - contact - selective herbicides are of little importance in turf or landscape.

Foliage applied - contact - nonselective herbicides used in turf landscape include paraquat and cacodylic acid (Phytar 560). These herbicides will kill all green and growing foliage contacted by spray solutions. Foliage of plants such as dormant bermudagrass, zoysiagrass, and other warm season perennial turfgrasses are not usually affected by application of this type herbicide. To completely escape injury, foliage must be completely dormant.

Contact type herbicides enter the plant where applied and do not move significantly beyond that point (limited upward translocation). Spray volume and subsequently coverage of the leaf surface of the target plants is very critical for maximum control. Extremely low volume applications

will often result in inadequate coverage and will kill the upper layer of the foliage canopy. Regrowth occurs in a comparatively short period of time.

With contact herbicides increases in control and possibly in speed of activity, especially with rapidly acting herbicides such as paraquat, are relative to the volume of water used. Depending on the amount of foliage present, increases in activity can be demonstrated beyond 50 to 60 gpa. On the other end of the scale, 20 gpa will generally minimize, or result in poor control, especially if a dense growth of weeds is present. A good compromise is perhaps 30 to 40 gpa.

Foliage applied - translocated - selective herbicides are absorbed into and move to points beyond the point of entry and kill plants. The most common herbicides in this group are the phenoxys (2,4-D, mecoprop), dicamba, bromoxynil, and the arsenicals (MSMA and DSMA). Although quite variable in the species that they control, and tolerance of turf species, this group of herbicides for the most part is readily translocated following absorption through the foliage (and of lesser importance through the root). They are the only group of selective type herbicides that are effective on perennial weeds. They are more effective than contacts since translocation (downward) of the herbicide to reproductive structures can take place following uptake by the foliage of the plant.

Spray volume and coverage is not as critical with translocated type herbicides as with the contact types. However, adequate coverage is essential for maximum weed control (of 30 to 40 gpa).

Foliage applied - translocated - nonselective herbicides are used in peripheral areas (around buildings, under fences, equipment storage lots, etc.). These materials are applied to the foliage of the target species and generally control

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Turf

all weed species present. Many of the foliage applied translocated selective herbicides above may become non-selective at extremely high rates. More often than not at higher rates they behave as contact type herbicides.

More pertinent examples of these foliage applied-translocated non-selective herbicides are dalapon (Dowpon), amitrole, and glyphosate (Roundup). In many respects, although somewhat of an oversimplification, this group of herbicides differs from the translocated-selected types only in that they are nonselective.

Soil applied - short residual - selective herbicides include the widely used preemergence herbicides DCPA, benefin, bensulide, atrazine, simazine, and pronamide. Pronamide and simazine applied to the soil also control established annual bluegrass (post-emergence). Maximum residual activity of these herbicides is a matter of weeks to a few months as compared to the long term residual herbicides in which control for several months would be expected.

Application technique, as with all types of herbicides, is important. While volume of spray solution is not as critical as with postemergence herbicides, even distribution is necessary for uniform effective control. These herbicides (preemergence) represent our best approach to the control of annual and biennial or perennial weeds germinating from seed. Where effective, these herbicides eliminate the competition effects that are encountered from the time of germination to the time of control where postemergence herbicides are also used.

Soil applied - short residual - non-selective herbicides are the temporary soil sterilants. They are usually referred to as fumigants and include methyl bromide and metham (Vapam). They are active in the vapor forms. Methyl bromide is a gas at atmospheric pres-

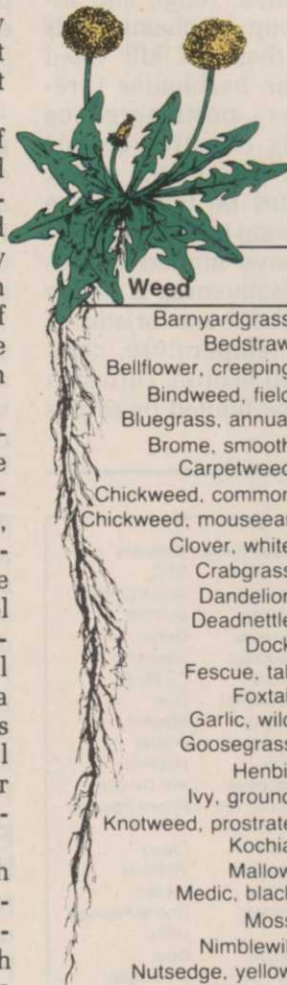


CHART 1
Growth and treatment periods

Weed	SPRING			SUMMER			FALL			WINTER		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Barnyardgrass												
Bedstraw												
Bellflower, creeping												
Bindweed, field												
Bluegrass, annual												
Brome, smooth												
Carpetweed												
Chickweed, common												
Chickweed, mouseear												
Clover, white												
Crabgrass												
Dandelion												
Deadnettle												
Dock												
Fescue, tall												
Foxtail												
Garlic, wild												
Goosegrass												
Henbit												
Ivy, ground												
Knotweed, prostrate												
Kochia												
Mallow												
Medic, black												
Moss												
Nimblewill												
Nutsedge, yellow												
Pigweed, prostrate												
Plantain												
Puncturevine												
Purslane, common												
Quackgrass												
Sanbur												
Shepherdspurse												
Sorrel, red												
Speedwell												
Spurge, prostrate*												
Thistle, Canada												
Thistle, musk												
Vervain, prostrate												
Violets												
Waterleaf (nyctelea)												
Woodsorrel, yellow												
Yarrow												

— Active period of plant growth. Varies from year to year and from north to south.

— Apply preemergence chemicals.

— Apply postemergence treatments. Approximate periods may vary two weeks from season to season. Use granular or wax bar formulations of 2,4-D, Banvel D, Silvex, and 2,4,5-T from late spring through early fall.

* Preemergence herbicide applications should be made a second time in late June or early July.

sure while metham, although formulated in liquid form, is converted to a toxic gas in the soil. Because of their volatile nature, both compounds require some kind of sealing to prevent evaporation into the atmosphere. Methyl bromide must be applied under a gas-tight cover (usually plastic) while vapam can be sealed by watering (irrigation), although weed control is more consistent if the soil is sealed with plastic following application.

Both herbicides are excellent for killing vegetative structures of perennial plants such as bermuda-

grass, nutsedge, and torpedograss and are effective on a large number of weed seed, fungi, and insects. This group of chemicals is the only one that will kill weed seed. All other herbicides (pre-emergence or postemergence types) are only effective against germinating or germinated seeds, i.e., growth must be taking place for this latter group to be effective.

Fumigants have limited usefulness. Their effectiveness is highly dependent on the characteristics of soil moisture, temperature, compaction, and soil texture. Diffusion of vapors can be limited by excess

moisture and/or compacted soils. And fumigants are extremely expensive. However, in certain turf establishment situations there is no alternate to these herbicides.

Soil applied - long term residual - selective and non-selective. Both groups will be combined in this discussion. Although certain examples could possibly be given of the selective type, for the turf user this group constitutes the non-selective soil sterilants. Their use is very limited in turf facilities and specifically are used in peripheral areas (to the turf or ornamentals where total vegetation control is desired and are usually effective for several months.

Bromacil (Hyvar®), karbutylate (Tandex®) and borate compounds are just a few examples of soil sterilants. These are active via the soil. Several mixtures of these and other compounds containing materials such as amitrole to give quick foliage kill are also available. Lateral movement of soil sterilants into turf areas can be a significant problem.

Factors Affecting Herbicide Activity

Most herbicidal failures aren't failures of the herbicide. Conditions (temperature, moisture, timing, application method, herbicide selection, etc.) are usually responsible for most "failures" we hear about. If we understand the conditions necessary for maximum effectiveness of a herbicide, many of the variables contributing to "failure" can be minimized.

To be most effective, herbicides must be applied at the appropriate time in relation to germination or growth of the target species. Herbicides may be applied in a number of ways but basically for applications to turf we are dealing with those that are applied directly to the target weed (post-emergence) and those that are applied to the soil (pre-emergence). In both cases we are making applications in es-

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Herbicides and Manufacturers

Chemical	Brand Name	Company	Chemical	Brand Name	Company
amitrole	Amitrol-T	Union Carbide	Ethofumesate	Prograss	BFC
asulam	Asulox	Phone Poulenc	fenac	Fenatrol	Union Carbide
atrazine	Atratol	Ciba Geigy	fosamine	Krenite	Du Pont
benefin	Balan	Elanco	glyphosate	kleenup	Ortho
bensulide	Betamec	P.B.I. Gordon		Roundup	Monsanto
	Betasan	Stauffer	linuron	Lorox	Du Pont
	Pre-San	Mallinckrodt	methyl bromide	Dowfume	Dow
bentazon	Basagran	BASF	metham	Vapam	Stauffer
bromacil	Hyvar	Du Pont	metribuzin	Sencor	MoBay
bromoxynil	Brominal	Union Carbide	monuron	Urox	Hopkins
cacodylic acid	Phytar	Crystal	MCP	Mecomec	PBI Gordon
chloramben	Amiben	Union Carbide		Chipco Turf Herbicide	Rhone Poulenc
chlorpropham	Furloe	PPG		MCP	Cleary
dalapon	Dalapon	Diamond Shamrock	MSMA	Weedhoe	Vineland
dazomet	Mylone	Hopkins	oryzalin	Surflan	Elanco
DCPA	Dacthal	Diamond Shamrock	oxadiazon	Ronstar	Rhone Poulenc
dinoseb	Premerge 3	Dow	paraquat		Ortho
	Dynamyte	Drexel	picloram	Tordon	Dow
Devrinol		Stauffer	prometon	Pramitol	Ciba Geigy
dicamba	Banvel	Velsicol	pronamide	Kerb	Rohm & Haas
dichlobenil	Casoron	Thompson Hayward	siduron	Tupersan	Du Pont
diphenamid	Enide	Tuco/Upjohn	simazine	Princep	Ciba Geigy
DSMA		Crystal	tebuthiuron	Spike	Elanco
dinitrophenol	Dinitro	Thompson Hayward	trifluralin	Treflan	Elanco
diuron	Karmex	Du Pont	triclopyr	Garlon	Dow
diquat	Ortho Diquat	Ortho	Vorlex		Nor-Am
endothall	Endothall	Pennwalt			
EPTC	Eptam	Stauffer			
Combinations					
Amizine		amitrol and simazine		Union Carbide	
Banvel plus		dicamba and 2,4-D		Velsicol	
Broadside		dicamba and 2,4-D, dalapon		Velsicol	
Chlorea		MSMA and cacodylic acid		Crystal	
		diuron, sodium chlorate, sodium metaborate		Rhone Poulenc	
Fenamine		amitrole, fenac, atrazine		Union Carbide	
Hopkins Rout G-8		bromacil and diuron		Hopkins	
Krovar		bromacil and diuron		Du Pont	
MonDak		MSMA and dicamba		Velsicol	
Pramitol 5PS		prometon, simazine, chlorate		Ciba Geigy	
Tordon		picloram and ammonium sulfate		Dow	
Trimec		2,4-D, MCP, and dicamba		PBI Gordon	
Urox		monuron and TCA		Hopkins	
Vegemec		prometon and 2,4-D		PBI Gordon	
Weedmaster		dicamba and 2,4-D		Velsicol	
Weedone		dichlorprop and 2,4-D		Union Carbide	

tablished turf and, consequently, this application is also made directly to the turf. In the case of preemergence herbicidal applications either supplemental irrigation or natural rainfall are employed to wash the herbicide from the turf foliage and get it to the soil surface and into the soil. Rainfall and/or irrigation are detrimental to the effectiveness of a postemergence herbicide immediately following an application. An understanding of the factors influencing the efficiency of both preemergence and postemergence herbicides is certainly helpful in explaining results obtained and maximizing the control obtained with herbicides.

Preemergence applications: Application of a herbicide before weed seed germinate. Preemergence herbicides are not effective against perennial weeds or established annuals. To be effective, herbicides must be applied uniformly over the area. Their action is exerted only during or after germination as growth commences. Therefore, application to a dry soil severely reduces the effectiveness of preemergence herbicides unless moisture is added soon after treatment. Time of application must correspond to periods of germination. If annual bluegrass germinates starting September 1, an application of a preemergence herbicide such as DCPA, benefin, or bensulide on December 15 will be of little value. In contrast, if goosegrass germinates June 1, then a March 15 application will probably be ineffective. The residual level of the herbicide at this time would be too low to give control.

Postemergence applications: Application after weed seed have germinated or broken through the soil surface. The herbicide is applied to the foliage of the weed plant. Postemergence herbicides act as contact or as systemic (absorbed and translocated) herbicides. Contact herbicides act rapidly while translocated herbicides

usually require several days for their phytotoxic action to be observed. Translocated types usually kill the entire plant while contact types kill only the contacted part of the foliage.

Best results will usually be obtained with postemergence herbicides if plants are young, actively growing and the temperature is above 70 F. Foliar applied herbicides are less effective if soil is dry. Consult label for growth stage and environmental conditions for best results with a given herbicide.

Surfactants are frequently recommended for use with postemergence herbicides. For consistent results use nonionic agricultural surfactants, sold specifically for use with herbicides.

Selection of Herbicide and Formulation

Two or more herbicidal products may be equally effective in a given weed situation. Also the same chemical may be available in a variety of commercial formulation trade names.

Your selection of herbicide and formulation will be determined by (1) the weed species involved, (2) the availability of the herbicide, (3) type of equipment at your disposal, (4) established residue tolerances, (5) hazards to humans, domestic animals, wildlife, and desirable plants, (6) relative total costs of materials and application, and (7) time of application.

All recommended rates of application are based on either active ingredient (most chemicals) or acid equivalent. Different commercial products vary in the percentage of active ingredient or acid equivalent. The label will give you the exact amount of weed-killing chemical present in the container. It is wise to figure the price of an available chemical on the basis of its active ingredient or acid equivalent. For example, Herbicide X can be obtained in liquid formulations varying from 6 pounds to less than 1 pound acid equivalent per gal-

lon. Usually, the more concentrated products are more economical on a per acre basis.

Granular formulations of many herbicides are also available. In comparison to sprays, granular herbicides offer both advantages and disadvantages. Some of the advantages are: simpler application - no water or mixing required, less drift, and a tendency toward longer activity in the soil. The problem of accurate calibration of granular equipment and the slightly higher per-acre cost of granular herbicides may offset these advantages. The range of concentration, particle size of product, and varying rates of application complicate calibration. More concentrated materials are usually more economical but errors in calibration are more critical. Calibration charts are supplied by manufacturers of granular applicators.

Control Strategy For Warm Season Turf

Comments in this section will be restricted mainly to weed control in bermudagrasses. Zoysia, bermudagrass, centipedegrass and St. Augustine vary in their susceptibility to both preemergence and postemergence herbicides. However, it is possible in most cases to discuss bermudagrass and zoysiagrass as a group and include centipedegrass and St. Augustine in a second group. In general, herbicides that can be used on bermudagrass can be used safely on zoysiagrass. Centipede and St. Augustine are similar in their tolerance to herbicides.

Winter grass weeds

Annual bluegrass is by far the most severe grassy weed infesting southern turf areas during the late growing season through the dormancy period and into the early growing season. It occurs in all turf environments. Aside from decreasing the aesthetic value of turf, the primary objection to annual bluegrass is its rapid die-back in

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late spring. Bermudagrass coverage is usually slow following fade out of annual bluegrass leaving large sections of bare ground exposed. Other weeds, such as goosegrass, tend to move into bare areas.

Annual bluegrass control with preemergence herbicides is usually accomplished with either benefin, bensulide, DCPA, Pronamide, simazine, or terbutol. Two applications may be necessary during the dormant season for acceptable control except with Pronamide or simazine.

Pronamide has shown excellent potential for either preemergence or postemergence control of annual bluegrass in bermudagrass.

There are two choices for annual bluegrass control on bermudagrass greens overseeded with perennial

ryegrasses. Bensulide may be applied prior to overseeding. Ethofumesate may be applied 15-30 days after overseeding. Check both labels for timing to avoid delaying spring transition.

A third approach, employed particularly on many golf courses, is to use a postemergence application of a non-selective herbicide such as paraquat or cacodylic acid prior to breaking of dormancy. This usually does an excellent job on annual bluegrass as well as those annual broadleaved weeds present. Injury is often encountered if application is delayed until the bermudagrass starts breaking dormancy. The degree of injury is dependent on the amount of green foliage present at the time of application.

Winter broadleaved weeds

Important broadleaf weed spe-

cies include: common chickweed, henbit, clovers, spurweed, mouse-ear chickweed, lawn burweed, common dandelion, wild onion, wild garlic, plaintains, and speedwells.

Preemergence control can be obtained with benefin, bensulide, DCPA, simazine and other herbicides. Henbit, chickweed, and clovers usually require something other than 2,4-D for postemergence control. In dormant bermudagrass and zoysiagrass, dicamba, or a combination containing dicamba are most used. The phenoxy herbicides are safe on completely dormant turfs. Actively growing turfs vary considerably in tolerance to phenoxy type materials. St. Augustinegrass will usually tolerate a .5 lb/A of 2,4-D with only

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Summary of herbicide treatments on control of weeds in turfgrasses in Georgia. (B.J. Johnson)

Treatments		Weed species ^a								
Herbicide	Rate	Crab-grass	Goose-grass	Henbit	Common chick-weed	Spur-weed	Parsley-piert	Hop clover	Corn speedwell	Annual bluegrass
Atrazine	2.0			Po	Po	Po	Po	Po	Po	Po
Bensulide	10.0	P					P			P
Benefin	3.0	P		P	P				P	P
DCPA	10.0	P			P				P	
DSMA	3.0	Po								
Ethofumesate										P, Po ^c
Glyphosate ^b	0.5			Po	Po	Po	Po	Po	Po	Po
Metribuzin	0.5		Po	Po	Po	Po	Po	Po	Po	Po
Metribuzin + MSMA	0.12+									
	2.0	Po	Po							
MSMA	2.0	Po								
Oxadiazon	3.0	P					P	P	P	P
Paraquat ^b	0.5			Po	Po	Po	Po	Po	Po	Po
Pronamide	0.75				P				P, Po	P, Po
2,4-D ^d	1.0			Po	Po	Po	Po	Po	Po	
2,4-D+dicamba ^d	1.0+									
	0.5			Po	Po	Po	Po	Po	Po	
2,4-D+mecoprop + dicamba ^d	1.0+									
	0.5+									
	0.1			Po	Po	Po	Po	Po	Po	

^aWeeds controlled from preemergence treatments are represented with P and those with postemergence treatments are represented with Po.

^bTurfgrass must be completely dormant when paraquat and glyphosate are used. Paraquat has restricted use and applicator must be certified. Glyphosate does not have specific label for turf except for renovation.

^cSafe to apply to bermudagrass overseeded with ryegrass.

^dRepeated treatments at 2-week interval may be needed for effective control.

minimal injury. At rates above .5 lb/A St. Augustinegrass is usually injured. This may seem unimportant when using phenoxy on dormant warm season turfs, but invariably application is made at various stages during spring transition. All turfgrasses are more susceptible to phenoxy injury during this transition period. The combination of mecoprop plus chlorfurenol is often used, especially by the homeowners on St. Augustine.

Summer grass and sedge weeds

Large crabgrass and dallisgrass invade more turf acreage in the Southern United States than any other grasses. Germinating seeds of both can be satisfactorily controlled with benefin, bensulide, DCPA, atrazine, and simazine. Certain formulations of atrazine and simazine are labeled for use on St. Augustinegrass, zoysiagrass, and centipedegrass for sod production while other commercial products containing atrazine and simazine are labeled for homeowner use.

Postemergence control of these two weeds in St. Augustinegrass and centipedegrass can be accomplished only with asulam (Asulox®). In bermudagrass and zoysiagrass, MSMA (monosodium methanearsonate) and DSMA (disodium methanearsonate) are effective. In fact, dallisgrass control is accomplished almost exclusively in bermudagrass and zoysiagrass with the arsonates.

In terms of difficulty of control, goosegrass is the number one summer grass problem in the Southern United States. Timing of application of preemergence herbicides (DCPA, benefin, bensulide or oxadiazon) is of paramount importance if control is to be achieved. We generally think goosegrass starts germinating in significant quantities 4 to 6 weeks after crabgrass. However, this can and does vary. If application of a preemergence herbicide is delayed, this means that large crabgrass will escape because it germinates

earlier than goosegrass. In bermudagrass and zoysiagrass, large crabgrass can be controlled quite effectively with post applications of the arsonate herbicides. The use of preemergence herbicides would appear to be a better approach to goosegrass control than postemergence control with arsonates.

Oxadiazon (Ronstar®) gives excellent control of goosegrass, however, cost may be a limitation. Research has shown that MSMA + metribuzen (Sencor) will postemergently give good control of goosegrass.

Other grass weed problems in southern turfs include sandbur,

Preemergence herbicides

for goosegrass control should be applied four to six weeks after application for crabgrass control.

bahiagrass, crowfootgrass, torpedograss, and others. Sandbur and bahiagrass can be controlled with arsenicals. No means of selective control of torpedograss in any southern turf species has been developed at the present time.

Both annual and perennial sedges are problems in the Southern United States. Purple nutsedge and to a lesser extent, yellow nutsedge are the most severe problems. Multiple applications of arsenicals or an arsenical plus a phenoxy are generally recommended at the present time for purple nutsedge. Successful control is dependent on repeated applications at appropriate intervals. This is the only method commonly used for selective control in southern turf and can be used only on bermudagrass and zoysiagrass. Basagran® can be used if yellow nutsedge is a problem.

Summer broadleaf weeds

Broadleaved weeds are a prob-

lem through the Southern United States in turf. However, no single species would appear to reach the level of infestation over large areas equivalent to that observed with large crabgrass, dallisgrass or goosegrass. Among the more important broadleaved weeds are prostrate spurge and Virginia buttonweed. As a group these are rather difficult to control. Multiple applications of 2,4-D + dicamba, Trimec® or Trex-San® are almost always necessary. Researchers generally observe that the use of a good agricultural grade nonionic surfactant is warranted.

Control Strategy For Cool Season Turf

The primary preemergence herbicides for grassy and broadleaf weeds in cool season turf are benefin (Balan), bensulide (Betasan, Betamec-4, Pre-San), DCPA (Dacthal), oxadiazon (Ronstar), and siduron (Tupersan).

Siduron is the only preemergence herbicide that can be applied near time of seeding. Bensulide and DCPA can be applied in the spring following a fall seeding.

Benefin and oxadiazon should be applied to established turf. Bensulide can affect rooting of existing bermudagrass and caution is advised for use of most preemergence herbicides on bermudagrass greens. Thinning of fine fescue stands has been reported.

Preemergence herbicides should be watered in to get the chemical to the seed prior to germination and should remain effective for two or more weeks. Timing the application is critical. Contact local extension personnel for recommended dates for application.

The primary postemergence herbicides for grassy weeds in turf are the arsonates; CMA, DSMA, MAMA, and MSMA. Treated areas should not be reseeded soon after application. See labels for delay period. Bentgrass and fescue are more sensitive to arsonates

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than other cool season grasses. CMA is the safest for bentgrass.

Weed foliage should be sprayed while still young (2 to 3 leaf stage) if possible. The effectiveness of arsonates improves with temperature and rates may need to be increased for temperatures below 80 degrees F.

The primary postemergence herbicides for broadleaf weeds are 2,4-D, dicamba (Banvel), and MCPP. These herbicides should not be applied until a new lawn has had at least three mowings. The target weeds should be actively growing for best results. The temperature should be at least 60 degrees F. Applications during extreme heat or drought can cause severe damage to desirable turf.

Again timing information can be obtained from your local extension service. Two treatments are generally necessary. See label for the right amount of time between applications. Winter annuals can be sprayed early in the year, followed by summer annuals and perennials. Fall treatment for perennials is possible.

Postemergence herbicides are often combined to achieve improved control and reduce application time.

Occasionally, a landscape manager chooses to fumigate a seedbed prior to planting to reduce weed seed, control insects and fungi, and eliminate any off-type grasses. Methyl bromide (Dowfume), metham (Vapam), dazomet (Mylone) and Vorlex are used for preplant fumigation. See the labels for the recommended time of delay before seeding.

Turf renovation of existing stands is becoming common. Glyphosate (Roundup, Kleenup) has been very useful in killing actively growing weeds and grasses prior to reseeding. Amitrole, cacodylic acid (Phytar) and dalapon are also used for renovation. Glyphosate and cacodylic acid are deactivated within a few days of application.

For Information Contact Your Nearest Ransomes Distributor

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Bearco, Inc. (North OH)
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