

Post-emergence weed control in cool-season grasses

For best results, control product applications must be made during the targeted plant's most susceptible growth stage.

by Prasanta C. Bhowmik, Ph.D.
Univ. of Massachusetts

■ Weed control helps make any golf course or landscape management program successful. Effective weed control is achieved by integrating cultural and chemical weed control methods.

Producing a dense, healthy stand of turfgrass is one way to control annual weeds. Proper mowing height and frequency, fertilization, and irrigation are parts of the management program that should be practiced throughout the growing season.

It is important to understand weed control principles, to make economical and environmentally sound decisions. At the same time, however, these decisions must produce good results. Turf managers should be familiar with the following steps for a successful weed control program:

- 1) knowing the specific problem (i.e. grassy weeds vs. broadleaf weeds);
- 2) knowing the life cycle of the weeds (annual vs. perennial); and
- 3) selecting the most effective herbicide.

Grassy weed control—Among annual grassy weeds, crabgrass and goosegrass are considered to be the most troublesome in turf, and are usually controlled with a pre-emergence herbicide program along with a

good cultural program.

Post-emergence control of annual grassy weeds is becoming popular because of integrated pest management programs which use scouting information on weed species and their abundance. Several products are available for post-emergence control on cool-season turfgrass (Table 1).

Broadleaf weed control—A successful post-emergence weed control program results from selecting the right herbicide and applying it uniformly over the foliage at an appropriate dosage. The herbicide selection depends on the weeds to be controlled and the turfgrass to be treated. Choose the most effective herbicide with

maximum safety to the turfgrass. The list of currently-available post-emergence broadleaf herbicides has not changed appreciably from last year (Table 2).



Dr. Bhowmik

Most hard-to-control weeds such as wild violet, wood-sorrel and ground ivy are perennials. Perennials have extensive root systems. For effective control, these root systems must be killed. In order for a herbicide to be effective, it must enter the plant and move through it. Some weed species absorb herbicides rapidly, while others absorb slowly.

The primary route of entry of post-

Table 1

POST-EMERGENCE GRASS AND SEDGE CONTROL

Common name	Trade name	Manufacturer	Comments
DSMA	DSMA liquid	Riverdale	Controls crabgrass and nutsedge. Repeat applications are needed for nutsedge control. Discoloration may occur in fescue and bentgrass.
	DSMA liquid	Drexel	
	Methar 30	W.A. Cleary	
	Broadside, DSMA 81%	Vertac	
MSMA	Daconate 6	Fermenta	Controls crabgrass, nutsedge. Repeat applications needed for nutsedge control.
	Drexar 530	Drexel	
	MSMA 6.6	Drexel	
Fenoxaprop	Acclaim	Hoechst-Roussel	Can be tank-mixed with residual pre-emergence herbicides and post-emergence broadleaf herbicides.
Bentazon	Basagran	BASF	Controls only sedges. Repeat applications are necessary.
Dithiopyr	Dimension	Monsanto	Can be tank-mixed with MSMA or Acclaim. Apply to crabgrass with three tillers or less. Can be applied with fluid fertilizer or other registered pesticides.

Source: Dr. Bhowmik

ELSEWHERE

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emergence herbicides is directly through the leaf surface. Therefore, it is important to have good coverage of the weeds, regardless of their growth stage.

Timing of application: If the application is not timed to coincide with the growth stage which is most susceptible to herbicide treatment, control results may be erratic or poor. In general, spring application of a product containing two or three herbicides is a standard treatment for broadleaf weed control. However, post-emergence herbicides can also be applied in the fall for certain weed species, such as ground ivy, hawkweed, plantain, wild strawberry and thistles. The fall treatment also controls many seedlings of winter annuals, germinating in late August or early September.

Common chickweed, corn speedwell and henbit are among many winter annuals.



Wild violets are difficult to control. A follow-up application is usually required one to four weeks after the first application.

Formulations: Choose a product formulation best suited to your needs. Ester and amine formulations have different activity. Amines are soluble in water, while esters are oil soluble. Esters are generally better weed control products than are corresponding amine products. Esters tend to penetrate into the leaf better than amines. However, esters are slightly volatile. This volatility loss can result in injury to non-target susceptible plants.

For post-emergence broadleaf weed control, mixtures of two to three herbicides are commonly used because the combinations are more effective than any single herbicide in controlling hard-to-control weeds.

Table 3 lists several products for hard-to-control weeds.

—The author is an associate professor of weed science at the University of Massachusetts.

Table 2

COMMONLY USED BROADLEAF HERBICIDE MIXTURES FOR POST-EMERGENCE WEED CONTROL

Herbicide	Trade name	Ratio	Manufacturer
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 + 2,4-DP	Chipco Weedone DPC Ester	1:1	Rhone-Poulenc
	Chipco Weedone DPC Amine	1:1	Rhone-Poulenc
	Turf D + DP Ester	1:1	Riverdale
2,4-D + dicamba	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 + 2,4-DP + MCPP	Weedestroy Triamine	1:1:1	Riverdale
	Weedestroy Triester	1:1:2	Riverdale
MCPA + MCPP+2,4-DP	Weedestroy Triamine II	1:1:1	Riverdale
2,4-D+MCPP+ dicamba	Three-way selective herbicide	1:0.5:0.009	Lesco
	Trimec classic	1:0.5:0.1	Gordons
	Bentgrass selective	0.5:1.5:0.2	Lesco
	Triplet	2.44:1.3:0.22	Riverdale
2,4-D + triclopyr	Turflon D Ester	2:1	Dow
	Turflon II Amine	2.6:1	Dow
Triclopyr + clopyralid	Confront Amine	3:1	Dow

Source: Dr. Bhowmik

Table 3

SUGGESTED TREATMENTS FOR HARD-TO-CONTROL BROADLEAF WEEDS

Weed	Control product trade name	Comments
Ground ivy (<i>Glachoma hederacea</i>)	Turflon D Super Trimec Weedone DPC	Very difficult to control in summer. Fall application is desirable.
Prostate knotweed (<i>Polygonum aviculare</i>)	Same as ground ivy	Summer control difficult
Creeping speedwell (<i>Veronica filliformis</i>)	Turflon D Weedone DPC Trimec	Difficult to control. Several other speedwell species are also difficult to control.
	Dacthal 6F	Can be controlled with pre-emergence application.
Spurge (<i>Euphorbia supina</i>)	Turflon D Trimec Weedone DPC	Spring/summer application desirable.
	Dacthal PreM, Team, Dimension	Can be controlled with spring application of pre-emergence herbicides.
Wild violets (<i>Viola spp.</i>)	Turflon	Difficult to control; usually requires follow-up app. in 1-4 weeks.
Yellow woodsorrel (<i>Oxalis stricta</i>)	Turflon D Super Trimec Weedone DPC Pre-M, Team, Dimension	Spring applications of pre-emergence herbicides will control oxalis.

Source: Dr. Bhowmik

Post-emergence weed control in warm-season grasses

Post-emergence herbicides control many problem annual and perennial weeds not controlled by the pre-emergents.

by Tim R. Murphy, Ph.D.,
University of Georgia

■ Proper turfgrass maintenance is the first step in developing a successful weed control program. Adhering to recommended fertility programs, water requirements, mowing heights and schedules, and disease and insect control will greatly

increase turfgrass competition with weeds. It will also improve the effectiveness of the chemical weed control program.

Post-emergence herbicides can be applied on a "spot treatment" or "as needed" basis directly to a weed infestation. Spot treatments of post-emergents are less expensive than broadcast applications of pre-emergents. Low rates of most post-emergents may be used on newly sprigged or sodded warm-season turfgrasses. In areas that are scheduled to be overseeded or renovated, the majority of post-emergents can be used up to one month before renovation.

The time interval from application to seeding, sprigging or sodding operations for pre-emergence herbicides varies from six weeks to four months.

Several factors must be considered in selecting the proper control product.

Turfgrass tolerance: Warm-season turfgrasses differ in their tolerance to post-emergence herbicides (Table 1). Consult the product label to determine if the herbicide may be used on a particular turfgrass species.

Weed species: Weed identification assistance is available at county extension service offices and through chemical company representatives. After the weed has been identified, the herbicide label should be reviewed to determine if the herbicide will control the problem weed.

Application frequency: For some weed species and herbicides, a repeat application



Dr. Murphy

Table 1

TURFGRASS TOLERANCE TO POST-EMERGENCE HERBICIDES

Herbicide	Turf Variety					
	Bahia	Bermuda	Centipede	Carpet	St. Augustine	Zoysia
asulam	NR-S	T*	NR-S	NR-S	T	NR
atrasine	NR-I	S(D)	T	NR-I	T	I
bentazon	T	T	T	NR-I	T	T
bromoxynil	T	T	I	NR-I	T	T
2,4-D	T	T	I	I	S-I	T
2,4-D + dicamba	T	T	S-I	S-I	S-I	I
2,4-D + dichlorprop	T	T	I	I	I	T
2,4-D + mecoprop	T	T	S-I	I	S-I	T
2,4-D + mecoprop + dicamba	I-T	I-T	S-I	S-I	S-I	T
2,4-D + mecoprop + dichlorprop	T	T	I	I	I	T
dicamba	T	T	I-T	I	S-I	T
diclofop-methyl	NR	T	NR	NR	NR	NR
DSMA, MSMA	NR-S	T	NR-S	NR-S	NR-S	I
fenoxaprop	NR-S	NR-S	NR-S	NR	NR-S	T
glyphosate*	S(D)	S(D)	S	S	S	S*
imazaquin	NR-S	T	T	NR-I	T	T
MCPA + mecoprop + dichlorprop	T	T	I	I	I	T
meclorprop	T	T	S-I	I	S-I	T
metribuzin	NR-I	T	NR-S	NR-S	NR-S	NR-S
metasulfuron	NR-S	T	NR-T	NR	T	NR-T
pronamide	NR	T	NR	NR	NR	NR
sethoxydim	NR-S	NR-S	T	NR-I	NR-S	NR-I

T=Tolerant at labeled rates I= Intermediate tolerance, use at reduced label rates S= sensitive, do not use this herbicide

D=- Dormant NR= Not registered for use on this turfgrass.

* Labeled only on Tifway (419) bermudagrass and St. Augustinegrass.

** Bahiagrass and bermudagrass are tolerant to glyphosate when completely dormant.

Source: Dr. Murphy

Post-emergence suggestions

• Apply post-emergents to small actively-growing weeds. Perennial and annual weeds that are growing under good soil moisture conditions at moderate air temperatures are easier to control with post-emergents than weeds that are environmentally stressed. Target the application to coincide with good soil moisture conditions and air temperatures of 60° to 90° F.

• Do not apply to heat-stressed or drought-stressed turf or weeds. The tolerance of warm season turf to post-emergents decreases at air temperatures greater than 90° F, when turfgrasses are drought-stressed or growing under high soil moisture and high relative humidity conditions.

Herbicides with 2,4-D, dicamba, mecoprop, dichlorprop, imazaquin, MSMA and DSMA should not be applied at high air temperatures since there is a high risk of increased turfgrass injury. Always follow the most restrictive warning shown on the label.

The tolerance of warm-season turf to herbicides is generally lower during

is necessary. For example, two applications of MSMA + Sencor, at a 7- to 10-minute interval, are needed to control goosegrass. In contrast, one application of Illoxan will usually control goosegrass.

Ornamental tolerance: Ornamentals may be injured by spray or vapor drift or by root absorption of the herbicide. Ester formulations of the phenoxy herbicides (2,4-D, dichlorprop) easily volatilize during warm temperatures and can injure sensitive ornamentals by vapor drift. Therefore, they should not be used during the warm months, on or near sites that contain ornamentals. Spray drift damage can be prevented by spraying when the wind velocity is less than five mph, and by selecting a nozzle tip and spray pressure that produce large spray droplets.

Because of their soil residual characteristics, Aatrex and dicamba (Banvel, Dicamba 4) can injure broadleaf ornamentals via root uptake, particularly on sandy soils if rainfall occurs immediately after application. Avoid using these herbicides

spring green-up than when the turfgrass is dormant or after full green-up. Research has shown that the decrease in turf quality which may result from using post-emergents during green-up is temporary and persists for two to six weeks after application. If dense weed populations necessitate using a post-emergent during green-up, use the lowest recommended rate or one-half the recommended rate to minimize herbicide injury to the turf.

- Single applications at high rates generally cause more injury than repeat applications at low rates. Also, single, high rate applications often do not control perennial weeds. The repeat application is usually made at intervals of seven to 14 days after the first application, or when regrowth of the weed is noted.

- Plan mowing schedules accordingly. Mowing should be delayed three to four days before or after a post-emergence herbicide application.

- Do not apply immediately before rainfall or irrigation.

- Use surfactants and crop oil concentrates according to label directions.

- Calibrate all spray equipment and train the operator.

over the rootzone of shrubs and small trees.

If possible, post-emergence herbicides use should be avoided during spring green-up or during extremely hot weather.

The need to use post-emergence herbicides during these times can be avoided by scouting for weeds during winter, late spring and early summer. Most turfgrass

post-emergence herbicides are more effective when applied to smaller weeds. Scouting will enable timely and effective applications of post-emergence herbicides.

—The author is an extension agronomist specializing in weed science, University of Georgia.

Table 2

POST-EMERGENCE HERBICIDES, WARM-SEASON TURFGRASS

Common name	Trade name	Uses
asulam	Asulox	Grass weed control in St. Augustinegrass
atrazine	Aatrex, others	Pre- and post-broadleaf and grass weed control
bentazon	Basagran T/O	Primarily used for yellow nutsedge control
bromoxynil	Buctril	Broadleaf weed control on seed or sod farms
2, 4-D	numerous formulations	Broadleaf weed control
2,4-D + dicamba	Eight-One, Phenaban 801	
2,4-D + dichlorprop	Weedone DPC Amine,	Broadleaf weed control
	Weedone DPC Ester	
2,4-D mecoprop	Lescopar, Phenomec 2+ 1,	Broadleaf weed control
	2 Plus 2	
2,4-D + mecoprop + dicamba	Trimec Classic, Tex-san,	Broadleaf weed control
	Three-Way	
2,4-D + mecoprop + dichlorprop	Weedestroy Triamine..	Broadleaf weed control
	Weedestroy Tri-Ester	
dicamba	Banvel, Dicamba 4	Broadleaf weed control
diclofop-methyl*	Iloxan	Goosegrass control in bermudagrass
diquat**	Diquat	Winter annual weed control in dormant bermudagrass
DSMA	numerous formulations	Grass weed control in bermudagrass and zoysiagrass
ethofumesate	Prograss	Pre-/early post-annual bluegrass control, overseeded bermuda
fenoxaprop	Acclaim	Annual grass control and suppression of bermudagrass in zoysia
glyphosate	Roundup	Winter annual weed control in bermudagrass
imazaquin	Image	Purple nutsedge and wild garlic control in warm season turfgrass (except bahiagrass). Also controls certain annual broadleaf weeds.
meoprop	Mecomec, Lescopex	Broadleaf weed control
meoprop + 2,4-D + dicamba	Southern Trimec	Broadleaf weed control
MCPA + mecoprop + dichlorprop	Weedestroy Triamine II,	Broadleaf weed control
metribuzin	Weedestroy Tri-Ester II	
	Sencor Turf	Goosegrass control in bermudagrass. Also controls prostrate spurge and numerous winter annual broadleaf weeds
metsulfuron	DMC	Controls bahiagrass, wild garlic prostrate spurge and numerous broadleaf weeds in bermudagrass and St. Augustinegrass
MSMA	Numerous formulations	Grass weed control in bermudagrass and zoysiagrass
MSMA + 2,4-D +	Trimec Plus	Grass and broadleaf weed control, bermudagrass/ zoysiagrass
meoprop + dicamba		
pronamide	Kerb	Annual bluegrass control in bermudagrass
sethoxydim	Vantage	Annual grass control in bermudagrass
sethoxydim	Vantage	Annual grass control and bahiagrass suppression in centipedegrass

* Diclofop-methyl has a state label for use in Alabama, Georgia, Florida, North and South Carolina.

** Diquat has a state label in Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee and Texas for winter annual weed control in dormant bermudagrass.

Source: Dr. Murphy

Soil test could solve 'lazy turf' problem

A proper soil analysis will reveal if a nutrient deficiency is the cause of turf lethargy.

■ Has your turf lost its "zing"? Does it have that lackluster, "not-as-bright-as-it-used-to-be" shade of green?

If you know it's not caused by disease, drought or insect damage, your turf's lethargic look could be caused by a nutrient deficiency in the soil, a problem that's easily remedied.

But first, you need a soil nutrient analysis, which starts by taking 15 to 20 core samples from the area in question.

"If you don't have a truly representative sample, one that represents the fertility level of the turf, the analysis will not be of

sample exchanges.

Heckman says not much has changed in the way soils are tested, but there have been interesting findings over the last few years. One of the most important is the high phosphorus content found in approximately 75 percent of all samples obtained from landscapers and homeowners in New Jersey and other states.

"This is due to repeated fertilizer applications," says Heckman. "Phosphorus is very strongly absorbed to soil particles; it doesn't leach. We'd like to see greater awareness, and a reduction in use of phosphorus fertilizers in soils that already test very high in that nutrient." According to Heckman, the excess phosphorus could cause reduced availability of other nutrients.

Private labs also do creditable work. The Harris company, a leader in agricul-



Jeff Frack:
Golf course soils offer a challenge.

tors who are providing the service to customers, primarily golf course superintendents.

Soil content varies greatly from one region to another, so you'll likely find differing results from sample taken in different parts of the country.

"In the eastern U.S., the soil will tend to be on the acid side," explains Frack, "so liming applications may be required. In the West, you're dealing with alkaline soils and higher sodium or salt content, where applications of gypsum or elemental sulphur may need to be made to lower a pH."

Golf courses represent unique challenges in any locale. "So much of (the golf course) is a man-made, particularly golf greens," says Frack. "They're building specifically to grow grass, so you don't necessarily have a 'natural' soil medium."

Thanks to USGA standards, many golf courses provide a better growing environment than what existed before, but managers still must fertilize accordingly and work the greens, due to sand content. "They may drain very well," says Frack, "but be a little low on the nutrient side."

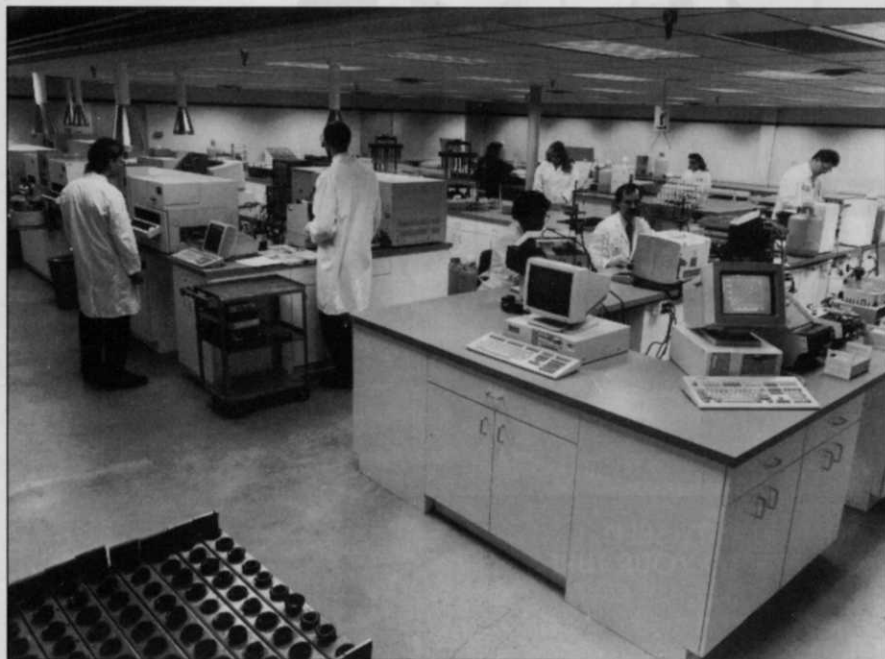
If you send the same sample to two different labs, and get two different readings, be sure both data are being reported in the same measurements, either parts per million or pounds per acre.

"Some even report in parts per two million," says Frack. "All the numbers could be exactly right, but if people aren't familiar with the methods or reporting units of the labs, you may actually think you've got different results."

A soil analysis is very inexpensive, especially when you consider the headaches it might solve for you.

Frack says Harris will conduct a basic N/P/K analysis for under \$20. A more complete analysis, with micronutrient content and sand/silt/clay percentage breakdown costs between \$30 and \$40.

—Terry McIver



Soil testing at state-of-the-art facilities is offered at reasonable prices. Shown here is one of the Harris labs, in Lincoln, Neb.

much value," says Dr. Joseph Heckman, a Rutgers University soils and crops specialist. "If you have another section of turf you know to be of a different composition, a separate sample is required."

Take your soil samples to a university-based laboratory or a good private lab. University labs have established good reputations over the years, and the accuracy of soil analyses from one to another is nearly exact, as proven by frequent university soil

tural soil testing for more than 60 years, also performs a good amount of testing for the landscape and golf course industries. "We get an idea of what the fertility levels are in the soil, whether it's golf greens, fairways or turf around large corporations," says Jeff Frack, Harris's vice president of agronomic services.

Frack says most of the company's non-ag soil testing is done for local fertilizer suppliers and other turf industry distribu-

Buffalograss roams beyond the plains

Continued development of buffalograss varieties is making the species at home in more regions.

■ Turf scientists continue to improve the appearance and low maintenance characteristics of buffalograss.

Jeff Klingenberg, Ph.D. of the University of Nebraska, says up to 10 new buffalograss varieties may be available over the next decade. Different varieties may be adaptable to the Northeast as far as New Jersey, and westward to California (see map).

Buffalograss—named apparently because it was the main food source for American bison—is a warm-season, fine-leaved, perennial, sod-forming grass. It grows to a height of six inches, and spreads by stolons and runners.

Klingenberg says three commercial seeded types are available: Sharps, Texoka and Bison. The 11 vegetative types include two commercial brands (609 Oasis and Prairie) and nine experimental varieties.

Bamert Seed Co. of Muleshoe, Texas, now markets what it says are the first proprietary turf-type buffalograss seed varieties, Plains and Topgun.

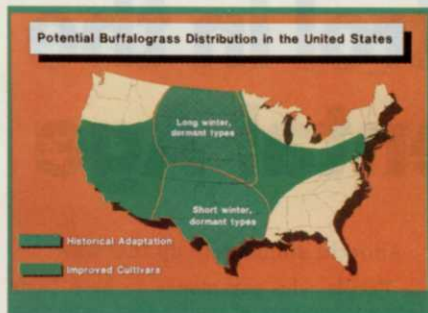
Adaptation—Buffalograss is naturally adapted throughout the Midwest and Southwest in areas of 12 to 35 inches of annual rainfall, sandy clay loam or heavier soils, pH 6.0 to 8.5, and up to 6,000 feet

elevation. Buffalograss is not shade tolerant, and is recommended for use in high-light areas.

Buffalograss gets high marks as a low-maintenance alternative to other turf varieties.

It's drought tolerant, has a deep root system and establishes quickly. It avoids drought and high heat stress by entering dormancy, but shows rapid recovery when water is again available.

According to Bamert Seed, studies have shown that buffalograss requires only 30



Potential for buffalograss expansion across the US.

to 60 percent of the water needed by improved bermudagrasses.

Klingenberg says that university research shows that it's possible to have "short winter" dormant species adapted to the southern regions. "Long winter" dormant types—those that come from the lower adapted areas of the U.S.—have a longer growing season compared to those



Klingenberg: seeding rate most critical success factor.

that adapted to the northern regions.

Seeding alternatives—Non-treated buffalograss seed will take two to three years to reach 80 to 90 percent germination. Treated seed—or seed that has been "fooled" into thinking it has gone through winter—achieves 75 to 80 percent germination in 10 to 14 days.

A third, time-consuming establishment method involves removing the seed from its nylon-like "burr" shell, says Klingenberg.

Non-treated burrs are less expensive, and have a longer shelf-life, but are slow to establish, and may require more irrigation and weed control. Treated burrs, which are most available and cost less than the naked caryopsis, have a 3- to 4-day germination if planting is well timed.

Three important considerations when attempting to seed buffalograss are:

● **Timing:** Late spring, when soil temperatures are no lower than 50° F. The best planting window is between May 15 and June 15. Don't plant any later than June 30. You may get good establishment, but you won't get good stolon performance you need in June to withstand a late October freeze.

● **Seed placement:** Klingenberg prefers drill planting, which results in the best soil/seed contact. Plant 1/2 inch apart, with 1- to 2-inch row spacing.

Broadcast planting requires a mechanical method of covering and good soil/seed contact. Rolling will aid establishment.

● **Rate:** This is where most mistakes occur. Consider the viability of the seed you're buying. "It's a different ball game compared to most of the other warm and cool season varieties," says Klingenberg. He also notes that pure live seed in the burr is going to be only 62 percent, so you should plant at least 1-1/2 lb. per 1000 sq. ft.

Also, avoid seeded buffalograss that's been in the bag more than 6 months.

—Terry McIver

Buffalograss checklist

ADVANTAGES

- ✓ reduced mowing, irrigation, fertilization
- ✓ available in seeded and vegetative types
- ✓ grows in dry, compacted soils
- ✓ tolerates temp extremes
- ✓ establishes quickly
- ✓ drought tolerant
- ✓ winter hardy

DISADVANTAGES

- ✓ does not grow in moderate shade
- ✓ sensitive to some herbicides
- ✓ male plants have seedheads
- ✓ possible disease problems
- ✓ turns brown after freeze
- ✓ not suited to sandy soils
- ✓ no dark green color
- ✓ seed is expensive
- ✓ winter dormancy

Source: Gayle Jacklin, Jacklin Seed Co.; Kevin Morris, USDA.