turfgrasses (Table 1), but not one herbicide is appropriate for all turfgrass weed control situations. The following guidelines should be considered to select a post-emergence herbicide.

- **Turfgrass tolerance**—Turfgrass species vary in their tolerance to herbicides (Table 2). For example, Bermudagrass has excellent tolerance to MSMA and DSMA; however, centipedegrass and St. Augustinegrass will be severely injured or killed by these herbicides. Additionally, cultivars within a species may respond differently to the same herbicide. For example, Meyer zoysiagrass has better tolerance to MSMA than Emerald and Matrella. Always refer to the label to determine if a herbicide may be used on a specific turfgrass species or cultivar.

- **Time of application**—The time of year that a herbicide is applied can influence turfgrass tolerance. For example, dormant Bermudagrass has excellent tolerance to glyphosate, however, severe injury will occur if glyphosate is applied to semi-dormant or to actively-growing Bermudagrass.

- **Weed species**—No single herbicide will control all weed species. Correct weed identification is a prerequisite in selecting an appropriate herbicide. Weed identification manuals and assistance are available at county extension offices. Several chemical companies also distribute turfgrass weed identification manuals.

- **Application frequency**—Similar to turfgrasses, weed species vary in their susceptibility to herbicides. With some weed species and herbicides, a repeat application is necessary to effectively control the weed. For example, two applications of MSMA + metribuzin, at a seven- to 10-day interval, are necessary to control goosegrass. In contrast, small crabgrass can often be controlled with a single application of MSMA. Large, mature crabgrass, however, may require two applications.

- **Ornamental tolerance**—Turfgrass herbicides are commonly applied to sites that contain ornamental plantings. Ornamentals can be injured through contact of the foliage or green bark by herbicide vapor and spray drift and by ornamental root absorption. Vapor drift is the movement of herbicide vapors from the area of application. Herbicides vary in their volatility or their potential for vapor drift. Ester formulations of the phenox herbicides (2,4-D, 2,4-DP) easily volatilize and can injure sensitive ornamentals by vapor drift. Ester formulations should not be used the warm months of the year when conditions are favorable for volatilization. Spray drift damage can be prevented by spraying on calm days when the wind velocity is less than five miles per hour, and selecting a nozzle tip and spray pressure that produces large droplets.

Due to their soil residual characteristics, certain herbicides can injure ornamentals by root uptake. Avoid applications of post-emergence herbicides that contain dicamba or atrazine over the root zone of desirable ornamentals. Injury to ornamentals by root uptake is most likely to Virginia buttonweed is rapidly becoming the number one problem broadleaf weed in turfgrass.

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occur on sandy soils when a heavy rainfall immediately follows a herbicide application.

Precautions
Post-emergence herbicides are applied after annual weeds emerge or when new growth of perennial weeds appears. Follow these guidelines for better weed control and improved turfgrass tolerance.

- Apply post-emergence herbicides in the fall and late spring months. Air temperatures are cooler at this time of year which results in better turfgrass tolerance to herbicides. Also, perennial weeds and many annual weeds are actively growing and are easier to control with post-emergence herbicides. Target the application to coincide with air temperatures between 60 and 90 °F. Applications below 60 °F can result in poor weed control.

- Do not apply post-emergence herbicides to turfgrasses and weeds that are stressed due to high air temperatures or drought. Turfgrass tolerance to post-emergence herbicides decreases at air temperatures greater than 90 °F and when turfgrasses are drought stressed. Herbicides that contain 2,4-D, MCPP, dicamba or MSMA should not be applied at high air temperatures since there is a good possibility of increased turfgrass injury.

Many herbicide labels include warning statements relative to the use of the product at high air temperatures. Always follow the most restrictive warning on the label. Control is also poorer when herbicides are applied to environmentally stressed weeds than when applied to actively growing weeds.

- Do not apply post-emergence herbicides during the green-up process of warm-season turfgrasses. The risk of injury is greater during the spring green-up process (transition from winter dormancy to active growth) than when the turfgrass is fully dormant or actively growing (fully green)

- Repeated applications at low rates will generally improve control and turfgrass tolerance. Single applications at high rates generally cause more turfgrass injury than repeat applications at low rates. Additionally, single applications at high rates often do not control the weed. Refer to the label for information regarding repeat treatments.

- Mowing schedules will need to be coordinated with post-emergence herbicide applications. A general recommendation is to delay mowing three to four days prior to or after a post-emergence herbicide application.

Table 2.
Warm-season turfgrass tolerance to post-emergence herbicides.

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Bermuda-grass</th>
<th>Centipede-grass</th>
<th>St. Augustine-grass</th>
<th>Zoysia-grass</th>
</tr>
</thead>
<tbody>
<tr>
<td>asulam</td>
<td>T*</td>
<td>NR-S</td>
<td>T</td>
<td>NR-I</td>
</tr>
<tr>
<td>atrazine</td>
<td>T (D)</td>
<td>T</td>
<td>T</td>
<td>I</td>
</tr>
<tr>
<td>bentazon</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>bromoxynil</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>2,4-D</td>
<td>T</td>
<td>S-I</td>
<td>S-I</td>
<td>T</td>
</tr>
<tr>
<td>2,4-D + dicamba</td>
<td>T</td>
<td>S-I</td>
<td>S-I</td>
<td>T</td>
</tr>
<tr>
<td>2,4-D + dichlorprop</td>
<td>T</td>
<td>S-I</td>
<td>S-I</td>
<td>T</td>
</tr>
<tr>
<td>2,4-D + mecoprop</td>
<td>T</td>
<td>S-I</td>
<td>S-I</td>
<td>T</td>
</tr>
<tr>
<td>2,4-D + mecoprop + dicamba</td>
<td>T</td>
<td>S-I</td>
<td>S-I</td>
<td>T</td>
</tr>
<tr>
<td>dicamba</td>
<td>T</td>
<td>S-I</td>
<td>S-I</td>
<td>T</td>
</tr>
<tr>
<td>dicamba</td>
<td>T</td>
<td>S-I</td>
<td>S-I</td>
<td>T</td>
</tr>
<tr>
<td>diquat</td>
<td>T (D)</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>DSM, MSMA</td>
<td>T</td>
<td>S</td>
<td>S</td>
<td>I</td>
</tr>
<tr>
<td>glyphosate</td>
<td>T (D)</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>imazaquin</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>MCPP</td>
<td>T</td>
<td>S-I</td>
<td>S-I</td>
<td>T</td>
</tr>
<tr>
<td>metribuzin</td>
<td>T</td>
<td>NR-S</td>
<td>NR-S</td>
<td>NR-S</td>
</tr>
<tr>
<td>pronamide</td>
<td>T</td>
<td>NR</td>
<td>NR</td>
<td>NR-T</td>
</tr>
<tr>
<td>sethoxydim</td>
<td>NR-S</td>
<td>T</td>
<td>NR-S</td>
<td>NR-I</td>
</tr>
</tbody>
</table>

*Asulam is labelled for use only on 'Tifway' bermudagrass (419).

T = Tolerant at labeled rates; I = Intermediate tolerance, use at reduced label rates; S = Sensitive, do not use this herbicide; NR = Not registered for use on this turfgrass; D = Dormant applications only.
Denser, darker green Manhattan II takes the bruises for your athlete

What goes up must come down... and that goes double for athletes’ knees and elbows.

Improved Manhattan II perennial ryegrass has a built-in cushion developed through genetic improvement. The greater tiller density of Manhattan II takes the punishment athletes dish out, then springs back to retain its great-looking appearance. All that toughness... with improved mow-ability to boot!

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Manhattan II was developed to save on maintenance costs... but the real saving is on knees and elbows!

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tion. The delay prior to treatment will increase the leaf surface area of the weed and result in better spray coverage and control. The delay after treatment is necessary to allow adequate time for herbicide absorption and translocation in the target weed species.

- Do not apply post-emergence herbicides immediately before rainfall or irrigation. Generally the performance of most post-emergence herbicides is better when rainfall or irrigation does not occur for six to 24 hours after an application. Rainfall or irrigation immediately after treatment can wash the herbicide from the treated foliage and decrease control.
- Use surfactants and crop oil concentrates according to label directions. The effectiveness of many post-emergence herbicides is enhanced by the addition of a surfactant or crop oil concentrate to the spray mixture. However, indiscriminate use of surfactants or crop oil concentrates can increase the risk of turfgrass injury.

**Problem weeds**

_Nutsedge—_Two different species of perennial nutsedge occur in warm-season turfgrasses. Purple and yellow nutsedge can be distinguished on the basis of vegetative differences (Table 3). Bentazon will provide control of yellow but not purple nutsedge. Monthly applications of MSMA in labelled turfgrasses can be used to suppress the growth of both species.

Imazaquin can be used in warm-season turfgrasses for yellow and purple nutsedge control. Recent work conducted in Mississippi and Georgia has shown that imazaquin is better than MSMA for nutsedge control.

_Dallisgrass—_Dallisgrass is a difficult-to-control perennial grass weed. It is believed that most pre-emergence herbicides will control dallisgrass that arises from seed. Established dallisgrass can be controlled in Bermudagrass and zoysiagrass with repeat applications of MSMA or DSMA. Applications should be made to actively growing dallisgrass. Also, a nonionic surfactant at 0.25% v/v is recommended with MSMA or DSMA for dallisgrass control. It is very important to stay on the treatment schedule (seven to 10 days between applications) for repeat applications. Shortening the application interval to five days may help in areas where dallisgrass has been difficult to control with MSMA or DSMA.

_Virginia buttonweed—_Virginia buttonweed is rapidly becoming the number one problem broadleaf weed in turfgrass. A perennial, Virginia but-

### Table 3. Vegetative characteristics of purple and yellow nutsedge.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Purple Nutsedge</th>
<th>Yellow Nutsedge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf color</td>
<td>dark green</td>
<td>pale or light green</td>
</tr>
<tr>
<td>Leaf surface</td>
<td>flat or corrugated</td>
<td>flat or corrugated</td>
</tr>
<tr>
<td>Leaf tip</td>
<td>abruptly tapers to</td>
<td>sharply tapers to</td>
</tr>
<tr>
<td>Rhizomes</td>
<td>wiry, scaly</td>
<td>sharp, needle-like tip</td>
</tr>
<tr>
<td>Tubers</td>
<td>oblong, coarsely hairy</td>
<td>weak, threadlike</td>
</tr>
<tr>
<td>Tuber taste</td>
<td>bitter</td>
<td>spherical, smooth</td>
</tr>
<tr>
<td>Seed head color</td>
<td>reddish - to</td>
<td>sweet</td>
</tr>
<tr>
<td></td>
<td>purplish-brown</td>
<td>yellow</td>
</tr>
</tbody>
</table>

**HINTS FOR HERBICIDE APPLICATION**

1. Read and observe instructions and precautions on the herbicide label.
2. Calibrate sprayers and recheck calibration prior to herbicide application.
3. Apply the proper rate of herbicide. Too much herbicide may damage or kill turfgrass.
4. Apply herbicides in one pint of water per 100 square feet or one gallon of water per 1,000 square feet.
Controlling prostrate spurge requires repeat applications of two- or three-way herbicides.

tonweed reproduces by seed, cut plant pieces and fleshy roots. Research conducted in Mississippi has shown that 2,4-D + dichlorprop application will increase the control of Virginia buttonweed. The increase in control with oxadiazon or simazine is believed to be the control of Virginia buttonweed plants that arise from seed.

**Bahiagrass**—Repeat applications of MSMA or DSMA will control bahiagrass in tolerant turfgrasses. In centipedegrass, repeat applications of sethoxydim will suppress bahiagrass growth and seedhead development.

**Prostrate spurge**—Repeat applications of two-way or three-way broadleaf herbicides will be required to control this summer annual broadleaf weed. In Bermudagrass, low rates of metribuzin (0.125 to 0.25 lb. Al/acre) will effectively control prostrate spurge.

**Wild garlic**—Wild garlic is a perennial that appears in turfgrasses in the mid- to late-fall months. Fall (November-January-February) applications of 2,4-D or two-way and three-way broadleaf herbicides that contain 2,4-D or dicamba will control wild garlic.

To effectively eliminate this weed from the turfgrass, the fall and spring treatment program will need to be repeated for two to three consecutive years.

Imazaquin has provided excellent control of wild garlic in experiments conducted in Mississippi. Late fall applications to emerged wild garlic have provided slightly better control than early spring applications.

Post-emergence herbicides enable the turfgrass manager to control many problem weeds not controlled by pre-emergents. In the event of a pre-emergence weed control failure, post-emergence herbicides can be relied upon for a complete chemical weed control program. However, sole reliance upon post-emergence herbicides for a total weed control program is risky.

Cultural practices that favor good turfgrass growth and development, the use of pre-emergence herbicides and the timely use of post-emergence herbicides will help the turfgrass manager to achieve the goal of a high quality, weed-free turfgrass. **LM**
"You can't cut grass with headaches. That's why I switched to Bunton."

Bill Wright, President
Lawn-Wright, Inc., Gaithersburg, Maryland

"When I started my lawn service business seven years ago I had a push mower and riding tractor. It only took a year to realize I could cut a lot more grass in the same amount of time with one commercial walk-behind mower," says Bill Wright, president of Lawn-Wright, Inc. "Four years later I discovered Bunton. Now I can cut even more grass with the same number of mowers."

The reduction in maintenance headaches compared to his other mowers was so significant that two years ago Bill Wright replaced his eleven mower fleet with Buntons. Here's why he just bought seven more:

**Welded steel deck construction**

"With Bunton, the deck is reinforced and welded into a single piece, not bolted together like other mowers. With no bolts to fall out, the problem of sagging decks and misaligned belts and blades was eliminated. Our maintenance went down and quality of cut went up."

**Stronger parts/better engineering**

"Other manufacturers make caster supports, bell cranks and other parts from aluminum, which breaks easily. Bunton makes them from steel, so they're more durable. And, Bunton has fittings at all critical wear points so parts can be greased to make them last longer."

**Better belt system**

"Because the belts are wrapped in straight lines without twists or back-bends, our belt life increased by at least five times when we switched to Bunton."

**Variable speed drive system**

"Bunton's pulleys are larger so we get better belt contact and less slippage, even when they're wet and going up hills. We also get a larger range of speeds with Bunton than with other mowers."

**Savings of time and money**

"There are many other features on Buntons that lower my maintenance costs. Overall, I have saved at least $6,000 in the two years since switching to Bunton, not including the added profit from increased productivity."

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THE BANNER PREVENTIVE PROGRAM

How to prevent dollar spot

Apply Banner at a 1 oz. rate early (April-May through September) to prevent dollar spot from ruining your greens for full 28-day control.

How to prevent brown patch and other diseases

Apply Banner at the 2-4* oz. rate (May or June through September) for 10-21 day brown patch control. And at 1-2 ozs., Banner provides excellent systemic control of anthracnose, powdery mildew, rust, red thread and stripe smut. Or, use Banner at the higher 2-4* oz. rate to achieve broader-spectrum control of leaf spot and melting out for 14-21 days. And the 4* oz. rate for summer patch and spring dead spot at 30-day intervals.

Tank mix Banner to control already-present brown patch

As with all turf fungicides, Banner’s scheduling is critical. But when schedules are interrupted and brown patch is present, use Banner at a 2 oz. rate in a tank mix with contact fungicides like Daconil 2787” or Chipco® 26019. The contact fungicides will control existing diseases and Banner will prevent future infections.

New Banner. Unsurpassed protection for greens, tees, and fairways. And you’ll know it on inspection day. *4 oz. label rate pending.

BANNER. LONGER LASTING, PREVENTIVE CONTROL.
A GOOD LINE

It might not get you a date, but a line trimmer will ease back pain by eliminating the need for stressful kneeling and bending to cut weeds or trim grass.

by Jeff Sobul, assistant editor

Oft times, brilliant ideas are born by accident. The line trimmer is no exception. Back about 17 years ago, George Ballas, a Texas real estate broker, got tired of the hairy weeds growing around the roots of two large oak trees in his yard.

So he went fishing for ideas and one popped into his head. He pulled an empty popcorn can out of the trash and poked holes for some nylon fishing line, then attached it to his long-handled power edger.

It was loud, he noted some years ago, but it did what he wanted it to do: rip grass and weeds from the oak's roots.

He called it the Weed Eater and set about marketing it. In 1972, his sales were a bit more than $500,000. Over the next four years, they grew exponentially, to $41 million in 1976. An industry was born.

Spreading like weeds

About two dozen companies in the United States manufacture, assemble and market string trimmers these days for both home and commercial use. Landscape Management readers spent an estimated $6 million on line trimmers in 1987. (This sales figure does not include the home market.)

Not surprisingly, trimmers have evolved and advanced immensely since their creation. Units are powered by electric cord and batteries in addition to gas-powered models.

Features that improve ease and efficiency of operation include automatic line feeders. The machines are safe, with line that tends not to cut skin, and debris guards to protect operators from flying detritus.

Why so popular?

Weed Eater was the first prototype nylon-line grass trimmer. The invention created a new product category that developed rapidly. More than 20 million Weed Eater gas and electric-powered lawn trimmers have been sold to professionals and homeowners, according to the company. (Fred Pascarelli of Homelite notes there is no real distinction in product

One of three trimmers from Bunton.

between homeowner and professional.)

In all, says Weed Eater brand manager Chuck Mattes, since the market began in 1972, total market sales have exceeded $2 billion. Units sold have gone from zero to nearly equaling that of lawn mower sales per year.

“We had no idea how big the market would be,” Mattes notes. The machines’ original intentions were for people physically unable to get down on hands and knees or bend over to use hand clippers to trim or edge.

But with prices for electric trimmers starting at around $20, trimmers became common sights everywhere. “If anyone’s ever used a chain saw, they can use a trimmer,” Mattes states.

Sales of gas-powered trimmers rose dramatically after prices were reduced, beginning around 1981 and taking off in 1983-84. Sales continue to rise between 10 and 20 percent annually. Mattes estimates that homeowners account for 80 percent of the market, but that is “a function of price.” Pricier versions go to the professionals. “People who have to use them every day look at the features rather than the price,” he explains.

Municipalities benefit greatly from the machines. “The trimmer adds a versatility they never used to have,” Mattes says, saving time and labor costs in the process.

Market growth shows no sign of slowing much either. Companies such as Solo continue to enter the market. In Solo’s case it was to complement an already existing line of lawn grooming products, according to Solo’s Jim Dunne. New technology such as the automatic feed heads featured on many new models will continue to add fresh ideas into the market. And, as Mattes notes, “there’s always something new on the horizon.”

The following is just an introduction to some established product lines and what has recently been introduced into the market by a number of companies:

Brushking—Brushking recently introduced the BK35 string trimmer with a 35 cc engine weighing in at 12½ pounds. It has a padded shoulder strap and handles four different Brushking monofilament line heads.

Bunton—Bunton has three trimmer sizes available with a choice of a tap string feed or manual string feed on each model. The smallest unit features an 18 cc Kawasaki 2-cycle engine and flexible type drive shaft.

The larger commercial units feature solid drive shafts with heavy-duty reduction gear drives for long life. These models are available with electronic ignition and a 24 cc or 33 cc Kawasaki two-cycle engine. All models include shoulder strap, engine stand, on-off switch, tool kit and blade guard.

John Deere—The 110G, 210G, 240G and 260G are four new gas-powered nylon line trimmers and bushcutters developed by John Deere. All four trimmers are powered by a redesigned engine with a 21.2 cc displacement. This is an air-cooled, two-cycle single-cylinder power plant. A new carburetor for the 110G, 210G and 240G simplifies adjustments. Only the idle speed requires setting.

Models 110G and 210G cut a 16-inch path with a single-exit nylon cutter head and 0.080-inch-diameter nylon line. Shaft length is 48 inches. Models 240G and 260G cut a 17-inch path with a dual-exit nylon cutter head and