TURFGRASS TRENDS

WEED CONTROL

# Goosegrass Shows No Tolerance to Compaction

*By Claudia Arrieta*

Goosegrass is a serious weed problem in golf and sports bermudagrass turf in warm climates. Bermudagrass turf can be susceptible to infestation by seed-dispersal weeds, such as goosegrass, especially when turf stands are thinned because of traffic, drought or other stresses.

Goosegrass is a prolific seed producer; most of the seed germinates in the first year and little thereafter (Holm et al, 1977; Hawton and Drennan, 1980). Since goosegrass seed germination responds to fluctuating temperatures, greatest emergence of goosegrass occurs on bare ground, in scalped and thin turf (Fig.1), where maximum diurnal fluctuating temperatures would be expected (Nishimoto and McCarty, 1997).

Goosegrass control relies on the use of pre- and post-emergence herbicides, and there is little documentation on cultural management practices to prevent goosegrass infestation. It is not known if compaction in these traffic areas enhances goosegrass growth while decreasing bermudagrass growth.

**FIGURE 1**

Goosegrass thrives on scalped turf, where temperatures most fluctuate.

## Control

The different options in goosegrass control are:

**1) Pre-emergence herbicides**: These kill goosegrass seedlings after they have germinated but before they have emerged from the ground. The common goosegrass pre-emergence herbicides products have these active ingredients: dithiopyr (Dimension), metolachlor (Pennant), oxadiazon (Ronstar), oryzalin (Surflan), pendimethalin (Halts, Pre-M, Pendulum,

*Continued on page 54*

## IN THIS ISSUE

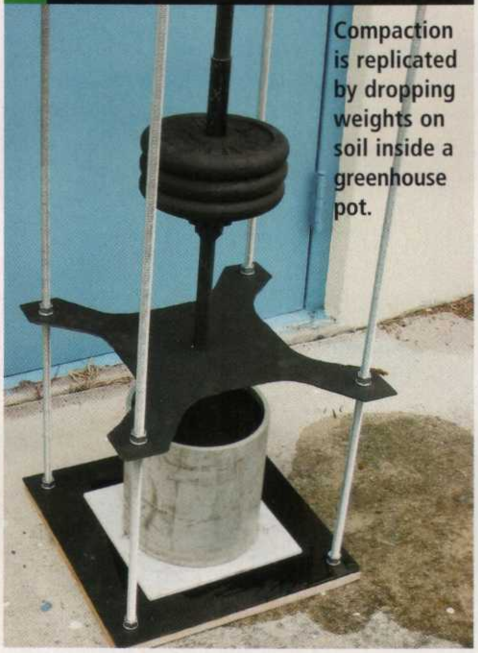


## OUR SPONSORS


**Spell doom for insects above and below ground with one application.**


Bayer Environmental Science
The end is near for grubs, cutworms, sod webworms, ants and more than 70 other turf-eating pests. Nothing on the market gives you better control of surface and subsurface insects. Allectus™ is a revolutionary new product that provides deadly broad-spectrum control that's both preventive and curative with a long residual effect. For insects, it's eternally long. To learn more, call 1-800-331-2867 or visit BayerProCentral.com.
allectus™
BACKED by BAYER.

FIGURE 2



Compaction is replicated by dropping weights on soil inside a greenhouse pot.

*Continued from page 51*

Southern Weedgrass Control), prodiamine (Barricade, RegalKade) and their combinations.

Application begins in spring (March in northern temperate areas) and continues through summer depending on the rate of application, the half-life of the herbicide and considerations of economics and goosegrass population density (Busey, 2004).

**2) Mechanical removal**: This involves hand weeding, where roots are cut below the ground to avoid disturbance of the surface appearance. It is impractical on a large turfgrass area, but it is useful in controlling mature goosegrass plants.

**3) Broadcast post-emergence herbicides**: These kill weed plants after they have germinated. However, post-emergence herbicides have some disadvantages in goosegrass control since they are less effective on mature plants and they may weaken the turf. The common product options are MSMA or monosodium methanearsonate (many brands), diclofop-methyl (Illoxan), metribuzin (Sencor) and foramsulfuron (Revolver) and their combinations.

**4) Spot treatment**: This is the application of nonselective herbicides such as glyphosate (Roundup) post-emergence herbicides on the center of individual plants. As well as mechanical removal alternative, it is impractical on large turfgrass area, but it is useful in controlling mature goosegrass plants.

Since high concentrations of arsenic have been detected in soils and water of some South Florida golf courses, there is concern over the use of arsenic-containing herbicides (MSMA) and older inorganic arsenicals. Studies have shown that arsenic in these soils is mobile and mobilizable, which may contaminate groundwater (Cai et al, 2002). However, the substrate composition significantly influences arsenic mobility and arsenic species transformation in the substrate and in percolate water.

It has not been proven that the arsenic in these ground waters is attributable to arsenical herbicides applied to the golf courses. In comparison to uncoated sand and uncoated sand and peat, naturally coated sand and peat showed a higher capacity of preventing arsenic from leaching into percolate water (Feng, et al, 2005).

There is pressure to reduce the use of arsenic herbicides, particularly involving municipal sports fields, and regulatory agencies are studying the association of arsenic in groundwater near golf courses.

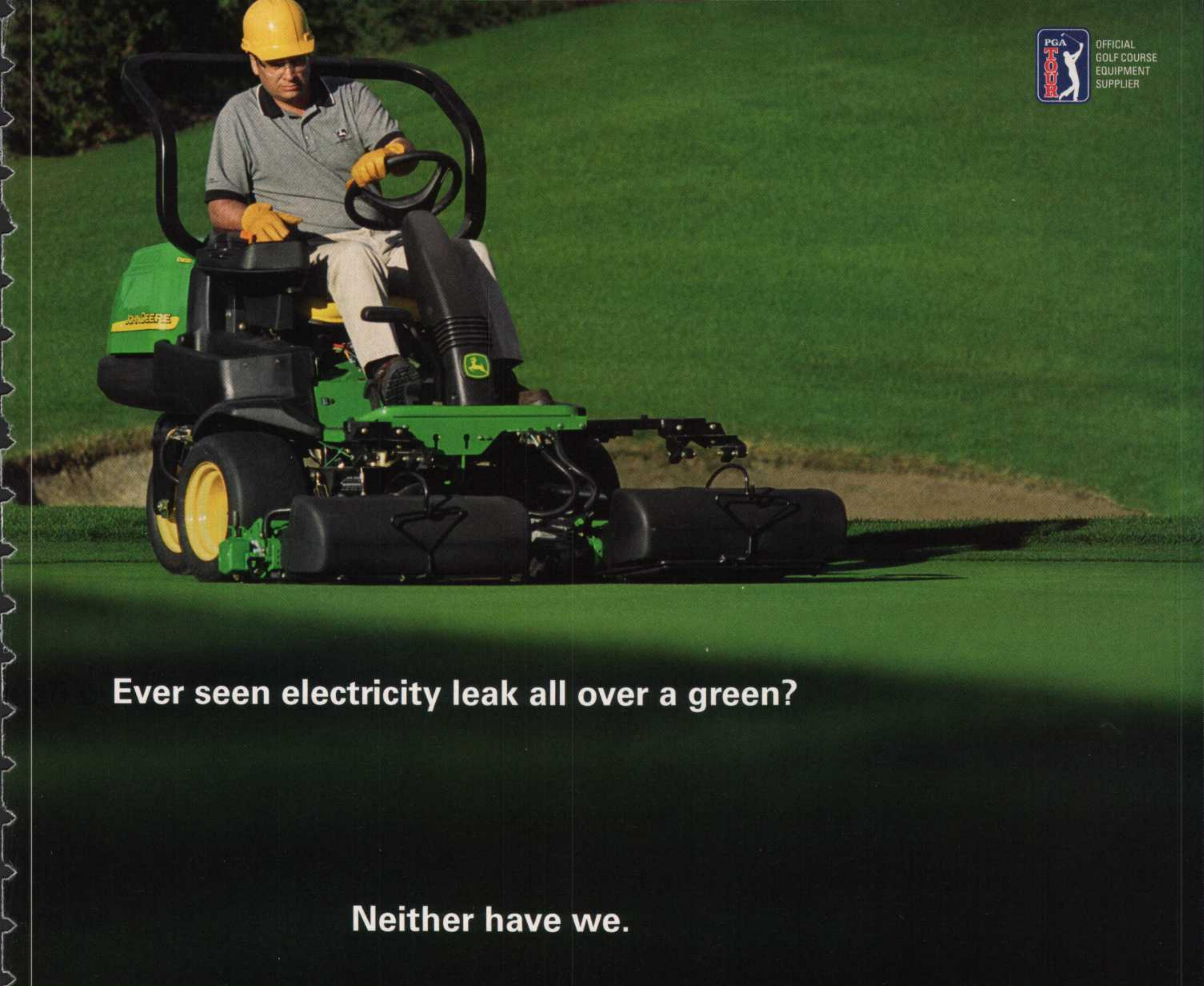
## Prevention

Cultural management of weeds in turfgrass is poorly documented, and more research is needed (Busey, 2003). Periodic cultural practices that can contribute to control of goosegrass are the use of fertilization, irrigation cultivation and traffic control.

**1) Fertilization**: Bermudagrass is a relatively rapid growing grass, and its growth responds strongly to increased fertilization. One pound of nitrogen per 1,000 square feet per growing month helps regrow turf canopy into areas damaged by traffic, and higher rates are used. A closed-leaf canopy can potentially shade the soil and reduce goosegrass seed germination (Busey, 2004).

**2) Irrigation**: I have observed (Arrieta, unpublished data, 2004) concentrated patches of goosegrass plants in dry spots in the field where the turf stand is thinned. There are no studies documenting the growth of goosegrass in dry conditions. Uniform irrigation

*Continued on page 56*




Better than a battery: an alternator powers the reels on the 2500E, giving it consistent power all day long.

www.johndeere.com

**The run-all-day, 2500E Hybrid Greens Mower by John Deere.**
It's about advanced technology. And common sense. The 2500E is a hybrid mower that puts power in its proper place. With a choice of a gas or diesel engine, the 2500E powers the reels using a belt-driven alternator. By removing all the hydraulics from the cutting units, we've eliminated 102 potential leak points. And since 90 percent of all hydraulic leaks occur in and around the reels, the possibility of a leak is extremely remote.

Also, the 2500E is battery-free. So the reels get consistent power right from the moment of engagement. Which in turn leads to a consistent cut, all day long. When you factor in lower sound levels and less fuel consumption, the 2500E makes even more sense.

Call your local John Deere distributor for a demonstration today.

JOHN DEERE GOLF & TURF
ONE SOURCE™
JOHN DEERE

FIGURE 3


High-compaction treatment results in an increase of roots in the first centimeters of soil.

*Continued from page 54*

distribution should be achieved to avoid having areas that are too dry or too wet.

**3) Traffic**: Recreational turf areas are exposed to frequent vehicular and foot traffic, which results in soil compaction and wear of the turf. Core aeration is the procedure used to alleviate compaction while wear is decreased by spreading and/or avoiding in some circumstances (after rain) traffic. It is known that goosegrass infects trafficked areas, and the reason for that is still unclear.

## Compaction studies

Goosegrass infestation in trafficked areas may be due to greater germination because of fluctuating temperatures on thinner bermudagrass turf, and goosegrass plants may grow better than bermudagrass in compacted areas.

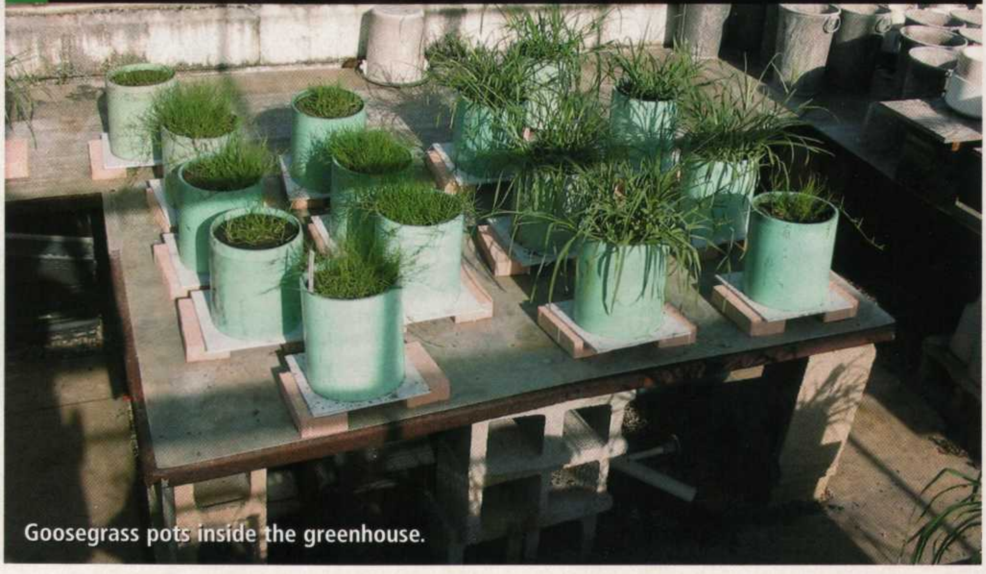
Soil compaction decreases pore space and air in the soil and increases soil density, which affects root growth, soil aeration and water infiltration. The Waddington and Baker study (1964) proved that goosegrass roots grow well under conditions of low oxygen diffusion, but Kentucky bluegrass root growth is reduced when oxygen diffusion decreases. However, this study involved limiting aeration while mechanical impedance has not been evaluated as an effect on goosegrass grows on compacted soil.

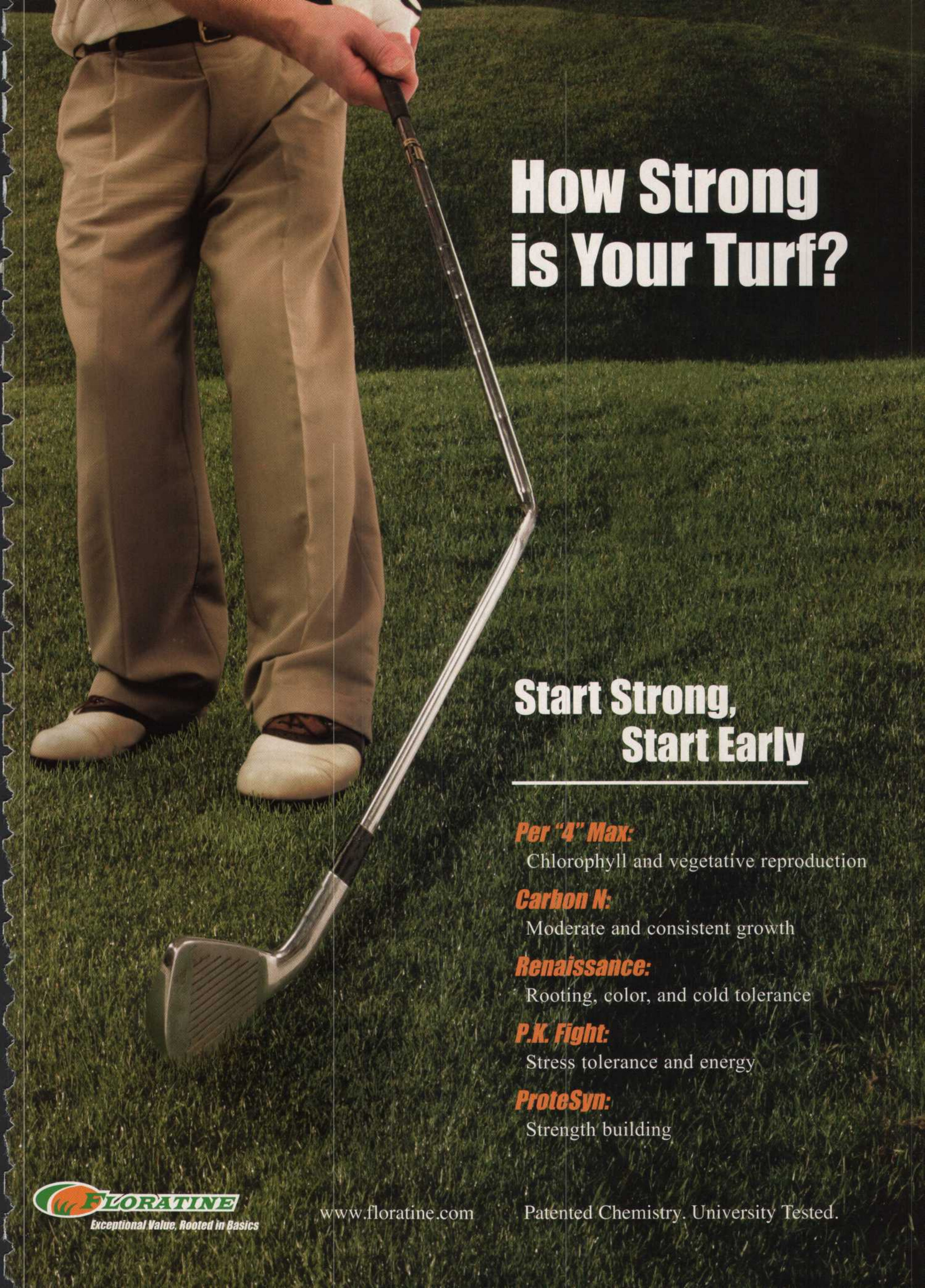
It is not known if a differential reduction in the growth of bermudagrass exists, or whether it is caused by compaction or wear or both. A few studies have shown good tolerance of bermudagrass cultivars to traffic where turf coverage and visual quality was evaluated (Dunn et al, 1994; Carrow et al, 2001), but no studies have evaluated the

*Continued on page 58*



FIGURE 4


Goosegrass pots inside the greenhouse.


How Strong
is Your Turf?
Start Strong,
Start Early
Per "4" Max:
Chlorophyll and vegetative reproduction
Carbon N:
Moderate and consistent growth
Renaissance:
Rooting, color, and cold tolerance
P.K. Fight:
Stress tolerance and energy
ProteSyn:
Strength building
FLORATINE
Exceptional Value, Rooted in Basics
www.floratine.com
Patented Chemistry. University Tested.

*Continued from page 56*

effect of compaction on bermudagrass.

Because compaction and wear occur concurrently in trafficked areas, procedures are needed to examine their separate effects. At present, the author is conducting studies to understand the infestation of goosegrass on compacted areas.

Compaction effect on shoot and root growth of different grasses has been evaluated on containers on greenhouse studies. Compaction has been done by dropping certain weight from certain height onto the pot to achieve different compaction levels (Fig.2).

## Interpretation

The study on perennial ryegrass (O'Neil and Carrow, 1983) showed that visual quality and clippings were reduced under compaction. However, total root growth was not affected by compaction, but after 12 weeks roots were distributed in the first 5 centimeters (cm) of the soil surface.

Another study on Kentucky bluegrass (Agnew and Carrow, 1985) showed the same results — rooting increase in the 5 cm of soil surface — but the total root growth did not decrease. In the Arrieta and Busey study, the increase of roots in the first centimeters of soil was observed on goosegrass roots (Fig. 3), but the total root growth decreased, too. Maybe bermudagrass stolons didn't have enough time to develop for all the compaction treatments, which could have showed a different result.

On this preliminary study, goosegrass shows no tolerance to compaction as commonly believed. Under soil compaction, root and shoot growth decrease. There are other factors that probably enhance goosegrass infestation in trafficked areas, such as greater seed germination and canopy gaps on the turf.

*Claudia Arrieta is a graduate student at the University of Florida, Fort Lauderdale Research and Education Center. She is studying the relationship between goosegrass and soil compaction in turfgrass. She is from Uruguay where she earned her bachelor's degree in natural sciences. She worked there as an extension agent for three and a half years. Currently, she is working as a senior biologist with Dr. Philip Busey, an associate professor on environmental horticultural department at FLREC.*

## REFERENCES

Agnew M, Carrow R. "Soil compaction and moisture stress preconditioning in Kentucky bluegrass. I. Soil Aeration, water use, and root responses." *Agron J.* 1985;77:872-878

Arrieta C, Busey P, Daroub S. "Soil compaction and goosegrass infestation in bermudagrass" (Abstract). In: ASA-CSSA-SSSA International Annual Meeting. C05 Turfgrass Science program; Nov. 8, 2005 Salt Lake City.

Busey P. "Cultural management of weeds in turfgrass: a review." *Crop Science.* 2003;43 (6):1,899-1,911.

Busey P. "Managing Goosegrass I-Prevention." *Golf Course Management.* 72 (1):199-202 II-Removal. *Golf Course Management.* 2004;72(2):132-136

Cai Y, Cabrera J, Georgiadis M, Jayachandran K. "Assessment of arsenic mobility in the soils of some golf courses in South Florida." The Science of the total environment. 2002;291(1-3):123-134.

Carrow R, Duncan R, Worley J, Shearman R. "Turfgrass traffic (soil compaction and wear) simulator: response of Paspalum vaginatum and Cynodon spp." *International Turfgrass Research Society J.* 2001;9(1)253-258

Dunn J, Minner D, Fresenburg B, Bughrara S. Bermudagrass and cool-season turfgrass mixtures: response to simulated traffic. *Agron. J.* 1994;86:10-16.

Feng M, Schrlau J, Snyder R, Snyder G, Chen M, Cisar J, Cai Y. Arsenic transport and transformation associated with MSMA application on a golf course green. *J Agric. Food Chem.* 2005;53: 3556-3562.

Hawton D, Drennan D. "Studies on the longevity and germination of seed of *Eleusine indica* and *Crotolaria goreensis.*" *Weed Research.* 1980;20:217-223.

Holm L, Plucknett D, Pancho J, Herberger J. "The world's worst weeds: distribution and biology. University Press of Hawaii, Honolulu.1977.

Nishimoto R, McCarty L. "Fluctuating temperatures and light influence seed germination of goosegrass (*Eleusine indica*)." *Weed Sci.* 1997;45:426-429.

O'Neil KJ, Carrow RN. "Perennial Ryegrass growth, water use and soil aeration status under soil compaction." *Agron. J. 1983;*75:177-180.

Waddington D, Baker J. "Influence of soil aeration on the growth and chemical composition of three grass species." *Agron. J.* 1964;57:253-258

Wilkinson J, Duff T. "Rooting of *Poa annua L., Poa pratensis L.,* and *Agrostis palustris* Huds. at three soil bulk density." *Agron. J.* 1972;64(1):64-68

# Alternative Tine Entry Angles Make Subtle Impact on Soil

*By Christian M. Baldwin, Haibo Liu and Philip J. Brown*

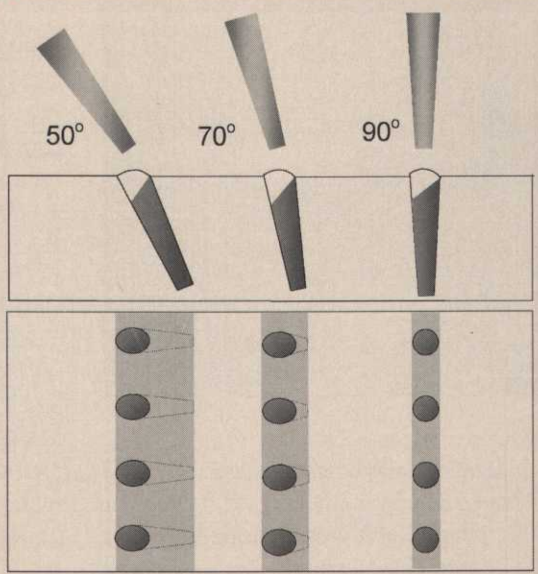
Soil compaction involves macropore reduction, where the soil surface is compressed by foot, maintenance equipment or vehicle traffic. Compacted soils are more dense, with less pore space leading to restricted water flow and root growth (Carrow and Petrovic, 1992).

To remedy these problems, cultivation has become a routine practice for turfgrass managers (athletic fields, golf courses and home lawns) because it relieves compaction, reduces localized dry spots and encourages thatch control by replacing a portion of compacted soil and thatch (McCarty, 2005).

Factors affecting cultivation efficiency include soil moisture, tine size, depth of aerification, soil texture, cultivation frequency and equipment type (Guertal and Han, 2002). Different techniques to reduce compaction and thatch for turfgrass managers include linear aerification, which is designed to treat the upper level of the soil to preserve surface diffusion rates (Jones, 2002), vertical mowing (McCarty et al., 2005), deep tine aerification (Guertal et al., 2003) and high-pressure water injection (Murphy and Rieke, 1994). However, effects of cultivation with different tine entry angles on soil hydrophobicity (dry spots) and water infiltration rates have not been investigated.

The authors hypothesize that aerifying with different tine entry angles (alternating each aerification date) will impact a greater surface area and a greater portion of the soil profile, thereby enhancing water infiltration rates, reducing localized dry spots and enhancing turfgrass quality (TQ). Therefore, the objective of this research was to determine the effects of tine diameter (quarter-inch and half-inch) and entry angle (50 degrees and 70 degrees) on TQ, soil hydrophobicity and water infiltration rates on a creeping bentgrass putting green surface.

**FIGURE 1**



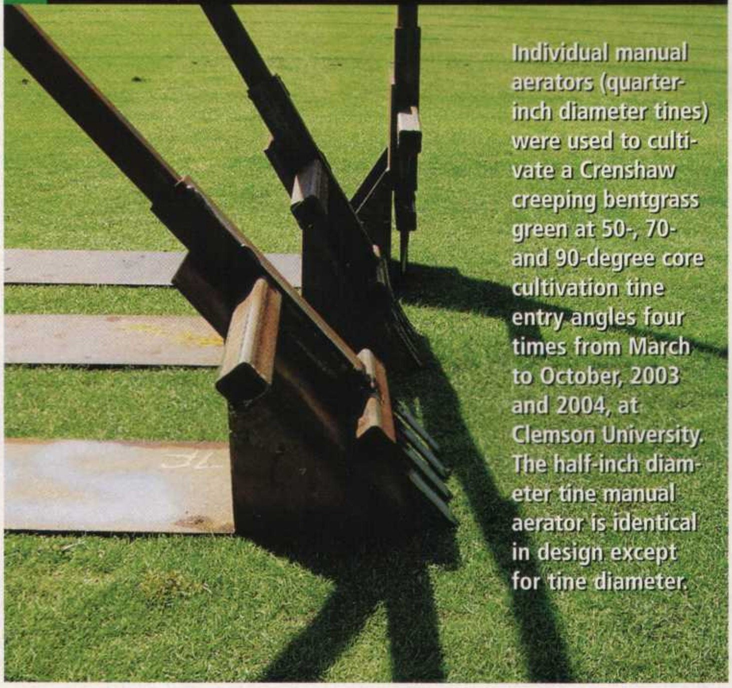

Surface area impacts of core cultivation tine entry angles of 50 degrees, 70 degrees and 90 degrees. The gray areas show the impacted turf surface area with various tine entry angles. Compared to 90-degree tine entry angle, the 50-degree and 70-degree angled tines increased the core surface area by 32.8 percent and 6.1 percent, respectively, regardless of tine diameters. Changing the aerification direction each month will impact a greater area of the soil profile.

## Materials and methods

A field study was conducted in 2003 and repeated in 2004 on a Crenshaw creeping bentgrass (*Agrostis stoloniferous* L. var. *palustris* (Huds.) research green constructed in 1997 with an 85:15 sand:peat root zone mix according to United States Golf Association (USGA) recommendations (USGA, 1993) at Clemson University.

*Continued on page 60*

**PICTURE 1**



Individual manual aerators (quarter-inch diameter tines) were used to cultivate a Crenshaw creeping bentgrass green at 50-, 70- and 90-degree core cultivation tine entry angles four times from March to October, 2003 and 2004, at Clemson University. The half-inch diameter tine manual aerator is identical in design except for tine diameter.

*Continued from page 59*

Cultivation treatments were implemented four times annually in March, May, September and October in both years. During the entire study, treatments included 50-, 70- and 90-degree hollow tine manual aerators plus an untreated without cultivation (Fig. 1).

Manual aerators, consisting of four quarter-inch and half-inch diameter hollow tines 3 inches in length and spaced 2 inches apart (Picture 1), were constructed at the Clemson University maintenance facility department.

Following core removal, topdressing was applied by hand until all holes were completely filled, using USGA specified sand for putting greens. Cultivation direction (North-March, South-May, East-September and West-October) varied with each treatment application.

## Data collection

Data collected included TQ, soil hydrophobicity (MED) and water infiltration rates. Turf quality was rated from 1 to 9, with 1 = brown, dead turf, 6 = minimal acceptable turf, and 9 = ideal green, healthy turf.

Soil hydrophobicity was tested using the MED technique. Undisturbed soil core samples (5 inches in depth and one-half inch in diameter) were taken monthly from each plot prior to cultivation treatments and allowed to air dry for 14 days. Droplets containing ethanol ($C_2H_5OH$) and distilled water solution were

*Continued on page 62*



**TABLE 1**

**Turfgrass Quality†**

| Month | | Treatment | | Tine Size | |
|---|---|---|---|---|---|
| May | 6.33b‡ | Untreated | 6.11b | 1/4" | 6.27 |
| June | 6.54ab | 50° | 6.22ab | 1/2" | 6.30 |
| July | 6.25bc | 70° | 6.44a | | |
| August | 5.95c | 90° | 6.39ab | | |
| September | 6.70a | | | | |
| October | 5.95c | | | | |
| LSD | 0.36 | LSD | 0.29 | LSD | 0.21 |
| p-value | 0.01 | p-value | 0.09 | p-value | 0.78 |

†Turfgrass quality based on a scale of 1 - 9, 1 = brown/dead turf, 6 = minimally acceptable turf, 9 = ideal green, healthy turf.

‡Values within a column followed by the same letter are not significantly different at P≤0.10 by protected LSD.

Turfgrass quality of Crenshaw creeping bentgrass influenced by month (May-October), cultivation treatments (50-, 70- and 90-degree core cultivation tine entry angles), plus an untreated plot (no cultivation) and tine size (two hollow tine diameters at a quarter-inch and half-inch) during Year II.