TABLE 2

Percent of plot area visually blighted by take-all patch as influenced by fungicide and/or nutrient application in a creeping bentgrass fairway at Bellewood Golf Club, North Coventry Pa.; 2006.

Treatment [x]	Percent of plot area blighted [y]		
	----------------0-100----------------		
	21 June	29 June	12 July
Heritage TL	13.7 a [z]	8.3 a	2.3 d
Headway	16.3 a	7.7 a	4.6 bcd
Headway + 0-0-0-5%Mn + WA	16.7 a	5.3 a	0.3 d
Lynx	19.0 a	8.0 a	2.3 d
Tartan	21.0 a	11.3 a	3.3 cd
Insignia	16.7 a	6.0 a	8.6 ab
Nutrient + Wetting Agent Program	10.4 a	5.0 a	1.7 d
Techmangum			
0-0-0-5%Mn			
12-0-0-26			
Flow thru wetting agent (WA)			
Untreated Control	22.3 a	10.7 a	13.3 a

x All treatments were applied on June 14 and 29, and July 13 2006.

y Percent of plot area blighted was rated on a 0 to 100 scale with 0= no disease and 100= entire plot area blighted with take-all patch.

z Means in each column followed by different letters are significantly different (P ≤0.05) according to the Fischer's Protected least significant difference test.

Continued from page 50

of cooler, wet weather in early July, TAP activity was slowed and reduced by mid-July.

By late July, plots that were completely TAP free (no blight symptoms) were those treated with Heritage TL, Headway plus 0-0-0-5 percent MN plus wetting agent, Lynx, and Tartan (data not shown). All other treatments including the untreated check had an average greater than 3 percent blight. The study area was again evaluated on Aug. 2, and no TAP was visible within any plots.

Due to the quick recovery of the creeping bentgrass within the study area and in the surrounding fairway, the TAP on this fairway was considered to be in the "decline phase." Data from this one-year study indicate that curatively managing TAP in the decline phase can be partially successful with applications of fungicides or fungicides and nutrients in tank-mix combinations. Future research is planned for the 2007 season evaluating preventive as well as curative control options for TAP in creeping bentgrass.

Steven McDonald is a consultant and researcher with Turfgrass Disease Solutions LLC, Pottstown, Pa.

Michael Fidanza, Ph.D., is an associate professor at Pennsylvania State University, Berks Campus, Reading, Pa.

Acknowledgements

The authors wish to thank Derek Hudson, golf course superintendent at Bellewood Golf Club, North Coventry, Pa, for his cooperation, and also Bayer Environmental Science, Plant Food Co. and Syngenta Specialty Products for additional support.

REFERENCES

Dernoeden, P.H. and N. R. O'Neil. 1983. Occurrence of Gaeumannomyces patch disease in Maryland and growth and pathogenicity of the casual agent. Plant Disease 67:528-532.

Goss, R.L. and C.J. Gould. 1967. Some interrelationships between fertility levels and Ophiobolus patch disease in turfgrass. Agronomy Journal 59:149-151.

Heckman, J.R., B.B. Clarke and J.A. Murphy. 2003. Optimizing manganese fertilization for the suppression of take-all patch disease in creeping bentgrass. Crop Science 43:1395-1398.

Hill, W. J., J.R. Heckman, B.B. Clarke, and J.A. Murphy. 1999. Take-all patch suppression in creeping bentgrass with manganese and copper. Hort Science 34(5): 891-892.

Latin, R. 2005. Managing take-all patch of creeping bentgrass on sand-based greens. Golf Course Management 73:2:101-105.

Smiley, R. W., P.H. Dernoeden and B.B. Clarke. 2005. Compendium of turfgrass diseases. Third edition. American Phytopathological Society, St. Paul, Minn.

Timing Crucial With Neonicotinoids

By David J. Shetlar

When using the insecticides in the neonicotinoid family, a key to success is timing the application of materials correctly.

Early data, based primarily on imidacloprid, indicates neonicotinoids have excellent activity against sucking insects (primarily *Hemiptera*), *Coleoptera*, and hymenopterous (e.g., sawflies) pests, but poor activity against lepidopterous pests. Because caterpillars can be significant pests of turfgrasses and ornamental plants, neonicotinoids have been combined with pyrethroids. Pyrethroid combinations also appear to improve control of other surface-feeding pests, especially chinch bugs.

In our field evaluation studies, imidacloprid controlled the turfgrass ant, *Lasius neoniger*, only when applied in April or early May when the mound building was first noticed (Tables 2 and 3, p. 54). However, this control (usually 80 percent or better) did not occur until about six to eight weeks after the application. We have three separate studies that demonstrated this phenomenon. But when thiamethoxam was applied at the same time, control was nearly immediate .

In a subsequent study, applying thiamethoxam in July also resulted in control of the ants within two weeks. More recent studies have shown that clothianidin has this same rapid ant control action.

Concerning hairy chinch bug control (Table 1), we have evaluated imidacloprid, clothianidin, thiamethoxam and acetamiprid and all produce excellent results in applications applied in June, July or August. However, when compared to the standard, bifenthrin, which can knock out the chinch bugs in three to five days, these neonicotinoids often take 10 to 14 days to achieve their maximum effect. In one study, we counted the different nymphal instars and adults, and imidacloprid took out the first through third instar nymphs in two to four days, but the larger nymphs took about a week to eliminate and the adults were the ones that took 10 to 14 days to control.

TABLE 1

Efficacy of Arena 50WP, Arena 0.5G and Talstar for Control of Hairy Chinch Bugs in a Home Lawn, Pickerington, Ohio, 2004.

Treatment[a]	Rate	Ave. number of insects/ft^2 (% Control)b		
	lb. AI/acre*	7DAT	14DAT	28DAT
Arena 50WP	0.2	6.4(95)b	0(100)b	0.9(100)b
Arena 50WP	0.3	0(100)b	7.3(97)b	0(100)b
Arena 0.5G	0.2	7.3(94)b	4.6(98)b	0(100)b
Arena 0.5G	0.3	5.5(96)b	0.9(100)b	0.0(100)b
Talstar F	0.2	2.8(98)b	5.5(98)b	0.9(100)b
Check	-	132.9a	260.4a	263.1a

*a Treatments applied 25 August, 2004 to plots 5 x 5 ft, replicated 4X. * Pounds of active ingredient per acre.*

b Data taken 1, 10 & 21 September based on the number of chinch bugs recovered from two 5-inch diameter cylinders per plot (water flotation). ANOVA and LSD based on plot totals. % Controls followed by the same letter are not significantly different (numbers per ft2 calculated). ANOVA = p<0.001 for all dates; LSD @ 0.05 = 8.206, 22.075, and 28.301, respectively.

Control of mole crickets with neonicotinoids has been inconsistent unless you carefully look at the timing of applications. When applied at egg lay to egg hatch, imidacloprid and thiamethoxam have produced very good results. This suggests that the mode of action is to cause the first instar nymphs to stop feeding or stop normal behavior. Of course, this is lethal for such small instars.

While imidacloprid controls the bluegrass billbug very well, it has generally produced poor control of the annual bluegrass weevil. But recent studies with clothianidin have demonstrated that it has excellent activity against this weevil. This again illustrates that each of these neonicotinoids can affect different spectra of pests.

In our sod webworm control studies, imidacloprid has always resulted in poor control, but applications of clothianidin, thiamethoxam and acetamiprid have been quite effective. Again, this control commonly takes seven to 10 days to be maximized compared to the pyrethroids that achieve maximum control in three to five days.

In future studies, fellow entomologists and chemical companies should be encouraged to fully evaluate all of the neonicotinoids for expansion of their target spectra — especially mole crickets, chinch bug species, weevil species, caterpillar species, crane flies and scales (e.g., bermudagrass scale).

Application timing issues

Because most discovery companies first targeted turfgrass insecticides for control of white grubs, and our IPM training recommends that these controls be optimized for egg hatch, many new insecticides are not initially evaluated for early or late applications. With the

Continued on page 54

TABLE 2

Efficacy of insecticides for suppressing ant mounds from *Lasius neoniger* on golf course fairway No. 11, Crockett's Green Hills Golf Course, Clyde, Ohio, 1999.

Treatment/	Rate	Active mounds/yd^2 and (% reduction)[b]				
Formulation[a]	lb.AI/acre	13DAT	30DAT	79DAT	128DAT	169DAT
Scimitar 0.88GC	0.06	0.1(97) de	3.1(57)cdefg	4.4(31)a	3.9(34)abcd	3.0(40)bc
Scimitar 0.88GC+	0.06+					
Merit 75WP	0.3	0.0(100)e	5.3(28)abc	5.1(20)a	2.5(57)e	1.3(75)cd
Merit 0.5G	0.4	3.4(29)b	6.3(14)ab	2.8(57)a	1.4(77)abc	0.9(83)d
MACH2 2LTI	1.5	1.8(63)b	3.8(48)bcdef	6.6(43)a	3.1(47)abc	3.1(38)b
Fipronil 0.05G	0.025	1.8(63)b	4.1(43)bcde	3.3(49)a	0.1(98)de	0.1(98)d
Talstar 0.66F	0.1	0.1(97)de	3.4(53)cdef	5.5(14)a	5.0(15)e	2.8(45)bc
Talstar 0.66F	0.2	0.0(100)e	1.4(81)fg	4.8(25)a	4.6(21)e	3.1(38)b
Check	-.-	4.8(--)a	7.3(--)a	6.4(--)a	5.9(--)ab	5.0(--)a

a Treatments applied 27 April 1999; plots 10x15ft replicated 4x, spray volume 1.5 gal/1,000ft2; no posttreatment irrigation.

b Data taken 10 May, 27 May, 15 July, 2 September & 13 October based on two 1 yd2 observations from each plot. Mound count sums analyzed by ANOVA and LSD @ " = 0.05. Means followed by the same letter are not significantly different (P < 0.001, < 0.001, = 0.193ns, <0.001, and <0.001 for 13, 30, 79, 128, and 169 DAT periods, respectively).

Continued from page 53

long soil residual half-lives of neonicotinoids, more and more tests are being performed with April, May and early June applications (well before white grub egg lay). These generally result in excellent control of the new white grub generation that arrives in July and August.

However, one might think that these early applications might miss some of the surface active insects, especially chinch bugs and sod webworms that normally appear in damaging populations in mid-summer. In our studies, May applications of most of the neonicotinoids result in excellent bluegrass billbug control.

Because it appears that the foliar and stem systemic residues of most of these neonicotinoids are at effective levels for only 20 to 30 days, these May applications should take out overwintered adult chinch bugs and any new nymphs as well as the first generation of sod webworm larvae that begin in late May and early June. May applications will achieve control of these secondary targets and still control the white grubs that arrive later in the season.

On the other end of the season, neonicotinoids generally have been considered to be poor as curative insecticides. Again, we have long known that imidacloprid will kill third instar white grubs, but death can take 14 to 20 days after exposure. In fact, these third instar grubs appear to die not from the insecticide but from secondary infections of bacteria, fungi and nematodes.

In more recent studies, we have found that thiamethoxam takes about seven to 10 days to kill third instar masked chafers but clothianidin achieves control in five to seven days. While these shorter rapidity-of-kill actions are still longer than achieved by trichlorfon, they are certainly within the acceptability range, especially if digging animals are not an issue.

Entomologists should continue to investigate earlier preventive and later curative timings to better define the affects of these chemicals on primary and secondary pests.

David J. Shetlar, Ph.D., is the urban landscape entomologist at The Ohio State University (Columbus). The Bug Doc can be reached at shetlar.1@osu.edu.

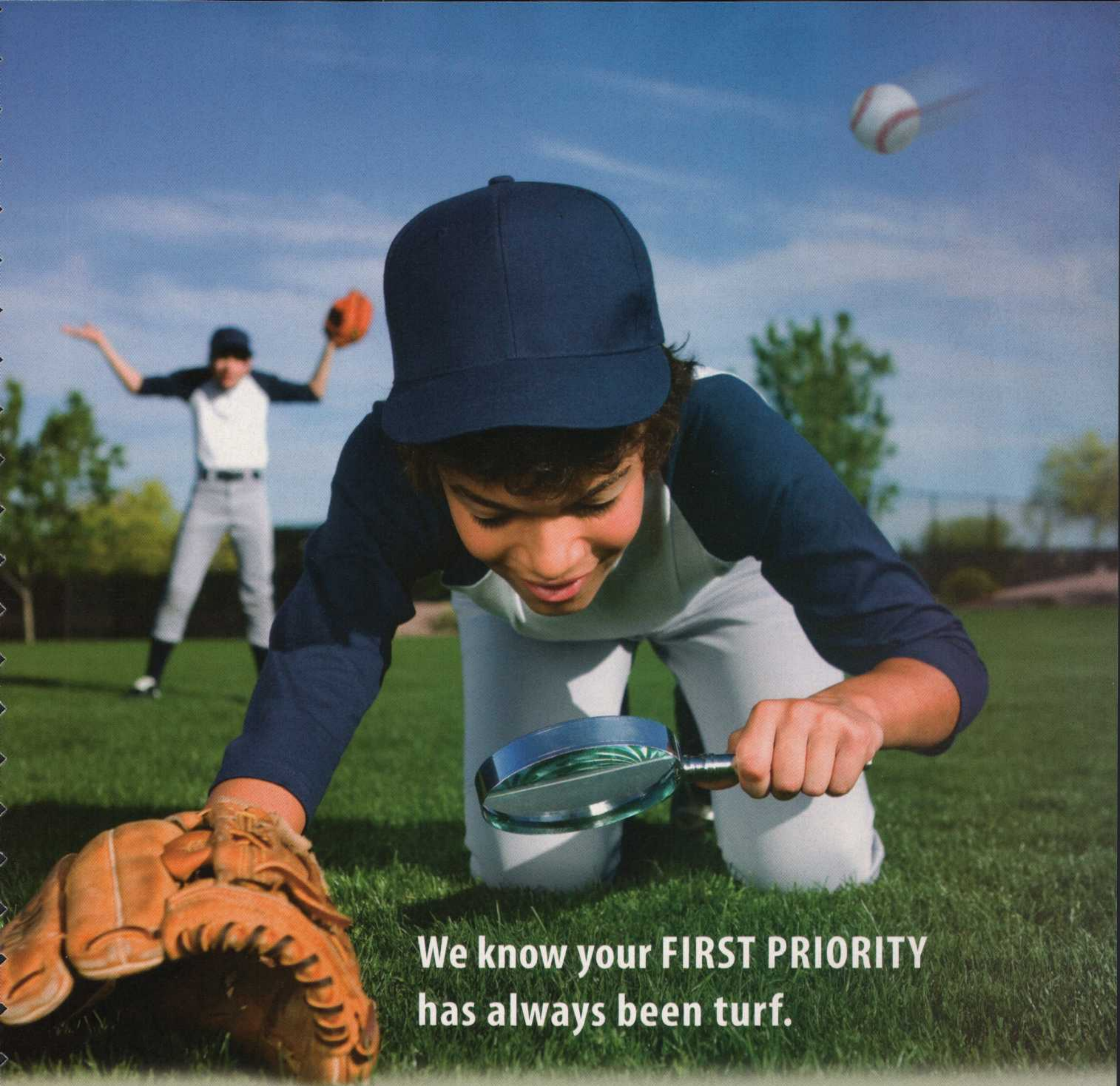
TABLE 3

Season-long efficacy of insecticides for controlling the ant mounds of *Lasius neoniger* on a golf course fairway at Crockett's Green Hills Golf Course, Clyde, Ohio, 2000.

	Rate	Active mounds/yd2 and (% reduction)[b]					
Treatment[a]	lb.ai./A*	7 DAT	14 DAT	28 DAT	8 WAT	12 WAT	21WAT
Talstar 0.2G	0.20	2.4ef(87)	7.3cd(46)	10.5a(26)	10.1ab(0)	10.8a(0)	5.9a(2)
Fipronil 0.0143G	0.025	10.6bc(37)	11.0abc(18)	11.1a(22)	6.4c(20)	2.3cd(63)	0.8b(88)
Merit 75WP	0.40	11.1abc(11)	8.9bc(34)	5.8b(60)	0.3d(97)	0.1d(98)	2.4b(60)
Meridian 25WG	0.26	5.6de(60)	3.0de(78)	0.8c(95)	0.1d(98)	0.1d(98)	2.0b(67)
Meridian 25WG +	0.26						
Scimitar 0.88GC	0.06	0.4f(98)	0.0e(100)	1.4bc(90)	0.5d(94)	0.6d(90)	1.3b(79)
Check	-.--	14.8 a	13.4ab	14.3a	8.0bc	6.4b	6.0a
	ANOVA	<0.001	<0.001	<0.001	<0.001	<0.001	=0.001
	LSD@0.1	3.998	5.396	4.622	3.290	3.571	2.639

*a Treatments applied May 17, 2000, to plots 10 x 15 ft replicated 4x. No post-treatment irrigation. *Pound of Active Ingredient per Acre.*

b Data taken 25 May, 1 June, 15 June, 13 July, 10 August and 12 October based on the same central 2 yd^2 area observed each time within each plot. ANOVA and LSD on plot totals. Means followed by the same letter are not significantly different at " = 0.05 (NOTE: confidential products removed).



Your eight teammates probably weren't happy with you, but since then a lot of foursomes have been.

When you're born with an eye for beautiful grass, you'll love what Agrium Advanced Technologies can do for your course. A customized Agrium fertility program helps you provide the kind of rich, healthy turfgrass that you and your golfers want, all season long. For details, call 800.422.4248, and see how we can help you stay on the ball.

Agrium Advanced Technologies

Smarter Ways To Grow

Agrium Advanced Technologies has all the slow- and controlled-release fertilizers and pesticides you trust.

POLYON PRECISE TRIKOTE DurationCR

Nutralene Nitroform SCU IB NITROGEN

Part 2 of 2

See July's TurfGrass Trends for Part 1.

Turfgrass Root Growth: Increasing Nitrate Metabolism

By Richard J. Hull and John T. Bushoven

Last month, we looked at the chemistry of how nitrates work in root systems. Now we want to know why nitrate (NO_3-) absorbed by roots was not metabolized in the roots but rather transported to leaves.

It seemed reasonable that if NO_3- were reduced and assimilated in the roots, the amino acids formed there might stimulate root growth. At the very least, keeping NO_3- from the leaves should eliminate the NO_3- signal from diverting photosynthetic energy toward shoot growth and allow the roots to get their share.

There are two likely reasons for NO_3- metabolism not occurring in roots: 1) Roots might not contain sufficient nitrate reductase (NR) enzyme to accommodate the NO_3- absorbed by roots or, 2) NO_3- simply passes through root cells and is loaded into the xylem, for transport to leaves, so quickly that there is little time for NO_3- reduction to occur.

We tried to decide between these two possibilities by growing perennial ryegrass in solutions containing a range of NO_3- concentrations. We wanted to use NO_3- concentrations that were similar to those encountered by turfgrasses growing on a golf course or lawn. An earlier field study (Liu et al., 1997) showed that soil water under several perennial ryegrass cultivars averaged 1.8 parts per million (ppm) NO_3-N (nitrogen as nitrate) and rarely exceeded 7 ppm.

We grew perennial ryegrass Palmer III cultures in complete nutrient solutions containing 0.14, 1.26, 2.8 & 7.0 ppm NO_3-N for 60 days and determined the concentration of NO_3-N in leaves and roots (Fig. 1).

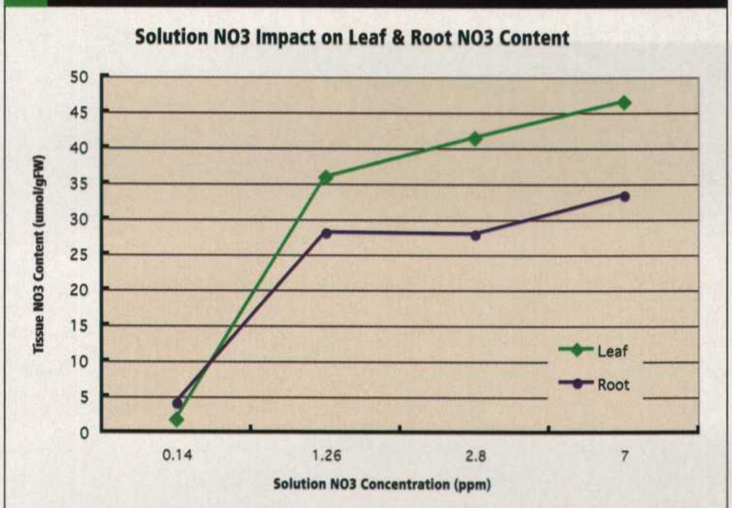
It is evident that the NO_3-N content of both roots and leaves increased as the culture solution NO_3- concentration increased. However, at 0.14 ppm NO_3-N, roots contained more NO_3- than did the leaves but at all higher-solution concentrations, leaf NO_3- was markedly greater than root NO_3-. This indicates that NO_3- metabolism in roots becomes saturated at a soil solution concentration between 0.14 and 1.26 ppm NO_3-N. As solution NO_3- increases, leaf NO_3-N content increases to levels greater than that in roots.

Since soil water beneath perennial ryegrass turf averages less than 2 ppm NO_3-N, it is reasonable to expect that NO_3- uptake by roots will normally saturate the roots' capacity for NO_3- metabolism, and substantial NO_3- will be carried to and accumulate in the leaves.

Is there any way to increase NO_3- metabolism in roots? The good news is that roots can metabolize NO_3-, but they exhibit only 10 percent of the NR activity observed in leaves (Bushoven and Hull, 2005).

We concentrated on NR because it catalyzes the initial step in NO_3- metabolism and is gen-

FIGURE 1



The increase of nitrate content in roots and shoots of perennial ryegrass grown in solutions containing four nitrate levels. Note that at very low nitrate levels, roots contained more nitrate than leaves but as solution nitrate concentrations increased, nitrate levels in leaves increased more rapidly than in roots.

erally considered to be the control point for the entry of NO_3- into its metabolic pathway. This brings us to the matter of speed by which NO_3- passes through root cells on its way to the xylem and transport to leaves. If NO_3- resides in the cytosol of root cells for only a short period of time and at low concentrations, it might not induce the synthesis of enough NR to metabolize more than a trace of the NO_3- passing through. Nitrate Reductase is an inducible enzyme in that it is only made when its substrate, NO_3-, is present. The gene that encodes NR is not expressed unless there is NO_3- in the cytosol. The relatively high concentrations of NO_3- in the roots (Fig. 1) does not mean that NR must be fully induced because most of that NO_3- has likely accumulated in the cell's membrane-bound vacuoles that are separate compartments from the cytosol. If the rate of NO_3- transport through the roots could be slowed, perhaps the cytosolic NO_3- concentration would increase and induce more NR synthesis.

We tested this idea by withholding potassium (K) from or adding sodium chloride (NaCl) to the nutrient solution. Potassium ions (K+) serve as a counter-ion for the loading of NO_3- into the xylem and during its transport to the leaves. If K+ is deficient in the roots, NO_3- transport in the xylem is slowed (Rufty et al., 1981). Adding NaCl to the nutrient solution increases the concentration of chloride ions (Cl-) that compete with NO_3- for entry into the xylem. It has been observed that plants subjected to salinity stress will increase NO_3- metabolism in their roots while decreasing it in their leaves (Cramer et al., 1995). We observed that both of these treatments did increase root NR activity as well as the percentage of NO_3- metabolized in perennial ryegrass roots, but the increases were small and not practically significant (Bushoven and Hull, 2005). However, these experiments did support the hypothesis that slowing the passage of NO_3- through roots could increase NO_3- retained and metabolized in roots.

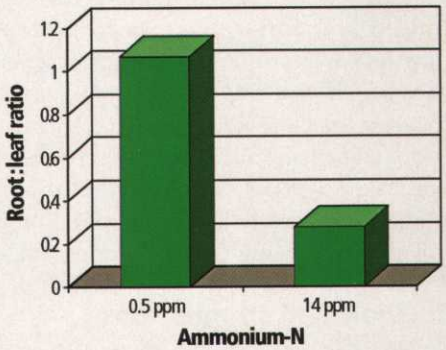
Turf grown without nitrate

In order to remove any possible NO_3- influence on root and shoot growth, perennial ryegrass was cultured in solutions containing ammonium (NH_4+) as the only nitrogen source. We supplied NH_4+ at a low and high concentration (0.5 & 14

FIGURE 2

Root Growth and Site of Nitrate Metabolism

Confining nitrogen assimilation to roots increases root:leaf ratios significantly.



Confining nitrogen assimilation to roots by growing perennial ryegrass in solutions containing low or high concentrations of ammonium resulted in less inhibition of root growth but markedly greater shoot growth at high nitrogen levels.

ppm NH_4-N) to observe the effect of nitrogen concentration on relative root and shoot growth without the complication of NO_3- signaling.

In solution culture, NH_4+ is rarely oxidized to NO_3- (nitrification) as it is in the soil. No NO_3- was detected in our solutions when NH_4+ was the nitrogen source. We found that, similar to NO_3-, high concentrations of NH_4+ markedly reduced the root:shoot ratio (Fig. 3). However, unlike NO_3-, the high NH_4+ concentration increased shoot growth 170 percent while NO_3, at the same concentration, actually reduced shoot growth 4 percent. Thus, the lower root:shoot ratio caused by high NH_4+ was caused mostly by increased shoot growth and not by dramatic reductions in root production.

Recent evidence might cast the nitrate problem in a somewhat different light and can offer a few solutions.

Still, high NH_4+ concentrations did reduce root growth 30 percent but not as severely as high NO_3- (35 percent). This can be explained by the fact that NH_4+ is more readily absorbed by root than is NO_3-. Also, once absorbed, NH_4+ is rapidly assimilated because it can easily become toxic if accumulated in root cells. Thus, as Bowman and Paul (1988) earlier showed, rapid NH_4+ uptake by roots will likely divert much available energy (sugars) in the roots to support NH_4+ assimilation into amino acids and not to growth. These excess amino

Continued on page 58

Continued from page 57

acids will be transported to the leaves where leaf growth will be stimulated as was demonstrated in the above experiment.

Thus, while NH_4+ can avoid the negative signaling problem of NO_3-, it presents some problems of its own that can reduce root growth. It is clear that root growth is fundamentally driven by photosynthetic energy obtained from the leaves, and anything that diverts this energy from the roots (high NO_3- in leaves) will depress root growth and compromise turf quality. This limitation to root growth will be considered in a future article.

Outlook and suggestions

The preceding discussion clearly suggests some strategies by which turfgrasses might be made more efficient in their use of nitrogen while increasing their utility as turf. All reactions involved in NO_3- metabolism and transport within plants are regulated by enzymes (proteins), which are ultimately under genetic control.

The application of molecular genetics to problems of NO_3- partitioning within turfgrasses, identified above, clearly have the potential to produce grasses that will be better adapted to the turf environment and more efficient in their use of nitrogen resources. Until this happens, however, there may be some turf management suggestions that emerge from our studies.

1) Do not apply NO_3- directly to turf. All nitrogen sources will ultimately be converted to NO_3- in the soil, but the process can at least be slowed by applying NH_3 forms, especially if they have slow-release properties.

2) Perhaps the use of nitrification inhibitors (slow the oxidation of NH_4+ to NO_3- in the soil) should be reconsidered. We and others have concluded that surface applications of these compounds are largely ineffective for increasing nitrogen use efficiency and minimizing NO_3- leaching in established turf. However, when incorporated into the soil prior to seeding or sod laying, some modest improvements in nitrogen use and retention were observed. Perhaps applying nitrification inhibitors using the high-pressure injectors employed for pesticide applications might prove effective in making more NH_4+ and less NO_3- available to turfgrass roots.

3) Nitrification occurs most readily in soil of near neutral pH. There might be some benefit in maintaining a more acid soil pH to slow the production of NO_3-. This might be most practical on sand-based greens where aluminum (Al) toxicity is less likely to be a problem. With the identification of more Al-tolerant turfgrass cultivars, lowering the soil pH may be realistic even on fairways and lawns. Of course, potential side effects (moss growth, disease, etc.) may complicate this approach.

4) Foliar applications of NH_4+ based soluble fertilizers should be investigated for their potential to increase root growth while maintaining high quality turf. In situations where soil NO_3- can be maintained at low levels, applications of NH_4+ sources designed for foliar absorption might have the same potential benefits as NO_3- metabolism concentrated in the roots.

Richard J. Hull, Ph.D., is professor emeritus of plant physiology at the University of Rhode Island, and an adjunct professor of horticulture at Clemson University.

John T. Bushoven, Ph.D., is an assistant professor of horticulture at California State University — Fresno (Calif.)

Routines Help Isolate Turf Troubles

BY KARL DANNEBERGER

Field diagnosis — like other rituals — varies among golf course superintendents, consultants and university personnel. Although I do not have a magical way to solve problems, I try to keep a few things in mind. Two keys in plant diagnosis are developing a routine and never assuming anything. Similar to a pre-shot routine in golf, successful diagnoses requires following an orderly process, and then practicing it so that it becomes second nature. This increases confidence in one's abilities and reduces the likelihood of panic when facing turf injury or loss.

Just as a golfer visualizes a shot in a pre-shot routine, an diagnostician must be aware of the entire landscape surrounding the damaged turf area. The initial viewing process should be telescopic in nature. In other words, take a broad look, almost panoramic, for the purpose of characterizing the turf injury in the broadest view. Ask questions like: Is the injury limited to a particular green or fairway? What makes the area different from the others?

Now as your focus becomes more directed to the injured area, what is the turfgrass species? Knowing the species is often assumed — incorrectly. Knowing the species, along with the weather conditions or time of the year helps eliminate several extraneous possibilities. Once the turfgrass is identified, mentally characterize the symptoms. Are they diffuse or in a definite pattern? A general rule I keep in mind is if the turf is dying in straight lines, then it is most likely caused by human error.

As you compress down from a panoramic or global view, what do the overall symptoms look like? Nondescript or definite patterns can be caused by abiotic or biotic stresses. But turf that dies in straight lines is likely a result of management error. One common diagnostic error at this point is assuming you know the problem without examining the turf closely.

As an example, during hot, dry periods of summer, moisture stress on fairways can occur, and at first glance, the symptoms might be evaluated as inadequate sprinkler head coverage. However, upon further examination (this might require getting down and pulling back the turf) the problem might actually be an insect pest. A common mistake is that black turfgrass *Ataenius* produces symptoms similar to moisture stress that will be misdiagnosed without closer examination.

DIAGNOSTIC SUCCESS REQUIRES A PANORAMIC VIEW AND A CLOSE-UP, TOO

As an analogy, how many of us would be comfortable going to the hospital with an illness and have the doctor pass by the examination room and make a diagnosis from the hallway? If your turfgrass plants could talk, how many of them would feel comfortable with you driving by in a golf car and making at 10-mph diagnosis?

Documentation of the site is critical. Besides close examination and storing historical information — such as soil and water quality reports — on-site information can be gathered rather quickly. First, capturing and describing symptoms requires a digital camera and the ability to use it. Digital photos that document the site should follow the telescoping idea of broad general pictures followed by close-ups of the symptoms.

Photographs can lead to rapid diagnoses. Digital photographs sent via e-mail can be disseminated rapidly to diagnostic labs, extension specialists or trusted fellow superintendents who might be able to provide insight into the problem.

Finally, if you are in a position to help a client or a friend or trying to gain an employee's perspective, an important trait is the ability to listen. By listening, the person will tell you what might have caused the problem. I try to remind myself that I have never learned anything when I was doing all the talking.

Karl Danneberger, Ph.D., is Golfdom's science editor and a Ohio State University turfgrass professor.