(Continued from page 19)

to supply additional microbes, often found in thatch. With the unending supply of products available, it is difficult to know which ones work in our soils, and which ones don't. And what about aerification and topdressing? What role will cultivation methods play with these new products?

Thatch control is not a once a year project; instead it requires an integrated approach involving prevention, biological control, and mechanical removal. (Carrow, 1979) Some interesting results were published in 1995 by Dr. Rich Gaussoin, University of Nebraska, which indicated that aerification, in addition to some of the thatch degradation products, significantly reduced thatch.

Over the next three years, we will be replicating some of these same studies at O.J. Noer Turfgrass Research Facility and University Ridge Golf Course, and we hope to clear up some of the confusion surrounding the control and prevention of excessive thatch.

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Wisconsin Turfgrass Disease Diagnostic Lab:
Golf Along the Nile

By Dr. Douglas P. Maxwell, Department of Plant Pathology, University of Wisconsin-Madison

Pyramids, the pride of Egypt, stand guard at the southwestern edge of the ancient city of Cairo. They seem to hold back the explosive construction of new apartment complexes needed to house the growing city of 15 million. It is nearly impossible for us Wisconsinites to picture Cairo. It straddles the River Nile at the southern tip of the Nile delta. On the north, a fertile plain extends to the Mediterranean Sea, and on the other three sides are desert sands without limit.

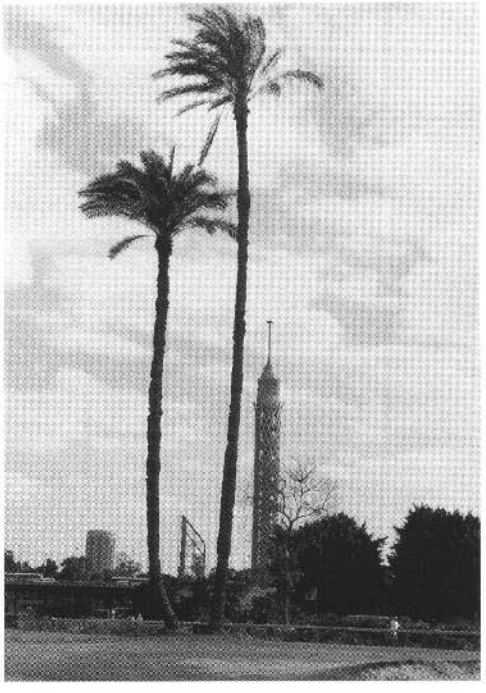
A visitor's first impressions are of 1) unbelievable traffic jams with cars, buses, donkey carts, camels, sheep and people all trying to get someplace as fast as possible; 2) tan apartment buildings everywhere with small shops on the ground floor and apartments on upper floors; 3) men in all kinds of dress from business suits to galahbiahs, long gowns of heavy cloth; 4) dust, dust, and more dust in the polluted air from millions of cars running on leaded gas; and 5) the muslim calls to prayer five times per day starting at 4:00 a.m. and finishing at 8:00 p.m. Mosques are everywhere so one is always within hearing distance of the "call to prayer."

Through this complex city of ancient culture and modern buildings runs the Nile, the longest river in the world. Situated on an island in the Nile in the heart of Cairo is the Gezira Sporting Club, the home of one of the two 9-hole golf courses in Cairo. Mr. Mohmoud Erfan, superintendent of the golf course and President of Egyptian Golf Federation, visited with me in fluent English. He had received his M.Sc. Degree in Food Science from the University of California-Berkeley in 1945 and started work at the Gezira Sporting Club in 1949.

He remembers the beautiful 18 holes which were reduced to 9 during the time of President Nasser. The nine fairways have 14 greens and occupy 19 acres. The Gezira Course was constructed in 1890 using a "foreign grass from Kenya or South Africa for the greens." "Diseases are not a problem," Mr. Erfan comment, "but the invasion of weeds into the greens is, along with the difficulty of getting enough water." Fairways are flood-irrigated about once each week. When we arrived, Mr. Erfan was reviewing literature for a new sprinkler irrigation system from the USA.

Cairo is a heavily populated and busy city.

Narrow streets add to the sense of confusion.



The Gezira Sporting Club in Cairo, Egypt.

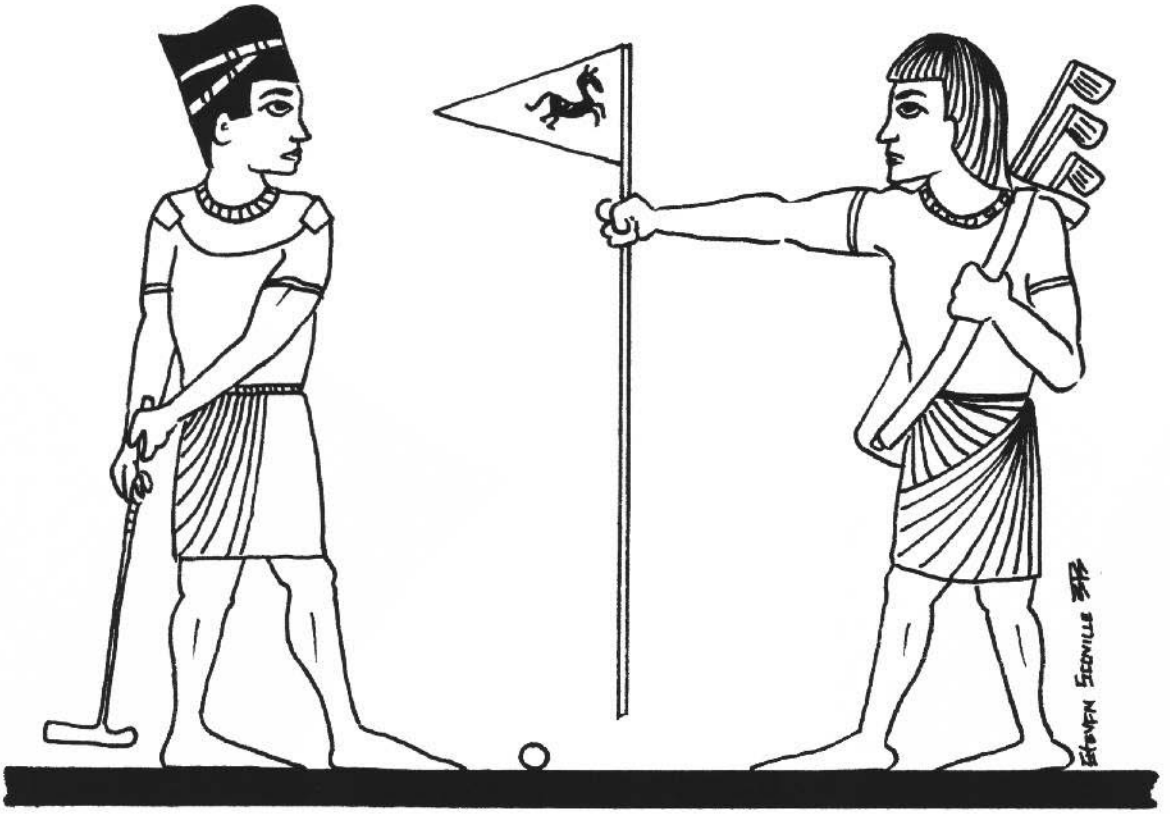
The golf craze has hit Cairo, according to Mr. Erfan. Four new 18-hole golf courses are under construction at the edge of the city and Mr. Erfan is a consultant for one of these. It will occupy 270 acres and include an 18-hole golf course, a clubhouse, apartment houses and villas.

Golf is not for everyone in Cairo as it is extremely expensive. To play nine holes at the Gezira Sporting Club costs $25 US, as much as many people make in two weeks of work. But for those who can afford it, the Gezira Sporting Club offers a quiet spot in the middle of a bustling, noisy dusty city.

Personal note: You may ask,"why was Doug Maxwell in Cairo?" I was invited by the Director of the Plant Pathology Research Institute, Dr. Hamed Mazyad, to review the plant virology program there and to give a seminar. Most importantly, I was asked to design a collaborative research program for developing salt-tolerant tomato hybrids with resistance to the devastating viral disease, tomato yellow leaf curl.

Our laboratory, along with Asgrow Seed Co., had just filed for a patent on a new procedure which uses recombinant DNA methods for engineering plants with resistance to viruses. I visited with persons engaged at all levels with this problem, from students to the Minister of Agriculture. From these many visits emerged a research proposal, and now I wait to see if it will be funded.

Research funding for many projects in the Middle East comes from the United States Agency for International Development, which annually provides about $2 billion in funding for Israel and Egypt. This may seem like a large number, and it is. But the US ranks tenth in all foreign aid as a percentage of gross national product, falling behind such countries as New Zealand, Sweden, Denmark and Norway.



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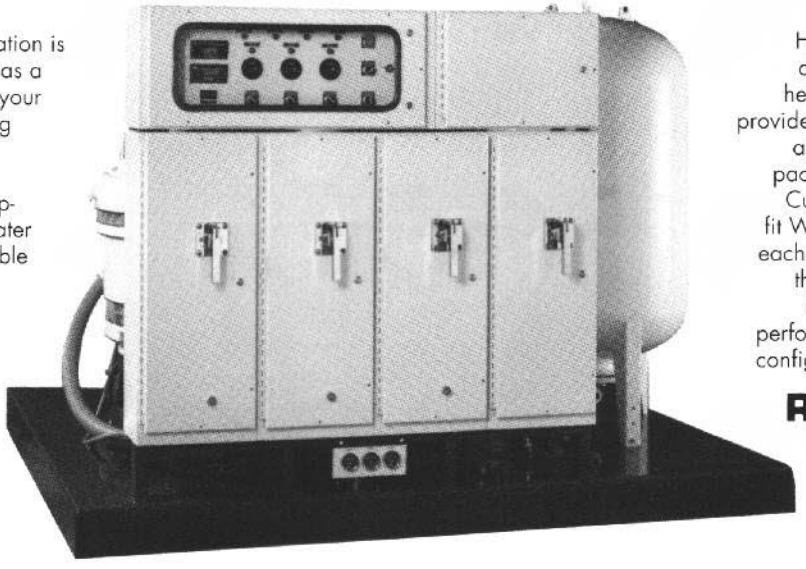

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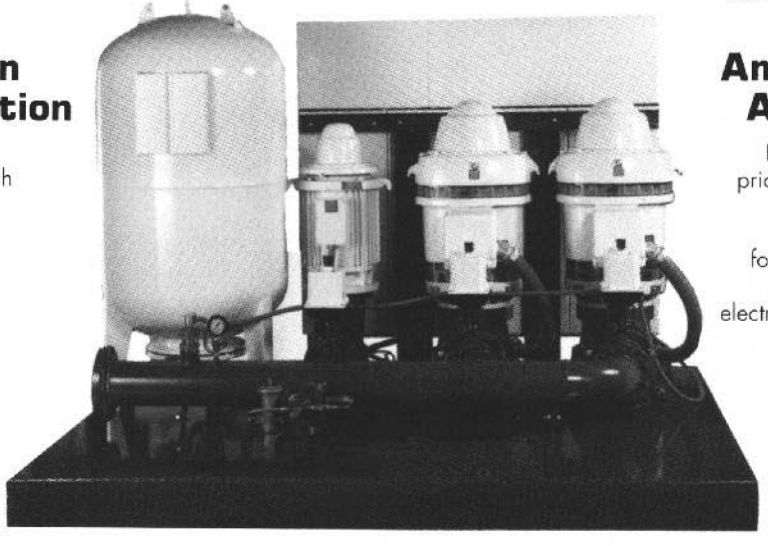

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Nitrogen and Organic Amendment Effects on the Grow-In of Simulated Bentgrass Putting Greens

By Christopher Kleinsmith

As pointed out by Dr. Kussow in the last two issues of THE GRASS ROOTS, there is widespread concern about the level of microbial activity in newly constructed sand putting greens. Low microbe populations have been implicated in the extremely high rates of nitrogen found necessary for grow-in and in the occurrence of Pythium root rot.

This greenhouse study was conducted to satisfy one of the requirements for a major in Soil Science with specialization in Turf and Grounds Management. The purpose was to observe the effects of four different N fertilization programs and organic amendments added to a commercial sand-peat root zone mix on creeping bentgrass grow-in. The organic amendments added were selected for their potential for stimulating buildup of microbe populations in the root zones.

METHODS

Simulated putting greens were established in 6-inch diameter PVC cylinders in the greenhouse. Each green consisted of 12 inches of root zone mix overlying 3 inches of pea gravel. The experiment consisted of 14 treatments (Table 1), each replicated three times. After packing the columns with the mixes, each was seeded to Providence creeping bentgrass after application of starter fertilizer. As soon as the grass began to emerge, the greens were lightly watered ona daily basis. Clipping was at a 1/2 inch height every 3 to 7 days. The experiment was concluded after a period of 3 months.

(Continued on page 27)

Table 1. Treatments tested.

Treatment number	ROOT ZONE MIX AMENDMENT * Type	Rate per yd^3	Nitrogen application
1	None	—	SRN as needed
2	None	—	0.1 lb N/M/week
3	None	—	.4 lb N/M/week
4	None	—	0.8 lb N/M/week
5	Inoculum	5 lb	SRN as needed
6	Sustane		SRN as needed
7	Milorganite	5 lb	SRN as needed
8	Milorganite	10 lb	SRN as needed
9	Milorganite	20 lb	SRN as needed
10	Sand-Aid Carbo-Aid	10 lb 10 oz	SRN as needed
11	Milorganite + Carbo-Aid	10 lb 10 oz	SRN as needed
12	Milorganite + Sand-Aid Blend	10 lb	SRN as needed
13	Milorganite + Sand-Aid Granular	10 lb	SRN as needed
14	Milorganite + Sand-Aid + Inoculum Blend	10 lb 5 lb	SRN as needed

* yd^3 of a commercial 85/15 sand-peat blend.

Table 2. Root zone mix characteristics.

Treatment	Moisture retention 30-cm tension	Bulk density	Relative bioactivity ‡ 2 week	Relative bioactivity ‡ 3 month	Ignition weight loss * Initial	Ignition weight loss * 3 month	Infiltration rate	Cation exchange capacity
	% vol	g/cc		%			inch/hour	me/100 g
1-4	14.8	1.67	8.1	55.3	1.20	1.23	57.3	1.18
5	20.7	1.63	11.1	49.1	1.46	1.19	46.7	1.29
6	18.4	1.64	7.8	55.7	1.66	1.25	45.1	1.32
7	15.5	1.64	8.3	53.9	1.71	1.23	46.2	1.49
8	16.1	1.61	11.4	41.6	1.73	1.47	37.5	1.50
9	14.5	1.63	13.4	40.2	2.01	1.38	41.0	1.62
10	18.6	1.50	22.4	75.0	1.75	1.05	44.4	1.66
11	17.9	1.63	13.6	57.3	1.75	1.00	40.3	1.27
12	17.0	1.64	12.4	76.1	2.45	0.95	42.9	1.61
13	19.1	1.62	22.9	57.0	2.06	0.93	38.3	1.40
14	17.8	1.58	34.6	53.6	1.82	1.07	39.8	1.53

* 600°C.
‡ Maximum = 100.

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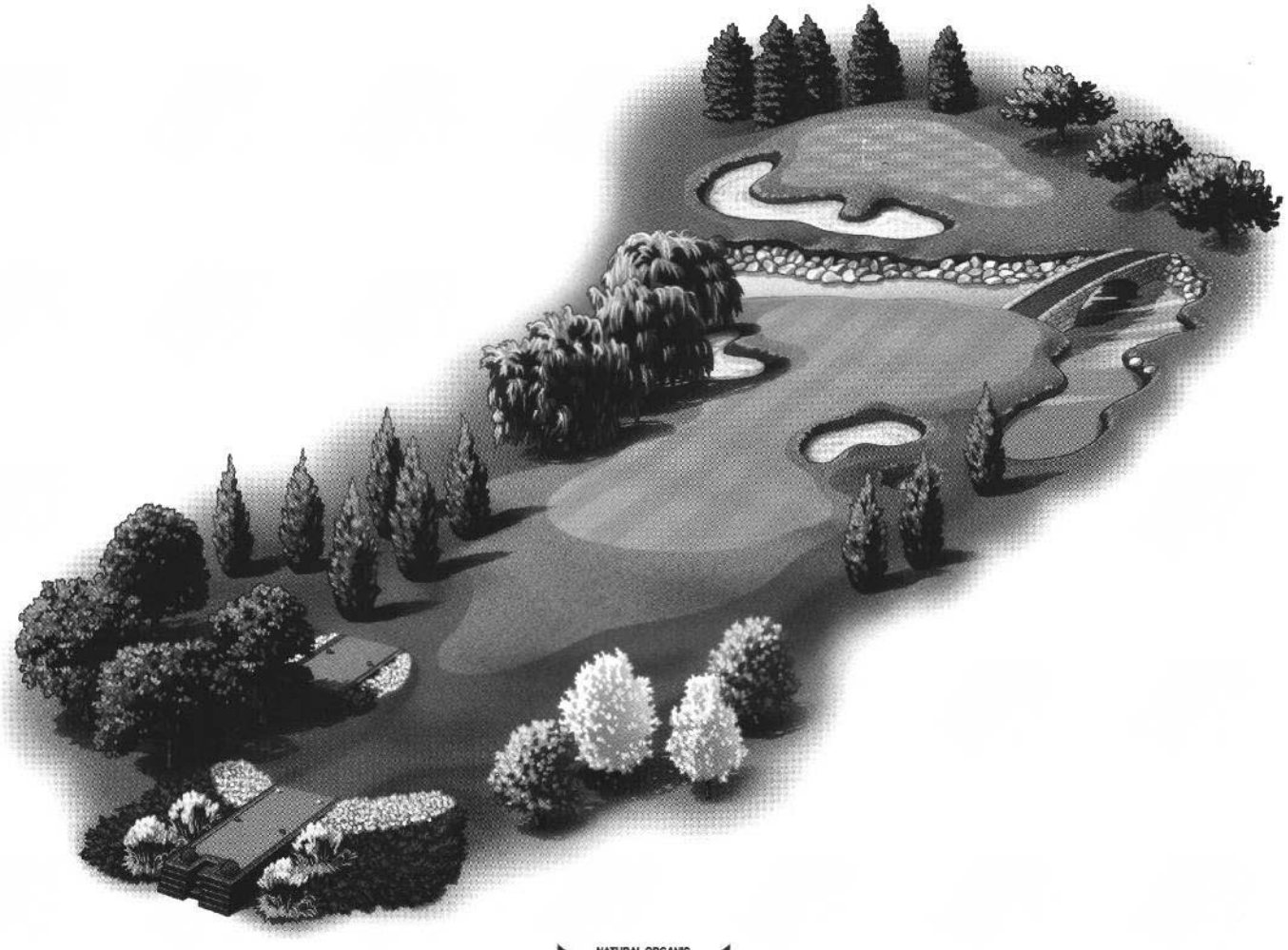

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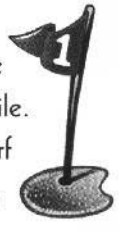


(Continued from page 25)

RESULTS AND DISCUSSION

The commercial root zone mix employed was an 85/15 sand-peat blend that meets USGA standards for putting green construction. Adding the various organic amendments increased moisture retention in compacted cores at 30-cm tension from 14.8 to as high as 20.7% by volume (Table 2). Amendment of the original mix also reduced bulk density somewhat. There was no consistent relationship between moisture retention and bulk density.

During the 3 months of the study, root zone mix samples were periodically removed from a 3-inch depth in the root zone mixes. These samples were placed in closed containers for 6 days and the carbon dioxide evolved trapped in sodium hydroxide. The amounts evolved were assumed to be an index of the amount of microbial activity in the mixes. As shown in Table 2, 2 weeks after seeding, there were fairly low levels of microbial activity in the un-amended root zone mixes (treatments 1-4). Some of the organic amendments appeared to have stimulatory action, the most effective being a combination of Milorganite, Sand-Aid, and an inoculum prepared from fish meal and dried, granulated kelp. By the end of the study, only the root zones mixes amended with Sand-Aid+Carbo-Aid or Milorganite+Sand-Aid had more microbial activity than did the unamended root zone mixes.

Weight losses of the root zone mixes ignited at 600oF were determined at the beginning and end of the study to estimate changes in organic matter content. Comparison of the two sets of numbers (Table 2) suggests that the organic amendments decomposed very rapidly. Not only did some appear to decompose completely, but reductions of weight loss to less than that of the original root zone mix signifies that in treatments 10 through 14, the amendments also promoted decomposition of as much as 22% of the peat originally present.

Addition of the organic amendments to the root zone mix reduced the putting green infiltration rates somewhat (Table 2), but not to levels considered unsatisfactory by the USGA. The amendments had the positive effect of increasing the cation exchange capacity of the root zone mix by as much as 40%.

The amendments had variable and sometimes dramatic effects on visual assessments of bentgrass establishment (Table 3). After 6 days, additions of the inoculum, Sustane, Milorganite at <20 lb/yd3 of root zone mix, Sand-Aid+Carbo-Aid, and Milorganite+ Sand-Aid+inoculum appeared to hasten bentgrass establishment as compared to the nitrogen treatments. In contrast, 20 lb/yd3 of Milorganite and Milorganite+Carbo-Aid were clearly detrimental. On the seventh day after seeding, the bentgrass in the greens containing 20 lb Milorganite/yd3, the Milorganite+ Carbo-Aid or Milorganite+Sand-Aid+inoculum suddenly turned brown. By the eighth day, all of the bentgrass in these greens was dead. Re-seeding of these greens was only partially successful. After 18 days, establishment ratings showed that the bentgrass stands in the nitrogen treatments were as good as, and often better than, where the root zone mix was amended with the organic materials.

The total weights of bentgrass clippings collected during the study and roots isolated after 3 months to a depth of 12 inches are shown in Table 3. The first thing to notice is the fact that in the nitrogen treatments, application of 0.4 lb N/M/week was optimum for shoot growth. At the 0.8 lb/week N rate (equivalent to 30 lb N/M over a 24-week season), shoot growth was reduced. This is reflected in the slightly lower establishment rating of this treatment at 18 days. This treatment also produced bentgrass discoloration that could only be partially corrected with applications of potassium and micronutrients. Bentgrass root growth progressively declined as the N rate was increased.

Table 3. Bentgrass responses.

Treatment	Establishment ratings 6 days	8 days	18 days	Total biomass production Shoots*	Roots‡	Shoot:root
	Scale 1-5			mg		
1	2.5	4.3	3.9	871	643	1.35
2	2.0	4.2	4.7	1214	891	1.36
3	2.3	4.2	4.7	1520	573	2.65
4	2.5	4.3	4.5	1157	306	3.78
5	3.5	4.1	4.4	1025	664	1.54
6	3.0	0.7	2.7	690	515	1.34
7	3.5	2.4	4.1	935	572	1.63
8	3.5	1.0	2.7	1076	349	3.08
9◊	0.5	0	4.3	1550	293	5.29
10	4.0	3.4	4.2	921	504	1.83
11◊	1.5	0	2.2	1082	365	2.96
12	2.7	3.8	3.9	1305	635	2.06
13	2.7	2.7	2.7	1110	242	4.59
14◊	3.5	0	0.7	979	166	5.90

* Sum of 11 harvests.
‡ After 3 months.
◊ Grass died, reseeded day 8.

Treatment 1, that in which the intent was to apply primarily SRN on a need basis, produced low bentgrass shoot growth and an intermediate amount of root growth (Table 3). It was found with this treatment that SRN alone could not maintain adequate bentgrass color and periodically had to be supplemented with soluble N.

Among the organic amendment treatments, the 20 lb rate of Milorganite produced the most bentgrass clippings, but root growth was relatively low (Table 3). Root growth was also strongly restricted in the homogenous Milorganite+Sand-Aid and Milorganite+Sand-Aid+inoculum treatments. The reason for this became evident at the end of the study. Samples taken from the full depths of the root zone mixes revealed that the bottom 4 inches of these mixes were chemically strongly reduced. This was very evident from the gray rather than normal reddish color of the root zone mix and the strong odor characteristic of soil from swamps.

CONCLUSIONS

The results of this greenhouse study provide strong indication that caution must be used in amending putting green root zone mix with readily decomposable organic materials to stimulate microbial activity. There appeared to be no clear advantages to doing so, and death of the newly seeded bentgrass is a possibility. The best approach observed for rapid grow-in was application of 0.2 lb/M/week of soluble (urea) nitrogen. Going to 0.4 lb soluble N per week was not advantageous and 0.8 lb N/week actually slowed the grow-in and markedly reduced root growth.

Chris Kleinsmith is a May 1996 graduate of the University of Wisconsin-Madison Turf and Grounds Management Specialization. The recipient of the 1996 AgrEvo golf turf management scholarship, he is now employed by The Pine Tree Golf Club in Boynton Beach, Florida.

WORKING "DOWN UNDER"

By Wayne G. Horman

In the middle of February, I was asked to go to Australia and work with new Scotts distributors. The distributors were not familiar with the Scotts product line, and it was my responsibility to work with some of their sales representatives.

What a fantastic experience, working in a distant country and calling on turfgrass managers. The turfgrass managers were golf course superintendents, greenkeepers for bowling greens, and groundskeepers for ovals (athletic fields).

The only thing I knew about Australia is what I saw in Crocodile Dundee movies, which isn't a whole lot! So I got the books out and located Australia on the world atlas. Most of the other information I received about Austrailia came from people who had visited there previously. The general consensus was that Australia was absolutely beautiful.

Australia

First of all, some general information on the country is in order. Australia is about the size of the United States, but it only has six states and a population of just under 18 million. Most of the population is located on the east coast in the cities of Sydney, Melbourne and Bisbane. There are about 1,100 golf courses in all of Australia.

I spent four days in Sydney, which is located in the state of New South Wales. Sydney is the largest city in Australia, and the climate is somewhat like northern Florida, with some light frosts during the winter months.

Grasses of Australia

The golf courses in the area have bentgrass/*Poa annua* greens and Bermudagrass (or what they call Coochgrass) fairways. Some of the older golf courses have Kikuyugrass mixed in with Coochgrass. Kikuyugrass is a low growing, aggressive perennial that spreads by leafy, very thick creeping rhizomes and stolons. Kikuyugrass doesn't require much fertilizer; in fact, it turns yellow when fertilized. It isn't a very attractive grass variety for high maintenance situations.

They do a lot of overseeding with ryegrass and some *Poa trivialis* in the fall. Remember, their fall takes place at the same time as our spring.

Golf Courses in Queensland

I spent almost two weeks in Brisbane, Queensland. Bisbane is located about 1 1/2 hours north (by plane) of Sydney and is closer to the equator. The weather is like southern Florida, and frosts are very rare. The state of Queensland is considered more of a vacation/resort area of Australia.

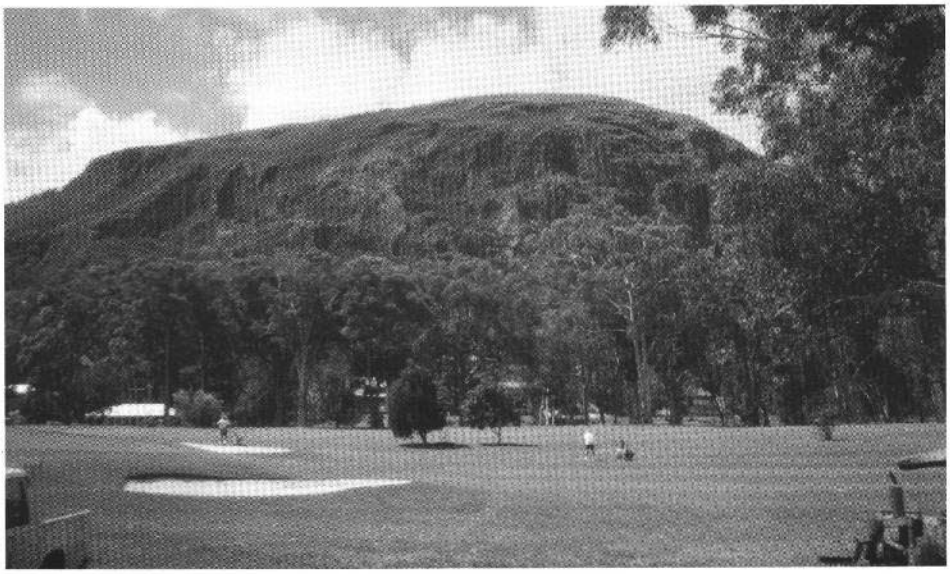
Queensland is a huge state. The Great Barrier Reef is located about 1,100 miles north of Brisbane, yet it is still in Queensland.

The primary grass variety on greens is 328 Bermudagrass. There are about nine or ten high profile golf courses that have bentgrass greens. It was very evident the bentgrass didn't do very well this past summer. Almost all of the courses had lost turf on greens due to high temperatures and humidity. The idea of using bentgrass in this area doesn't seem to be practical. Most of the fairways in the area had improved varieties of Bermuda.

In general, the golf courses in the Brisbane area were some of the best in Australia. The vacation spots along the ocean are the Sunshine Coast and the Gold Coast. They both have a large number of resort golf courses that cater to vacationers from the Pacific Rim and southern Australia.

Some of the most noticeable differences between the turfgrass industry in Australia and the United States are the expectations of the golfers. I didn't visit a golf course that mowed their fairways everyday. Not one of the golf course superintendents I visited mentioned golfer concerns with green speed.

It is important to note that golfing in Australia is considerably cheaper than it is here. The higher profile resort courses charge in the $75 range, which is only $55 in US dollars. The private courses charge from $700 to $5,000 Australian dollars per year, but nowhere near what it costs here.



Mt Coulum GC, near the Sunshine Coast, the 2nd largest rock in the southern hemisphere.

Maintenance

The reduced maintenance is directly related to the number of workers, or I should say lack of workers. The highest profile 18-hole courses had only eight to ten employees, including the golf courses superintendent. They don't have any seasonal employees, since they don't really have the multiple seasons.

Almost the entire Australian labor force takes what they call a "holiday" at some point in time during the year. This holiday lasts an entire month, and sounds great for employees.

Overseeding isn't as popular in Queensland since the Bermuda doesn't go completely dormant. In the fall, they do renovation work on greens, but it mostly involves aerification and preparation of greens for the slow growing period of winter.

Superintendents have to deal with some of the same problems we deal with here in the U.S. Black layer is a growing problem in the area since most courses use effluent water for irrigation, and a large number of these courses have USGA specification putting greens. Other diseases that are most common are pythium and spring dead spot.

The issue of increasing beneficial microbial activity in sand greens isn't limited to Wisconsin. There are a number of wonder products available to purchase in Australia as well.

In Australia, kangaroos are as numerous as deer are in Wisconsin. They are wonderful to look at, but are a nuisance on the golf course. Automobiles and trucks are equipped with Roobars to buffer the impact between auto and kangaroos on the highway. Seeing kangaroos and koalas on golf courses did provide a real thrill.

Snakes are a different story though. Seventeen of the top twenty most venomous snakes in the world are located in Australia. Fortunately, I didn't get up close and personal with any of these, but a man was bitten by one when I was there and died a few days later. I might have mentioned this a bit too much while visiting superintendents as many of them were very anxious to try and find some for me. It must be tough to mow a fairway with a ten foot snake in the middle of it.

The equipment available to the golf course superintendents was the same as here. The top golf courses

(Continued on page 31)

The maintenance complex at the Hope Island GC Resort. The superintendent's office and shop are on the left, and storage facility on right.

Reconstruction of a green at Southport CC on the Gold Coast south of Brisbane. The grass type is 328 Bermuda which is commonly used on greens in the region. The man with the white hat is the green committee chairman!

This Kubota is set up to do almost everything at the Pacific Golf Club.

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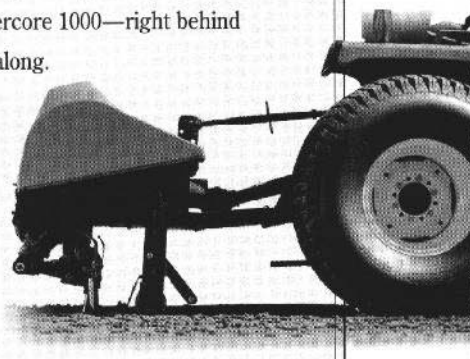

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