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Table 2. Nutrient Analysis of Leached Soils

No.	NH_4	NO_2	P	K	Ca	Mg	Zn	Al	pH
2	6	10	0.77	25.7	144	15.4	2.1	2.1	5.5
5	12	10	2.04	36.4	158	17.3	5.1	6.1	5.6
8	18	10	1.81	38.3	199	31.6	11.8	3.8	5.7
11	24	10	2.75	58.8	342	32.7	4.4	3.4	5.5
NG	10	6	2.90	25.6	136	16.1	4.4	15.9	6.3
Jiffy	48	10	9.70	69.6	523	272	3.7	1.85	6.5
Rec. Levels									
High	24	75	25	200	1600	150	70	200	6.5
Low	6	10	2	50	300	20	3	40	6.5

NH_4 added initially to the extent of about 60 p.p.m. in a balanced fertilizer.

The above figures furnished by Soil Analysis Lab, Suburban Field Station, Waltham, MA.

5. Terragreen, calcined montmorillinite clay supplied by Oil-Dri Corp. A similar material is made by I.M.C. called Turface (to be investigated).
6. Ground Limestone having 34 percent CaO, 1.5 percent MgO.
7. Gypsum, hydrated $CaSO_4$ by U.S. Gypsum, finely ground.
8. Peat Moss, labeled Mr. Peat and supplied by Agway, dried and sifted through ¼ inch screen and then ground to about 1/8 inch.

Nutrient analysis of leached soil

The samples prepared in our procedure and leached as in Set 2 with 23.6 inches of water, were analyzed by our Cooperative Extension Service in Waltham, Mass.

Examination of their results, shown in Table 2, reveal an increasing amount of NH_4 in going from sample 2 (no addition to the sand), to No. 5, in which 25 percent of the sand has been replaced by clay, and further to No. 8, using Vermiculite, and finally to No. 11, using Terragreen (calcined clay). A similar effect is shown for K (potassium), for Ca (calcium) and Mg (magnesium).

It appears clear, therefore, that these additions possess valuable powers for retaining nutrients; powers that are utterly lacking in sand.

It will be remarked that in all specimens the NO_3 content is low, which is to be expected since there is little, if any, cation content which is necessary in order to absorb anions such as NO_3. There is an abundance of anion content to absorb cations such as NH_4, K, Ca, Mg., etc.

Continues on page 24

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Topdressing *from page 22*

Effect of gypsum and alum

The effect of gypsum and alum to cause coagulation, or agglomeration of clay particles can be demonstrated visually, and quickly, as follows. I took three portions of clay, dispersed each in a glass of water. To glass No. 2, I added a pinch of gypsum ($CaSO_4$) and to No. 3, a pinch of alum ($A1_2(SO_4)_3$). After about one minute, No. 1, untreated, was still very cloudy whereas No. 2 and No. 3 were fairly clear and a noticeable precipitate had formed. The precipitates were weighed and No. 2 and No. 3 were twice the weight of No. 1.

Each sample was contained in the same cylinder used for percolation test, viz: A depth of 5 in. times an area of 5 in. gives a total volume of 25 cu. in. They were saturated with water and allowed to drain for 3 days. All tests were performed at room temperature.

Each was placed on a solid support and subjected to initial compaction by allowing a 4-lb. weight to drop 6 in. three times over the entire area (5 sq. in.), resulting in an expenditure of energy 3 times 6/12 times 4 equals 6 ft. lbs.

They were then subjected to the compression test by measuring the depth of penetration of a cylinder (rounded at the edges) 3/4 in. diameter, area 0.44 sq. in. and weighted 6 lbs. The resulting pressure was then 6/44 equals 13.5 lbs. per sq. in. (a man's bed pressure would be about 10 lbs. per sq. in.) The duration of pressure was 30 seconds. Results are shown on Plate 2.

Inspection of Plate 2 shows that, as expected, resistance to compaction is increased by mineral content. It indicates, further, that a composition of sand containing some clay increases resistance more rapidly, i.e., less is required to achieve the same resistance, resulting in a large saving in cost of top dressing and with better qualities otherwise, as discussed elsewhere in this report. The use of Terragreen does not appear to affect compaction more than straight sand, whereas Vermiculite has less affect. However, as shown on Plate 2, all may be equated with each other depending on how much top dressing you decide to use.

The skilled greenskeeper will adjust his top dressing to adjust for the level of softness he wants. He will not use too much, else his greens will not "hold" when at a normal water

Continues on page 34

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An open letter on water use

By Robert L. Sanders, CGCS, City of Prescott, Arizona

A key word used in the "Publisher's Point", GOLF BUSINESS, March, was "adequate". The entire sentence read: "How do you plan to conserve and use less water while trying to maintain adequate playing conditions."

First we must define adequate. Or possibly adequate is not the correct word. It should be remembered that golf did not originate on perfect turf. Maybe we should get "back to basics" and play the game as it was designed. Someone once said, referring to the touring pros, that they would tee up the ball on concrete if the money was right. Possibly we as golfers and golf course superintendents must educate other players to accept for the first time in many years a course "commensurate" with nature. Play the ball as it lies. Remember "rub of the green". Stop trying for the absolute perfect set of conditions in which to tee up the ball to shoot 100.

Not being a low handicap player it is common for me to visit many areas of a course. The course where every blade of grass is the correct height is a beautiful thing to see, play, and I am sure, be a member of, as well as a great source of pride for the players and the superintendent. And this is, of course, possible if the players are willing to pay the price. However, we might remind ourselves that all of us are not playing for checks with five figures before the period. It is granted that each game we play is very important to us, as it should be. However we might remind ourselves that five years ago gas was 40 cents a gallon, a high water bill was $10.00 and a high interest rate was 9%. Things change and all change is not bad if the attitude of the person is good. And as I said I am accustomed to playing all the golf course and therefore using all the clubs in my bag. This is fun. It is as it should be. The highly manicured course where the player consistantly hits a driver, high iron and putts may not be as much fun for some of us.

It is my belief that if we do get somewhat back to basics and be commensurate with nature we will use less water. Fairways may be off-colored green and possible mowed a little higher.

Roughs may be native grass and a little taller. Rule 17-2 of the Rules of Golf states, "The player is not of necessity entitled to see the ball when playing a stroke". Greens may be fertilized less, mowed higher, verticut more often, spiked on a regular schedule and watered less. It might be necessary for us to learn the pitch and run instead of going full tilt, all out for the flag stick. Course fertilization for greens, tees and fairways might utilize more organics, and spiking of all play areas on a regular schedule along with aerification with hollow tines.

These are but a few of many ideas that might then get us back to basics as golfers and superintendents. It will utilize less water, cost less, and in one superintendents opinion get us back to golf as pure golf. **GB**

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Life cycle and control of southern insects

Insect	*Characteristics*	*Life cycle*
Chinch Bug The chinch bug common in Florida is *Blissus insularis* Barber.	Adults about 1/5 inch long, black with white patches on wings which are folded over back. Young (nymphs) range from 1/20 inch long to nearly adult size. The smallest chinch bugs are reddish with a white band across the back but darken and become black in color as they near adult size.	Sometimes adults hibernate in winter in Northern Florida, but all stages present year-round in most of the state. Eggs laid in leaf sheaths or crevices and cracks in nodes and other protected places. In summer, hatch in 1 to 1-1/2 weeks. Young develop to adults in 4 to 5 weeks. Adults may live for weeks.
Sod Webworms In Florida — particularly in summer and fall — the one found is *Herpetogramma Phaeopteralis* Guenee. *Crambus* spp. also occurs, especially in the spring and early summer.	Larvae of both species grow to 3/4 inch in length; spotted and greenish. Adults are dingy brown moths with wingspread of about 3/4 inch.	Adults of both species lay eggs among grass. Eggs hatch in about 1 week. Larvae feed on grass blades and grow large enough to cause noticeable injury within 2 weeks. Feed on grass next 1 to 1-1/2 weeks until pupation. Adult appears about 1 week later. They complete their life cycle in 5 to 6 weeks and have several generations a year.
Armyworms The one found principally is the fall armyworm. *Spodoptera frugiperda* (J.E. Smith).	Caterpillar grows to 1-1/2 inches long. Greenish when small; dark brown when full grown. Has a light midstripe along back; darker bands on each side of midstripe. Midstripe ends in inverted "Y" on head. Adults are brownish moths with wingspread of about 1½ inches.	Moth lays eggs on grass and on almost any object near lawns. Development is much like sod webworm. Armyworms pupate in the soil, however.
Mole Crickets The principal ones found in Florida lawns are the southern mole cricket, *Scapteriscus acletus* R. and H., and the Puerto Rican mole cricket, *S. vicinus* Scudd.	Large crickets growing to 1-1/2 inch long. Have velvety appearance from covering of fine, brown hairs. Front legs flattened and adapted for burrowing.	Adult lays approximately 120 eggs in underground cells. Nymphs develop throughout summer and most are adults by fall. Most eggs are deposited in May.
Bermudagrass Mite *Aceria neccinodonis* Keifer.	These mites are extremely tiny with the largest being only about 1/125 inch long, and not visible to the naked eye. The mites are creamy white in color and somewhat wormlike in shape.	The life cycle is very short requiring only about a week. The eggs are placed under the leaf sheath and after hatching there are probably two molts before the adult stage is reached. All stages are found together under the leaf sheaths and many may be crowded under each sheath.
Billbugs *Spenophourus venatus vestita* (Chttn.)	Larvae are white, legless grubs growing to 3/8 inch in length. Adults are black bettles — weevils with chewing mouthparts at the end of a long "bill". Adults are about 3/8 inch long.	Adults lay eggs near crown of plant. Larvae live in soil and feed on roots and underground runners. Pupate in soil.
White Grubs There are a complex of four species in Florida. *Bothynis, Strategus, Cyclocephala* and *Phyllophaga.*	Larvae are fat grubs which lie in C-shaped positions. Whitish in color with dark areas at rear. Brownish head. Adults are beetles.	Adults lay eggs in the soil. Grubs live in the soil and feed on roots. Different species take varying times to complete life cycle — 1 to 4 years. Adults do not feed on grass.
Spittlebugs *Prosapia bicincta*	Nymphs are white in color and live within a mass of spittle they secrete. Adults are 1/4 inch long, black with two reddish-orange transverse bands on the wings.	Eggs are laid at the base of grass in the thatch. Life cycle requires about 2-1/2 months and there are two generations per year. It overwinters in the egg stage.

Control	Active ingredient	rate per 1000 ft.^{2}	Notes
Aspon 6E	7¼ - 10 lbs.	3½ - 5 fl. oz.	Consult local cooperative extension office for minimal fertility recommendations for St. Augustine grass. Reduced amounts of Nitrogen result in less chinch bug programs. Also, less damage occurs when water insoluble nitrogen is applied as opposed to water soluble sources. Control of thatch will reduce chinch bug numbers and pesticides will be more effective if they are required where thatch is not allowed to buidup. If St. Agustine is being established or replaced, use the Floratam variety.
Baygon 1.5E	8 lbs.	16 fl. oz.	
Baygon 70WP	7½ lbs.	4 oz.	
Diazinon AG500	4 - 8 lbs.	3 - 6 fl. oz.	
Diazinon 4E	4 - 8 lbs.	3 - 6 fl. oz.	
Dursban 2E	1 lb.	1½ fl. oz.	
Ethion 8E	1 lb.	2½ - 4 fl. oz.	
Mocap 5G[3]	10 lbs.	4½ fl. oz.	
Primicid 4E	1½ lbs.	1 fl. oz.	
Granulated formulations of the above materials are equally effective. Apply as directed on the label. Several pockets of organic phosphate resistant chinch bugs have occurred in South Florida recently. If one of the above organic phosphate insecticides do not control, apply a carbamate insecticide.			
Bacillus th (Dipel[4])	2 - 4 lbs.	¾ - 1½ oz.	Same applies for these caterpillars as with chinch bugs on all turf grasses. (Floratam recommendation only for chinch bugs).
Diazinon AG500	5 lbs.	4 fl. oz.	
Diazinon 4E	5 lbs.	4 fl. oz.	
Dursban 2E[5]	1 lb.	1½ fl. oz.	
Methomyl 1.8E[5] (Lannate or Nudrin)	1 - 2 lbs.	¾ - 1½ fl. oz.	
Mocap 5G[3]	5 lbs.	2¼ lbs.	
Primicid 4E	1-2 lbs.	¾ - 1½ fl. oz.	
Sevin 80% WP[5]	8 lbs.	4 oz.	
Toxaphene 8E	5 lbs.	2 fl. oz.	
Trichlorfon 80% WP (Dylox or Proxol)	5 - 8 lbs.	2½ to 3¾ oz.	
Baygon 70WP	2 - 4 lbs.	1 - 2 oz.	In order for grass to better tolerate damage do not mow shorter than recommended heights: Bahia 3", St. Agustine 2-3", Centipede 2", Bermuda 3/16-1/2", depending on variety. Don't allow turf to dry-out excessively.
Diazinon 2E[6]	5 lbs.	8 fl. oz.	
Mocap 5G[3]	10 lbs.	4½ lbs.	
Baits: Baygon, Dursban, Malathion, Sevin, or Toxaphene			
Proper timing of pesticide application is extremely important. On turf areas where economic damage has occured in previous years, apply a recommended spray or granule during the latter part of June or a bait during early July. Pesticides may also be applied when damage appears in spring due to oviposition activity or during August and September, when nymphs are maturing, but will not be as effective at these times. Irrigate before application. Irrigate after applying sprays or granules with 1/2 inch water. Do not irrigate after applying baits for 3-4 days if possible. In N.E. Florida and other scattered areas of the state, mole crickets are resistant to toxaphene.			
Diazinon 2E	4 lbs.	6 fl. oz.	Collect grass clippings and destroy to help avoid dispersing mites. In general, as mowing height is decreased, mite infestations are decreased. Keep all areas of bermudagrass mowed as close as practical. Infestations usually develop in the taller grass (rough areas, around sand traps, along canals, fence rows, etc.).
Diazinon AG500	4 lbs.	3 fl. oz.	
A wetting agent in the spray mixture will improve results. Apply a second application in 5-6 days.			
Baygon 70WP	7½ lbs.	4 oz.	
Baygon 1.5E	8 lbs.	16 fl. oz.	
Diazinon 2E	5 lbs.	7½ fl. oz.	
Diazinon AG500	5 lbs.	3¾ fl. oz.	
Trichlorfon 80SP Dylox or Proxol)	8 lbs.	3¾ oz.	
Diazinon 2E	4 lbs.	6 fl. oz.	
Diazinon AG500	4 lbs.	3 fl. oz.	
Diazinon 50WP	4 lbs.	3 oz.	

Use spray and bait to control mole crickets

Every golf course superintendent in southeastern coastal areas is familiar with the damage associated with mole crickets. They are even more aware of the expense it takes trying to keep the pest under control.

In the past, an application of the chlorinated hydrocarbon insecticide Chlordane did an effective and economical job of keeping mole crickets from completely taking over a course. As time wore on, and the use of Chlordane increased, the mole cricket developed a biological resistance to this insecticide. Since then, the EPA has taken the product off the market.

Removing Chlordane didn't hurt golf course managers as much as did the question of what was going to replace it before complaining golfers replaced them. Since the removal of Chlordane from the golf course superintendent's chemical arsenal, little in the way of new product research has been reported. In addition, there have not been many published reports that tell managers of the application, timing and effectiveness of chemicals presently labeled for control of mole crickets.

According to Leon Stacey, an Extension Entomologist with the University of Georgia, there *is* an economical means of controlling mole crickets. As a matter of fact, Stacey even claims that their four-year research and demonstration program has found the right product at a reasonable price, and can even tell you the correct time to apply it for optimum results information golf course managers in the Southeast have needed for 15 years.

Mole crickets are also known as "cricket moles" or "ground puppies". They may damage practically any kind of crop by feeding on the roots, tubers or fruits of the plant, and by burrowing in the upper inch or two of the soil about the roots, uprooting and causing them to dry out excessively. Seedlings or transplants are especially subject to injury when they are fed upon or uprooted. Grasses are a favorite food. Mole cricket damage is especially severe in newly planted or sprigged areas; however, established grasses also can be destroyed if the infestation is not controlled.

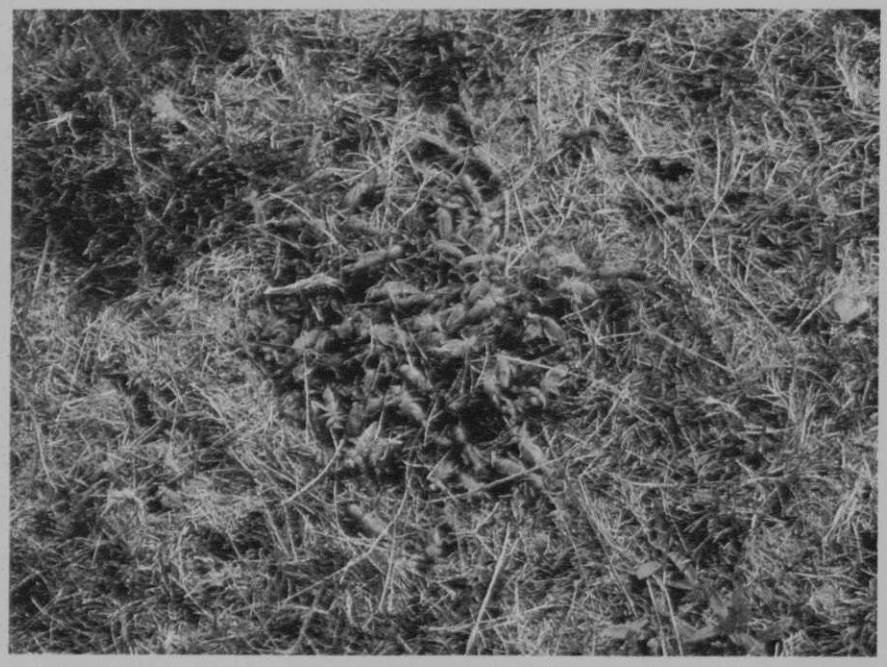
Infestations on turf are first detected by walking over an infested area and sensing a fluffiness of the soil. Closer examination usually will reveal grass dying with partially destroyed root systems, holes in the ground about the diameter of a pencil that are exits and entrances to mole cricket tunnels, and burrowing trails.

Full-grown mole crickets are about 1-1/2 inches long and 1/4 inch wide. They are light brown, the lower surface being much lighter than the upper and often slightly tinged with green. The insect's most striking features are the large, beady eyes and the short, broad front legs, which bear shovel-like feet well adapted for digging. Only the adults have wings and are capable of flying.

Mole crickets spend most of their time in burrows several inches deep in the soil. During cold weather these burrows are dug deeper, so freezing has little, if any, effect upon these insects. They are most active at night, particularly when the soil is wet and when evening temperatures are above 60°F. During such times, activity increases and the crickets will tunnel the upper inch or two of the soil. It is on such occasion that bait, if available, will be taken.

"We have conducted the majority of our testing at the golf courses on Jekyll Island, just off the Georgia coast near Brunswick," says Stacey. "In 1978, superintendent Leslie Getchell was facing perhaps one of the worst populations of mole crickets seen in the Southeast. The first thing we did was eliminate the products for mole cricket control that, for one reason or another, were ineffective. Our extension research over the past few years shows that general products like spray formulations of Malathion, Sevin carbaryl and Proxol or Dylox were just not very effective for mole cricket control. We eliminated them after our inital tests and went with what was left for further research.

"The four products that passed extensive testing were the Knoxout formulation of Diazinon; Bagon 70% wettable powder; Dursban Bait; and a newly registered product, Sevin 20% Bait. All four products gave excellent mole cricket control. The only variance we noticed in the testing was the new Sevin 20% Bait," Stacey notes. "It was very effective when used at only one pound of active ingredient per acre and was the only product that reduced per-application cost. It averaged out to be at least one-third less expensive



An effective bait, used when crickets are active in the Fall, will draw them to the surface.