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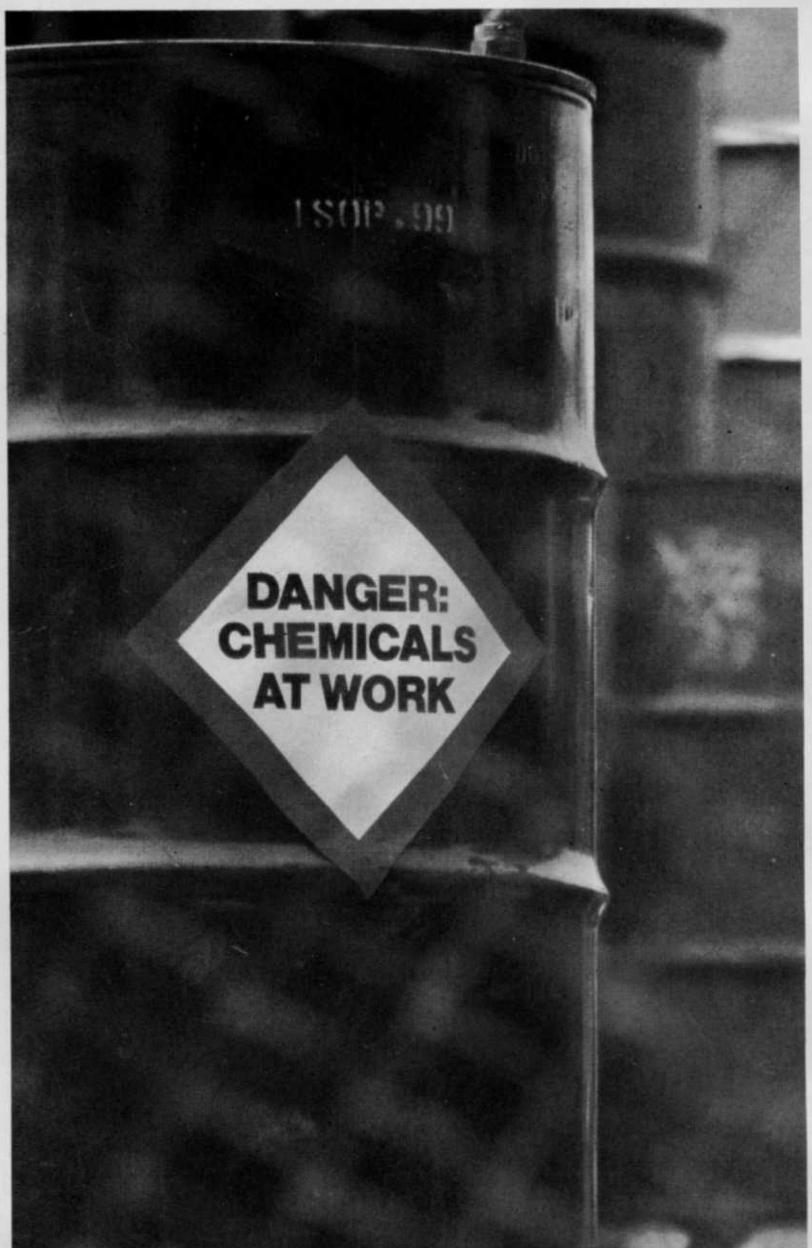
CHLORDANE—WHAT ARE THE ALTERNATIVES?

by Ron Morris



Environmental Protection Agency hearings on the chlordane issue are still rolling on, but all indicators point toward turf insect control without chlordane by sometime this fall.

"It (chlordane) probably won't go completely out of the picture," in the opinion of one EPA official, but will definitely be out for use on turf. The reason is potential human exposure. Chlordane will probably remain in use as a subterranean termite control because of its long persistence in the soil and, most likely, farmers will be allowed limited use provided applicators protect themselves with proper clothing.

In the past, when other chlorinated hydrocarbon insecticides were banned, substitutes came to light. For example, when aldrin, dieldrin and heptachlor were banned, chlordane came into use. Now chlordane is going and a substitute must be used.

Existing organophosphate insecticides, such as diazinon, chlorpyrifos (Dursban), and trichlorfon (Dylox or Proxol) can provide the answer if applied properly. Since organophosphates are not persistent, they need to be moved from the surface into the soil immediately to be effective.

"Thatch is a major factor limiting the effectiveness of insecticides in controlling soil inhabiting insect pests of turf," according to Dr. Harry Niemczyk, professor of turfgrass entomology at the Ohio Agricultural Research and Development Center.

Currently available organophosphate insecticides do not move freely through thatch, so it becomes an urgent necessity to move them. If rainfall doesn't do it, then irrigation is called for.

Experiments in Ohio have shown that one-half inch of thatch in turf can significantly reduce the effectiveness of the organophosphate insecticides.

Liquid diazinon, giving 90 percent or better control at 5.5 to 6 pounds AR/A (active ingredient per acre), was reduced to 52 to 60 per-

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CHLORDANE

Continued from page 22

cent effectiveness by one-half inch of thatch. Granular diazinon, giving 90 percent or better control also, was reduced to 69 to 74 percent control. Dursban at two and four pounds AI/A, controlling an average of 69 to 74 percent, respectively, was reduced to 21 and 26 percent control, respectively.

Experiments at the Ohio Agricultural Research and Development Center in Wooster, Ohio, concluded the reason was that the insecticides were becoming bound to the thatch and were simply not reaching the soil, the target area.

One-half inch of thatch can reduce effectiveness of insecticides.

Chlorpyrifos was the most readily bound. Trichlorfon has a lesser tendency to bind, but results from it have been varied, according to Dr. Niemczyk. The reason for this variability is not known and must be better understood to ensure future control of soil-inhabiting insects.

Two experimental insecticides, CGA-12223, a product of CIBA-GEIGY, and bendiocarb, a product of Fisons, have shown to be effective against grubs and are not prone to absorbtion by thatch.

CGA-12223, an organophosphate, has shown good activity against a broad spectrum of soil insect pests in corn, vegetable crops and turf. Broadcast at rates of one-half to two pounds AI/A, it has demonstrated effective control of Japanese beetle, European chafer, Southern masked chafer, June beetles, chinch bugs, sod webworms and mole crickets. Turf tolerance has been excellent with eight pounds AI/A showing no damage to a cross section of northern and southern turf species. It is being tested further for control of nuisance lawn pests such as ants and clover mites.

CIBA-GEIGY currently holds a one-year experimental permit from the Environmental Protection Agency for CGA-12223 and is planning to renew it for another year. They expect to submit a full label request soon.

The company is working with 2E and 5G formulations for commercial turf usage.

The 2E formulation contains two pounds AI/gallon. It is recommended for chinch bugs, cutworms, mole crickets, sod webworms and white grubs (dung beetle, European chafer, Japanese beetle, June beetle, Southern masked chafer) at the rate of two to four quarts per acre in a minimum of 25 gallons of water per acre. It is further recommended for grubs and mole crickets that the turf be thoroughly irrigated after application. For other insects, light watering is sufficient.

Five to seven gallons of the 2E formulation per acre in a minimum of 25 gallons of water will control cyst, ring, spiral, sting, stubby root and stunt nematodes.

CGA-12223 5G, a granular formulation containing 5 percent AI controls insects at the rate of 20 to 40 pounds per acre and nematodes at 200 to 300 pounds per acre. Watering is recommended for moving the formulation directly to the soil.

Fisons' NC 6897 experimental insecticide currently has EPA registration under the trade name FICAM for pest control operator use. Garvox is the proposed trade name for agricultural use and bendiocarb is the proposed common name.

NC 6897 is a carbamate compound and has been effective in controlling both larval and adult stages of May and June beetles, Japanese beetles, dung beetles and controls chinch bugs and sod webworms. There has been limited evidence to suggest that NC 6897 will also control billbugs, armyworms, cutworms and mole crickets. It is effective against many nuisance pests including ants, crickets, fleas, ticks, wasps and sowbugs.

NC 6897 is being tested against sub-soil pests in granular and wettable powder formulations at rates of one to four pounds AI/A. Thorough irrigation after application is recommended. It is being tested against surface feeders at rates of one-half to two pounds AI/A.

Fisons plans to take data from its experimental program this year and submit for registration sometime in late '78, hopefully in time for marketing in late 1979. □

PRINCIPLES OF SOIL PHYSICAL AMENDMENT

by Art Spomer

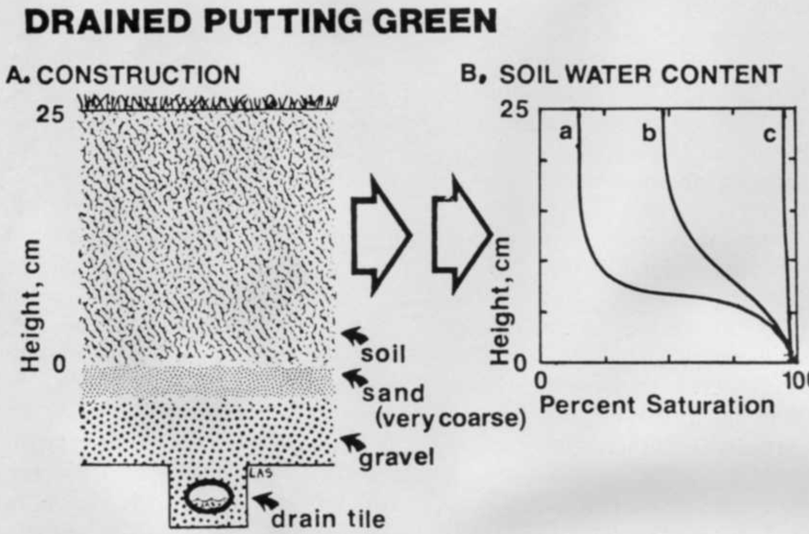

Figure 1. Water distribution pattern (B) for three different soils in a typical drained putting green (A). Soil 1 = coarse-textured sand; 2 = fine-textured sand; 3 = silty clay loam. All three soils are saturated at the drainage level (perched water table) and water content decreases with height above this level.

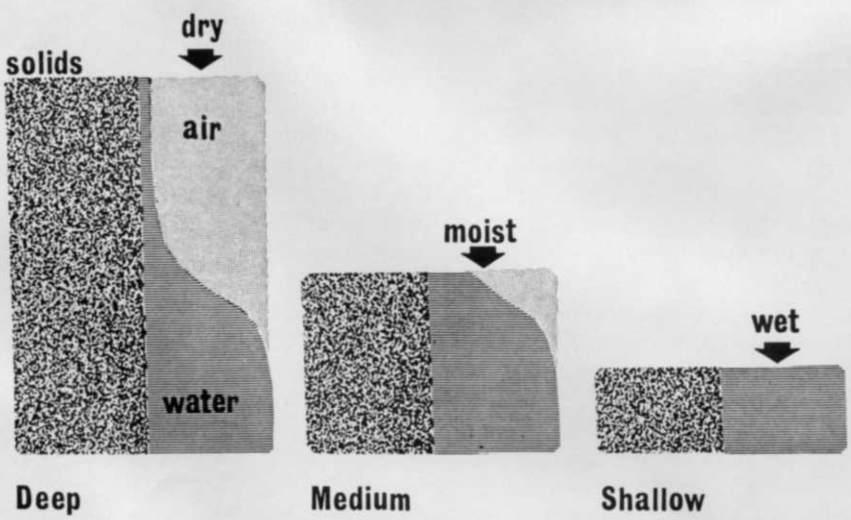

Figure 2. Effect of green drainage depth on soil water content. A shallower soil always has a greater water content following irrigation and drainage than a deeper soil.

Water is quantitatively the most important nutrient required for plant growth and survival. Actively growing grass tissue consists of about 90 percent water by weight.

Plants not only contain large quantities of water, they also usually require hundreds of times this amount during growth. This enormous amount of water contained and used by plants is more than just an inert filler, probably every plant growth activity is directly or indirectly affected by water. All of this water is absorbed from the soil through the plant's root system.

Since water is very essential for plant growth, and since all of the water used by plants comes from the soil, any factor affecting the absorption of water will, therefore, probably affect plant growth.

A number of biological, chemical and physical factors directly and indirectly affect either soil water retention and movement, or plant root growth and absorption. The primary soil physical factors affecting plant water absorption are soil water content and soil aeration.

Water content is important because it indicates how much water is potentially available for plant use.

Soil aeration (the exchange of oxygen and carbon dioxide between the soil and above-ground atmosphere) is important in maintaining a constant supply of the oxygen required for good root growth and absorption. Both aeration and water retention depend primarily on soil structure which is determined by the kind and arrangement of particles in the soil.

Most golf greens have two important features which distinguish them from other golf course turf sites:

1. They are subject to severe

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foot and mower traffic, and

2. they are drained.

The effects of the traffic are obvious (soil compaction, poor root growth and absorption); however, the effects of the shallow drainage (excess soil water content, poor soil aeration) are less obvious but are generalized in Figure 1. A perched water table forms at the drainage level in such a green following irrigation and drainage. Under these circumstances, any good, medium-textured natural soil will likely be saturated throughout (Fig. 1-B) and grass growth will probably be poor.

Both problems are minimized in practice by amending the soil with coarse-textured materials (e.g. bark, calcined clay, gravel, perlite, sand, scoria, vermiculite, etc.) to increase the soil's resistance to compaction and to increase the amount of large aeration pores which drain despite the water table. Unfortunately, "too little" amendment reduces both soil aeration and soil water retention without increasing the soil's resistance to compaction and "too much" reduces water retention excessively.

The "optimum amount" of soil amendment should maximize soil compaction resistance and at the same time provide soil aeration and soil water retention which closely match those required for good turfgrass growth and water absorption.

This article briefly discusses the changes in soil physical properties when natural soils are amended with coarse-textured materials.

Soil Amendment — soil physical changes

Figure 4 "pictures" what happens as a coarse-textured amendment is mixed with soil in increasing proportions. Since soil mixtures are usually prepared from bulk quantities (e.g. bu. ft.^{3}, lit,m^3,yd^3 etc.), component and mixture quantities are herein expressed as

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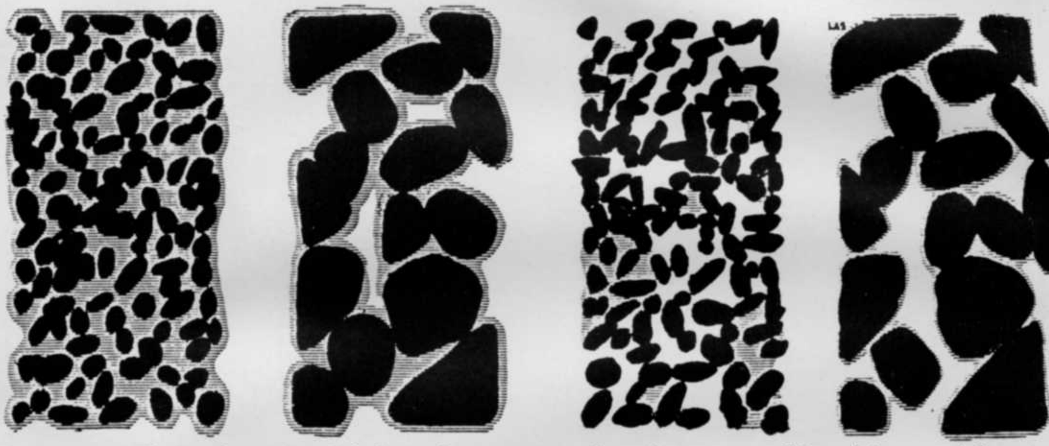

Figure 3. A drained green soil, left, is always wetter than that same soil in a fairway, right, following irrigation and drainage.

Effect of Amendment on Soil Porosity

AMOUNT OF SAND, SOIL & PORES (yd^3 in ten yd^3 mixture)

	A	B	C	D	E	F	G
soil	10.	7.7	5.5	3.6	2.5	1.5	0.
sand	0.	3.5	7.	10.	10.	10.	10.
pores	5.	3.9	2.8	1.8	2.4	2.9	3.6

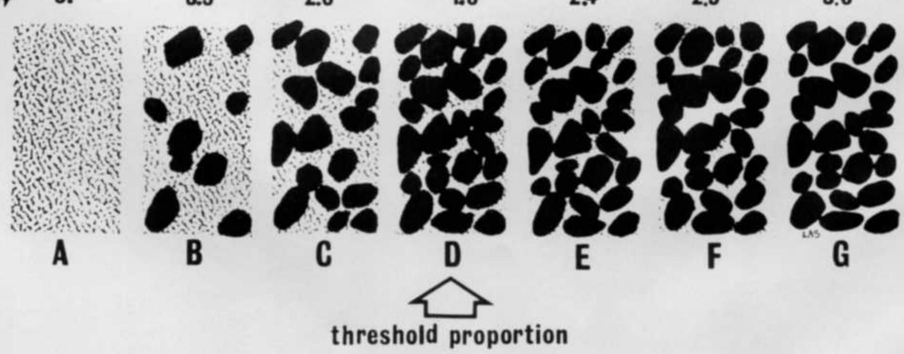

Figure 4. Microscopic "picture" of what happens to soil porosity as a coarse-textured amendment such as sand is added to the soil in increasing proportions.