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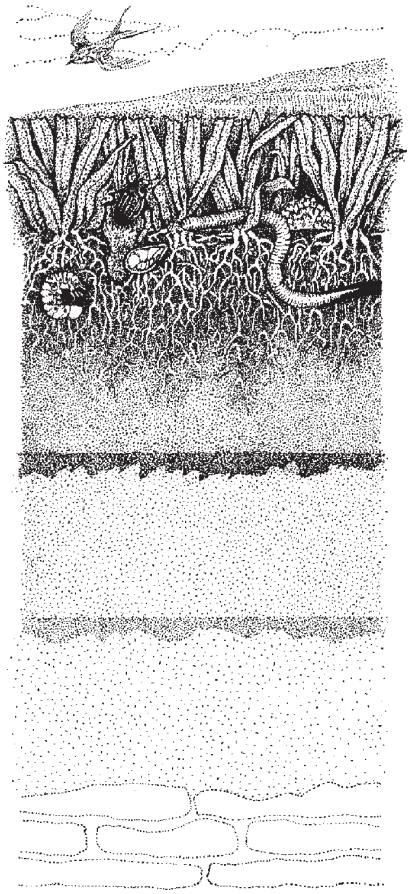

Subsurface Placement of Pesticides

Sometimes when a turf manager uses a pesticide and it does not meet his expectations, he thinks the material has "failed". In fact, there are many circumstances when the material was not used appropriately – the wrong rate, the wrong time of year or even the wrong time of day, the wrong use of water before or after the application, the wrong material for the pest, or the wrong formulation for the conditions. ■

One insect pest which causes headaches to turf managers is the white grub complex. The damaging stage, the white grub, is active at or below the soil-thatch interface. Insecticides which are applied to the turf surface must be moved down into the thatch or the grubs must be drawn higher into the thatch so that the grubs come in contact with the insecticide. In most cases post-application irrigation (or rain) is used to initiate that movement, but often the water is not put on quickly enough after application or it is not put on in sufficient quantity to accomplish the job.

High Pressure Liquid Injection

The challenge faced by northern turf managers regarding white grubs is virtually identical to that faced by southern turf managers when dealing with mole crickets, which are very mobile soil insects. Several years ago some engineers in the Southeast came up with a concept of using very high pressure and small nozzle tips to drive materials deeper into thatch than a conventional surface application. They built a prototype "high pressure liquid injection" (HPLI) unit which was used to make small research plot applications. This unit had four separate 15 gallon tanks which could be used independently or in combination. The delivery system included two independent two foot booms, with nozzles placed at three inch spacing. The booms rode directly on the ground with the nozzles projecting a few degrees forward of vertical, and the nozzle tips were no more than 0.5 inch off the ground. The technology used in the research unit is available on commercial units with as large as 1,000 gallon tanks with 16 foot booms.

This unit was used to apply numerous field trials testing control of mole crickets. Many of those trials were conducted under the direction of Dr. Pat Cobb at Auburn University in Alabama. Preliminary indications were that the technique had tremendous potential and certainly had many advantages over a conventional surface application. Environmentally, the surface exposure to pesticides was reduced considerably. (One study on warm season grasses showed that surface residues were reduced up to 90%.) In addition there was virtually no drift during the application, because the nozzles rode so close to the ground. In certain circumstances the rate of application could be reduced 50% using HPLI and still provide the same level of control as a conventional application at the full rate.

The same prototype unit was brought to Massachusetts in the spring of 1989 to put out some Japanese beetle grub trials. Several of those trials looked at Triumph 4E® (primarily because we

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Subsurface Placement of Pesticides

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were reluctant to use wettable powder formulations with such sensitive nozzles). We looked at 2.0, 1.0, and 0.5 pounds active ingredient (AI) per acre using HPLI compared to 2.0 or 1.0 pounds AI per acre for conventional application. In every case the 1.0 and 0.5 pound rates with HPLI performed as well as the 2.0 pound rate applied conventionally. That performance often was statistically significantly better than the reduced rate applied conventionally.

I purchased my own research unit, virtually identical to the original unit, and continued studies in the fall of 1989, and in 1990 and 1991. We have subsequently looked at Diazinon® (because the application technology may well be appropriate for use in home lawns or athletic fields), Dursban®, Tempo and Turcam®. The Turcam® trial will not be sampled until early October 1991, but the results of the other studies were fairly consistent. In each case (except with Triumph®) the subsurface placement of material did not enhance the performance of the material (lower rates using HPLI did not perform any better than lower rates applied conventionally). However, many turf researchers feel that the most important aspect of HPLI is the reduction of environmental problems related to surface exposure, so any reduction in application rates would be "gravy".

There is at least one other kind of high pressure liquid injection equipment currently available which, like the equipment we use for our trials, does not slice the turf. This unit, available on a contract basis in parts of the Northeast, uses a computer-driven micro-plus system. The depth of penetration into the turf can be set by adjusting the length of each micro-pulse, the pressure, and/or the ground speed. The unit seems to be the "second generation" of HPLI and has lots of application possibilities.

Some golf course superintendents may be thinking that the Toro HydroJect™ unit might be used to deliver liquid insecticides below the surface. In fact the HydroJect™ was not built with the purpose of applying pesticides in mind, so the seals and delivery systems are not designed to handle pesticides. In addition the purpose of the HydroJect™ is to shatter the soil structure using even higher pressures than the systems so far described. Studies conducted by Dr. Harry Niemczyk at Ohio State University indicate that placing insecticides BELOW the point where grubs are active is just as ineffective as not moving them down from a surface application. Placing materials as little as an inch below the thatch-soil interface results in their failure to perform.

HPLI — High pressure injection unit, Bolton, MA. (Photo by Patricia J. Vittum)

Turf Slicing Systems

Another approach to subsurface placement of pesticides involves slicing the turf, in a manner similar to an overseeder, and dropping the material into the slice. There are several companies working on variations of this theme, including large tractor driven units and smaller walk behind units. In each case the concept is the same – slices are cut in the turf, tubes deliver pesticide (through gravity feed) into the slice, and a plate "tucks in" the turf around the slice. There are at least two obvious advantages to such a system. First, there is no high pressure system with the inherent dangers of blown lines. Perhaps even more importantly, the depth of application can be set very accurately – often within 1/8 inch. As a result the unit can be adjusted to handle the conditions of each given turf area.

Slicing units can deliver pesticides to areas with thick (more than one inch) thatch just as effectively as to areas with less thick thatch. (NOTE

that the main drawback to the systems I have observed so far is that the slicing process does pull out a lot of thatch and generate lots of "hay". This hay must be disposed of in some fashion in a large scale operation to prevent the machine from clogging up.) At least some of these units have liquid adapters so that they can be used to apply liquid formulations into the slices. I have just obtained a slicing unit which was used to put out two trials (looking at full and half rates of Turcam®, Mocap®, Crusade®, and Triumph®). Those trials were sampled in early October and the results were reported at the New York State Turfgrass Association Conference in Rochester in November. The technology of sub-surface placement of pesticides has expanded tremendously in the past couple years. It appears that the technique reduces surface exposures tremendously. (One trial we are currently conducting at University of Massachusetts is looking at the surface residue of Diazinon® and Triumph® using HPLI v. conventional application. The laboratory analyses of that trial will not be completed until early January but we are reasonably confident that the results will mirror those of similar studies done on warm season grasses, which indicated substantial reductions of surface residues.)

Environmental Concerns

Risk of drift is reduced considerably, particularly with the HPLI technique. As a result turf managers could make applications during mildly windy conditions when conventional applications would not be an option. In addition subsurface application techniques MAY provide an applicator with a longer window during which post-application water can be applied. (Results of some of our trials suggest that delays in post-application watering are less crucial in subsurface applications than in conventional applications. These results are definitely still preliminary, and studies will be expanded in 1991.)

Subsurface placement of pesticides is a technology whose time has come, particularly in areas of the country (like the Northeast) where environmental concerns are paramount. Availability of subsurface application technology will only increase in the next few years. Some units (including HPLI and slicing units) are already available on a contract basis. If you are interested in contacting these companies, please contact me (Dr. Patricia J. Vittum, Department of Entomology, Fernald Hall, University of Massachusetts, Amherst, MA 01003) and I will send you the names of companies of which I am aware. Many developers are designing units for golf course/athletic field use OR for use by commercial lawn applicators, so there should be something for everyone.

PATRICIA J. VITTUM,
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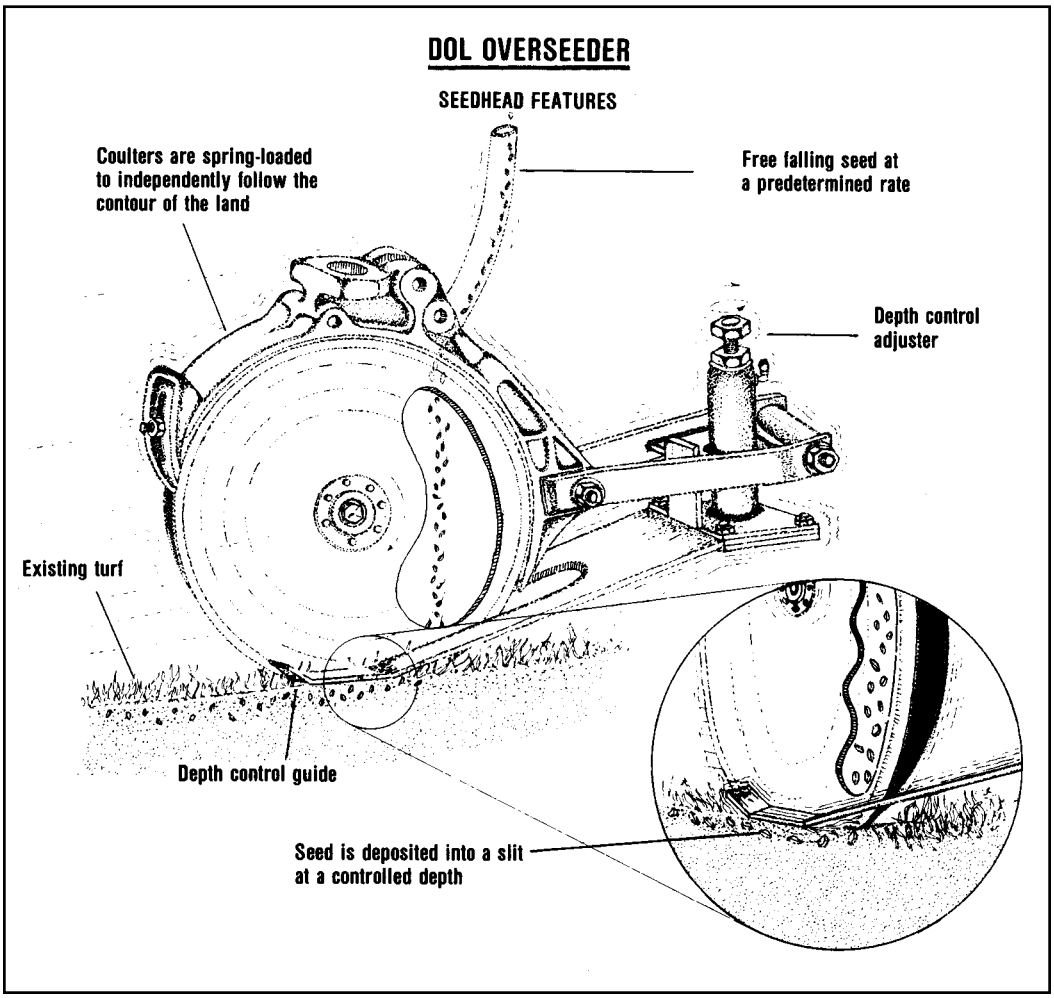
Please note that Triumph® and Crusade® are not registered for use in the state of New York.

Turf slicing systems have the advantages of no high pressure lines and very accurate application depth.



Schematic of the DOL overseeder. (Illustration used with permission of Dol Brothers Limited Sodding and Hydroseeding, Toronto, Canada.)