AMERICAN LAWN APPLICATOR

September/October 1982
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Mole Crickets– Adults/Nymphs

Turfgrass diseases in soil

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Visual Analysis of Turfgrass Problems • 23

Kentucky bluegrass, note clear bundle sheath surrounding the vascular bundles.

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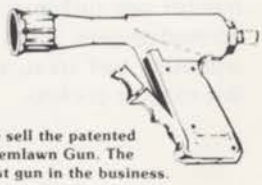

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Mole Crickets

by Pat Cobb, Auburn University

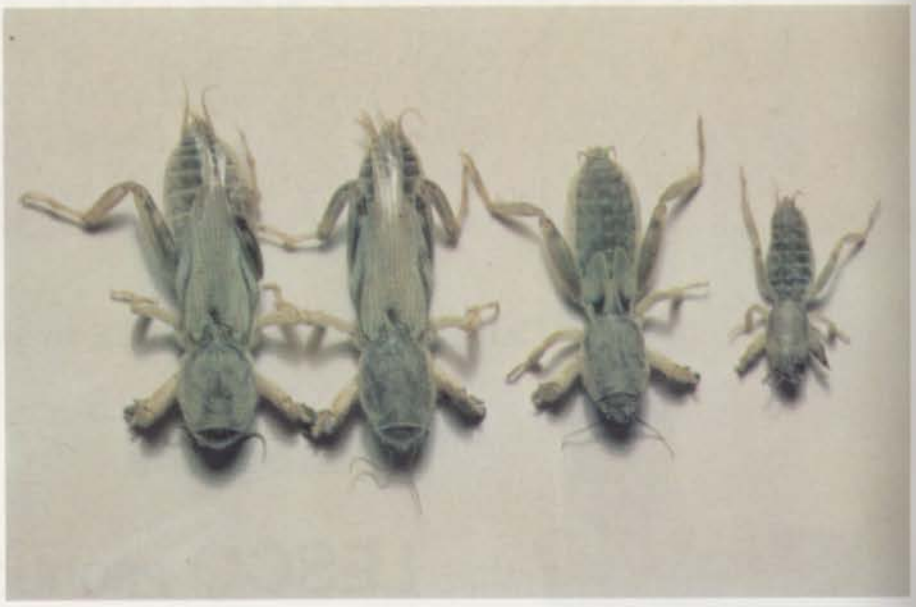
Dr. Pat Cobb is an Extension Entomologist at Auburn University, Auburn, Alabama. She holds a B.S. degree in biology from Huntingdon College and an M.S. and PhD. in entomology from Auburn University. Dr. Cobb's responsibilities include insect and mite management programs on turf grass, woody ornamentals including Christmas trees, and greenhouse crops.

Mole cricket damage to lawns and turf increased in southern Alabama during the 1970's, and has become the area's number one turf insect problem. The bermudagrasses, often used on lawns and other turf areas, are very susceptible to mole crickets.

Mole crickets are familiar pests of turf and pasture grasses in Florida and eastern Georgia. Two damaging mole cricket species were introduced around the early 1900's at various eastern and Gulf ports from the West Indies or the eastern coast of South America (Walker and Nickle 1981). One species, the changa, spread more slowly throughout the southeast than did the southern mole cricket, according to Walker and Nickle (1981). Whereas the southern mole cricket was the most common species in southern Alabama several years ago, the changa is now well-established.

Mole crickets damage turf by tunneling through the soil, uprooting grass plants and causing them to dry out. Mole crickets also feed on the grass plants. The changa is thought to be the more serious pest because it does more feeding damage than the southern (Reinert 1980). Severely damaged area may appear to be "plowed". On thick sod tunneling may result in a "fluffiness' of the turf.

Turf managers in south Alabama, who have been in business for 15 to 20 years, say they've always seen mole crickets in the area. However, all of those surveyed agreed that mole crickets were not a problem to be dealt with until 5 to 7 years ago. Then managers in Gulf Shores areas began to see large areas of turf, including some lawns, infested and damaged by mole crickets. Four years ago several turf managers in the Mobile area were amused as they listened to fellow professionals talk about the increasing mole cricket problem and the difficulty of control.



Mole Crickets– Adults/Nymphs

Mounds made by new generation nymphs in July

Mole Cricket nymphs

For the last two years, the same turf managers in Mobile knew about the problem first hand because in many areas there, and to the northeast in the Dothan and Montgomery areas, mole crickets became a serious problem. Although Alabama mole cricket damage is still not as extensive as that in Florida, damage increases each year.

Mole cricket collections made in southern Alabama during the last four years indicate that there is one generation per year. Newly hatched nymphs have been found from mid-May through July. Toxic baits have been recommended in Alabama from July through August to control nymphs because by this time most have hatched, are actively feeding and are still small. Damage becomes greater as the mole crickets grow larger. Bait applications are often repeated every three weeks through August. Baits give less acceptable contol as the season progresses. Spring applications of baits do not give acceptable control, either.

Sprays have often given erratic mole cricket control in Alabama, regardless of timing, especially where the soil is "heavier" than in eastern Georgia and central Florida. Bendiocarb and diazinon, however, have been our best spray materials.

On lawns, granular diazinon applied once or twice in the spring and once to monthly July-September has provided acceptable control in many cases.

Fall applications of insecticides of any kind continued to be the least effective in controlling Alabama mole crickets. The search continues for spring and fall management practices, including insecticides that give acceptable control. Small plot tests with sprays and baits indicate immediate effectiveness of chemical control (Short and Driggers, 1973; McCord, Short and Strayer 1974; and Barry and Suber 1975). However, evaluation of chemicals for mole cricket control is often complicated by the mobility of these pests, small plot size, and death of crickets below the soil surface (Ulagaraj 1974). Turf managers have taught us that the real test of a chemical for mole cricket control is the quality of the turf– whether or not damage signs de-

TABLE 1: Average ratings* (0 = best, 10 = worst) for March 30-31, 1981 treatments on .5 acre fairway plots at Gulf Shores and Mobile, Alabama.

TREATMENT	RATE	GULF SHORES		MOBILE	
		May 1981	Oct. 1981	May 1981	Oct. 1981
Microencapsulated diazinon	6 lb ai/acre	.96	–	1.30	–
dioxathion	7.2 lb ai/acre	1.28	–	.92	–
isofenphos	2 lb ai/acre	.12	1.00	.52	.75
untreated check		1.52	5.71	1.75	4.42

*All values are the average of twenty-four .5 m^2 determinations.

Mole Crickets

crease and how long it is before new damage occurs.

In 1981 we tested several turf insecticides in demonstration plots for mole cricket control in the Gulf Shores-Mobile areas. Three materials were tested on bermudagrass golf course fairways where large plots (one fourth to one acre) could be treated. Evaluations of turf quality were made in March before treatment, and in May and October after treatment. Extent of tunneling was rated on a scale of 0 to 10 (0=no mole cricket tunneling, 10= completely tunneled). Twenty-four (.5 m^2) samples were taken within each plot. Samples were at least a meter apart on all sides. All treatments were watered in immediately with .5 inch irrigation water.

Early season tests were begun March 30 and 31, 1981, when mole cricket damage was increasing but pretreatment ratings were still below a 2, a level above which treatment was considered necessary on fairways. The first evaluations of these test plots were made May 5, 1981. Turf quality on all treated plots at this time was better than that on the untreated check plot, and all were below treatment level (*Table 1*).

New damage from the 1981 generation of mole cricket nymphs began to appear in mid-July. By late July most treated test plots began to exceed the "2" damage level, and had to be retreated by mid-August. However, by late July noticeable differences had shown up on plots treated with isofenphos (Oftanol 5G) and those treated with other potentially residual chemicals. Isofenphos was used to treat a one acre fairway plot (2 pounds active ingredient per acre) and on 10 golf greens (9 with 1 pound active ingredient/acre and 1 with 2 pounds active ingredient/acre) on a Gulf Shores golf course

In the past 5-7 years mole cricket damage has increased

on July 23-24, 1981. Mole cricket mound counts on treated greens were used to evaluate the effectiveness of the treatment (*Figure 1*). Reduction of mounds progressed over several days. By August and through September, isofenphos-treated greens had no mounds. No difference was observed in the one pound active ingredient and the two pound active ingredient/acre. Check greens had to be treated by September. The final evaluation of the early-season tests and the mid-season test on greens was made October 8, 1981 (*Table 1*). At this time damage on isofenphos-treated plots was still below a "2", check plots were well above treatment level, and other plots had been retreated at the discretion of the turf manager. Evaluation of the mid-season one acre fairway plot came earlier than expected– August 31, 1981 (*Table 2*). By August, damage on this one-acre plot had increased almost to the level prior to treatment. Why was isofenphos effective so long at the one pound active ingredient per acre rate on greens treated at mid-season and at the two pound active ingredient/acre rate from early season tests and only effective a few weeks on the one-acre plot treated in July? We don't know. Watering and pH were essentially the same. The one acre fairway plot was sandier than other locations, but whether or not this made any difference we don't know. Here are some things we have learned from these tests:

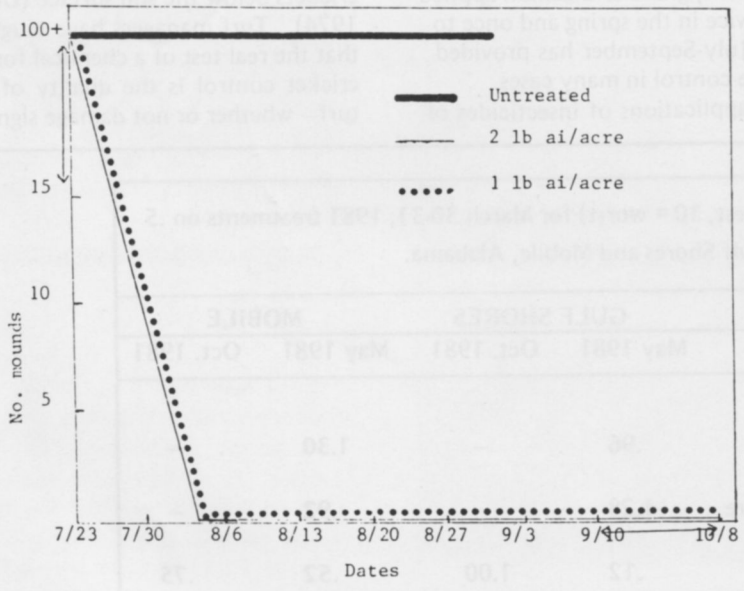


Fig. I. Number of mounds on golf greens treated with isofenphos July 23, 1981, Gulf Shores, AL

TABLE 2: Average ratings* (0 = best, 10 = worst) for one-acre fairway plot treated with isofenphos (2 lb active ingredient/acre) July 24, 1981, at Gulf Shores, Alabama.

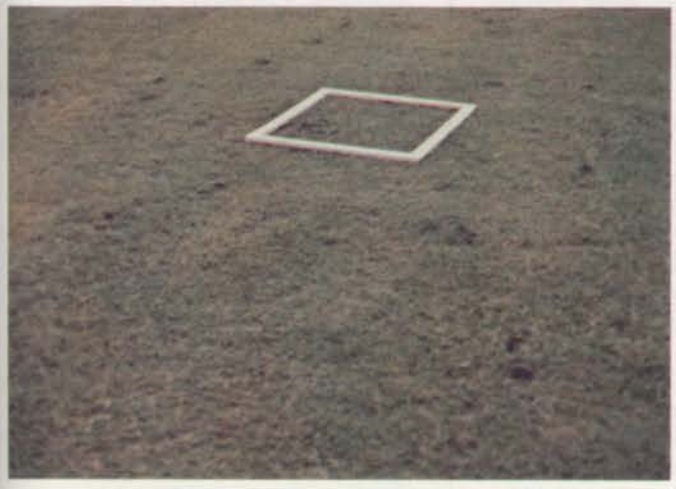
DATE	RATING	COMMENTS
7/23/81	4.5	Pre-treatment
7/24/81	4.5	Treated, isofenphos 2 lb ai/acre
8/4/81	2.0	
8/31/81	4.0	Retreated 8/31/81 with .5% chlorpyrifos bait at 75 lb/acre

*Values are the average of twenty-four .5 m^2 determinations.

1) Mole cricket damage test plots treated with isofenphos showed improved turf quality for a few weeks in one case and several months in others.

2) Reduction in damage signs in isofenphos-treated plots was slow and no dead mole crickets were found on the surface.

Isofenphos is not the answer to our mole cricket problems in Alabama. We know from past experience with other chemicals what happens when we depend too heavily on just one chemical for insect control. Implications are that now we have one more tool— isofenphos— to assist us in our battle against mole crickets. Proper management practices, accurate diagnosis and assessment of insect problems and knowledge of how and when to properly use chemical tools are basic to success-



.5 m^2 frame used in rating large plots.

Mole Cricket "run" (tunnel)

Mole Crickets

Mole Cricket damage to bermudagrass in August 1981

ful lawn care and other areas to the turf industry. This season we are developing management programs in order to determine where isofenphos "fits" best in mole cricket control in many areas of turf management.

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Elizabeth Egner, Michigan National Bank of Detroit, explained how you could go about obtaining a small business loan (possibly to buy that computer Marc was selling). Elizabeth discussed why some requests are turned down and went into depth explaining everything that is taken into consideration when granting a loan.

Promoting your business, now that you have extra cash and more free time, was explained by Phil Miller from American Field Marketing of Lansing, MI. Phil explained how direct mail advertising would help increase your profits and what kind of return you could expect, depending on how you went about it.

Bob Robinson from ChemLawn talked about Pesticide Safety and pointed out some of the peculiar laws that are still on the books affecting us today. Some farmers buy buffer property around their field in order to comply with chemical drift laws. However, Bob did not recommend that you buy the land surrounding your customers home, (or did he)?

Data on the EL500 project (growth retardant) of Elanco Products was discussed by Dr. Tom Perkins. Tom used slides to show the advantages as well as the disadvantages they are experiencing with their test results.

Dr. Malcolm Shurtleff, University of Illinois, was next on the agenda. More on his session will be included in this article.

Communication was the topic of Dr. Hal Hepler's speech. Dr. Hepler is from Michigan State University and did an excellent job of showing how important the skill of communication is. It was the perfect ending to a very informative conference.

The seminar also included a display room in which everyone was able to meet with the following vendors: AMERICAN LAWN APPLICATOR; The Andersons; Benham Chemical; BFC; Bulkkem; Grower Service; Lawn Equipment; Lebanon; Mallinckrodt; M.L.S. Computer Service; Rhone Poulenc; USS Agrichem; Velsicol; & W.F. Miller.

Dr. Shurtleff gave a very informative talk on Rhizoctonia, "Yellow Patch" and included slides in his presentation. The audiance was then impressed with the importance of using a microscope or having an analysis done when trying to identify common lawn problems. The slides on the following page were shown and we were asked to make an identification of each using only a pen, paper and the naked eye. Dr. Shurtleff was kind enough to share those slides with us. See how many you can identify.

+++

1. _____

2. _____

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4. _____

5. _____

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7. _____

8. _____

9. _____

Answers can be found on page 28.

The Lawn Weeds of Summer

by Richard J. Hull, University of Rhode Island

Richard J. Hull is a Professor of Plant and Soil Science at the University of Rhode Island. He received his B.S. and M.S. degrees from the University of Rhode Island in agriculture and agronomy respectively and his PhD. in botany from the University of California at Davis. For five years, Dr. Hull studied the physiology of perennial weeds at Purdue University in Indiana. At Rhode Island, his research has concentrated on the nutrition of turfgrass, woody ornamentals, and tidal salt marsh vegetation.

During the hot dry days of midsummer, most cool season lawn grasses grow slowly and if not fertilized and irrigated properly, they will become 'dormant' and stop growing altogether. At the same time, the summer weeds grow at accelerated rates and fill in areas thinned by foot traffic, insect feeding, or disease injury. Crabgrass (*Digitaria* sp.), goosegrass (*Eleusine indica*), spotted spurge (*Euphorbia supina*), nutsedge (*Cyperus esculentus*), and fall panicum (*Panicum dichotomiflorum*) are some of the summer weeds. They flourish under conditions that seriously depress the growth of lawn grasses and so cannot normally be controlled by herbicides without risking injury to the turf. As a result of these conditions, summer weeds are among the most troublesome weed pests and often most difficult to control.

An obvious question concerning summer lawn weeds is why do they grow so well under conditions that are stressful to lawn grasses? The answer lies in the photosynthetic metabolism of these weeds which evolved under hot subtropical conditions. By comparison most lawn grasses commonly used in the northern states and Canada originated in cooler temperate climates. This article will discuss the differences between these two plant types and suggest ways of reducing the competitive advantage enjoyed by the summer weeds.

Most crop plants and all cool season lawn grasses fix carbon dioxide (CO_2) photosynthetically by the enzyme ribulose bisphosphate carboxylase (RuBP-CO_2ase). This enzyme is a very large protein molecule and often

Figure 1: Common summer lawn weeds.

Figure 1a: Smooth crabgrass (*Digitaria ischaemum*).

Figure 1b: Goosegrass (*Eleusine indica*).

Figure 2: CO_2 fixation reactions.

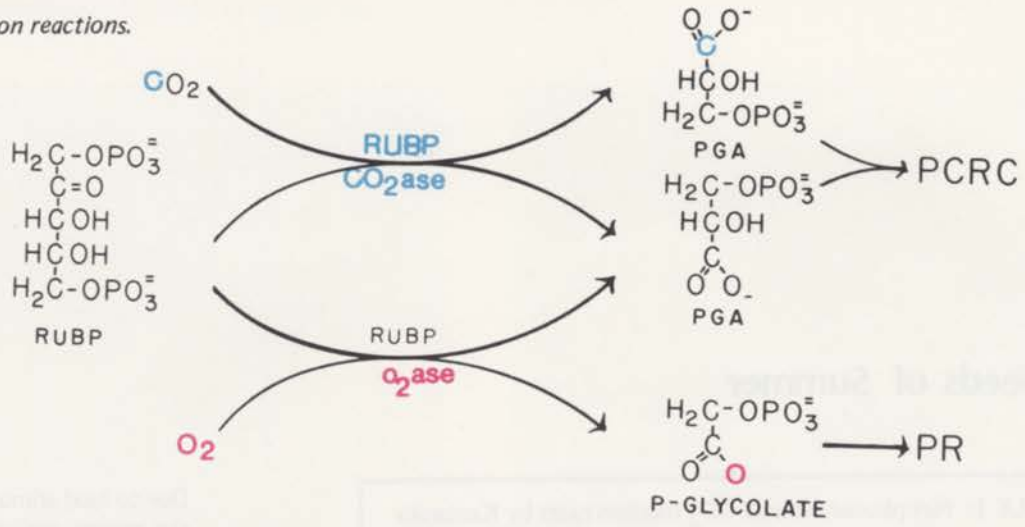

Figure 2a: RuBP-CO_2ase and RuBP-O_2ase. PCRC = photosynthetic carbon reductions cycle, PR = photorespiration.

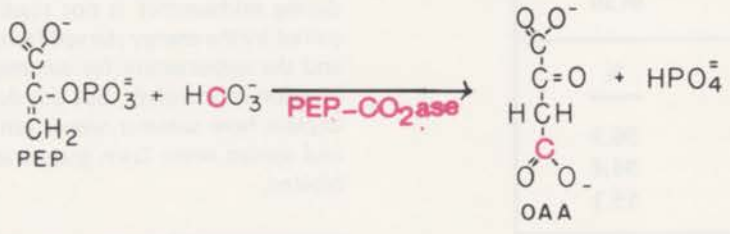

Figure 2b: PEP=CO_2ase reaction of C_4 plants.

accounts for more than fifty percent of the protein present in green leaves. The mechanism of CO_2 fixation catalyzed by this enzyme involves the combination of CO_2 with a five-carbon sugar, ribulose bisphosphate (RuBP), followed by a splitting of the resulting product into two molecules of the three-carbon acid, phosphoglyceric acid (PGA). This reaction can be written as shown in Figure 2. The carbon atom from CO_2 becomes an acidic group in one of the PGA molecules. Through the photosynthetic carbon reduction cycle this carbon is reduced and eventually forms 1/6 of a sugar (glucose) molecule. The cycle also regenerates the RuBP which can combine with another CO_2 through the action of RuBP-CO_2ase and begin another turn of the cycle.

Apparently RuBP-CO_2ase was one of the first successful enzymes to appear for photosynthetic CO_2 fixation and evolved at a time when the earth's atmosphere contained less oxygen (O_2) than it does today. This appears to be true because at the present oxygen content of the atmosphere (21%), the enzyme catalyzes a second reaction utilizing O_2 instead of CO_2 (*Figure 2*). When O_2 is utilized, the enzyme acts as an oxygenase (RuBP-O_2ase) and produces one molecule of PGA and one molecule of phosphoglycolate (P-glycolate) which containes two carbon

Figure 1c: yellow nutsedge (*Cyperus esculentus*).

Figure 1d: Prostrate spurge (*Euphorbia supina*).

Lawn Weeds of Summer

TABLE 1: Net photosynthetic CO_2 fixation rates by Kentucky bluegrass turf at three fertility levels in air and 2% O_2.

Fertilizer Rate	Net CO_2 fixation*		Inhibition in air
	Air	2% O_2	
lbs/1000 sq. ft.	mg $CO_2/m^2/min$		%
2.5-1-1	15.6**	35.7	56.3
5-2-2	14.6	32.0	54.4
10-4-4	17.0	37.9	55.1

*Irradiance = 1.2 $cal/cm^2/min.$, Temp = 31°C
**Each value is the average of two plots

atoms. This oxygenase reaction consumes one RuBP and one O_2 but results in no net CO_2 fixation. The P-glycolate enters into a series of reactions which ultimately yield one CO_2 and one PGA from two P-glycolate molecules. This RuBP-O_2ase activity with the subsequent release of CO_2 occurs in the light and is called photorespiration. However, unlike normal 'dark' respiration, photorespiration produces no energy which the plant can use for growth. Consequently photorespiration is often regarded as a wasteful process which may protect cool season plants from excessive light energy, but basically reduces the effeciency of their photosynethesis.

Under optimum growth conditions for cool season lawn grasses, the RuBP-CO_2ase activity dominates with the oxygenase and photorespiration reducing net photosynthesis by only 15-20%. However, when the temperature increases into the supraoptimal range and light energy levels are high, the enzyme operates more as an oxygenase and photorespiration reduces net photosynthesis by 50% or more. Apparently as the temperature increases, the affinity of the enzyme for CO_2 decreases while affinity for O_2 increases (Berry and Björkman 1980).

The amount by which apparent photosynthesis is decreased due to photorespiration can be estimated by measuring CO_2 fixation rates in normal air and in an atmosphere containing only 2% O_2. At low O_2 concentrations the oxygenase activity of RuBP-CO_2ase is inhibited and the rate of CO_2 fixation is not reduced by photorespiratory CO_2 release. Comparisons of apparent photosynthesis by Kentucky bluegrass turf exposed to normal air and to a 2% O_2 atmosphere are presented in Table 1. At reduced O_2 levels, apparent photosynthesis was 2.25 times greater than at 21% O_2 or more correctly stated under the conditions of these measurements apparent photosynthesis was inhibited 55% by photorespiration.

This explains why lawn grasses grow less during midsummer conditions. Due to heat stimulated photorespiration the energy available to the grass is sharply reduced leaving less available to produce new leaves or tillers. This means that injury to the turf occurring during midsummer is not readily repaired by the energy starved lawn grasses and the opportunity for summer weed invasion is provided. But this does not explain how summer weeds can grow and spread when lawn grasses are inhibited.

Photorespiration produces no energy which can be used for growth

Most summer weeds have originated from semitropical areas where hot dry conditions are common. Apparently under those conditions, an alternative enzyme for CO_2 fixation has evolved. This enzyme combines CO_2 with the three-carbon acid phosphoenolpyruvate (PEP) producing the four-carbon acid oxalacetate (OAA). Called phosphoenolpyruvate carboxylase (PEP-CO_2ase), this enzyme is present in the leaves of most summer weeds (Krenzer et al. 1975) and warm season lawn grasses, e.g. bermudagrass, zoysiagrass, St. Augustinegrass and centipedegrass (Krans et al. 1979). Because the first product of photosynthetic CO_2 fixation is a four-carbon compound these plants have been termed C_4 species. Conversely cool adapted plants that form the three-carbon acid PGA as the first photosynthetic product are called C_3 species. The CO_2 fixing enzyme PEP-CO_2ase gives C_4 plants a distinct advantage over C_3 species. Because PEP-CO_2ase has a

Figure 3: Cellular organization in leaves of C_3 and C_4 grasses.

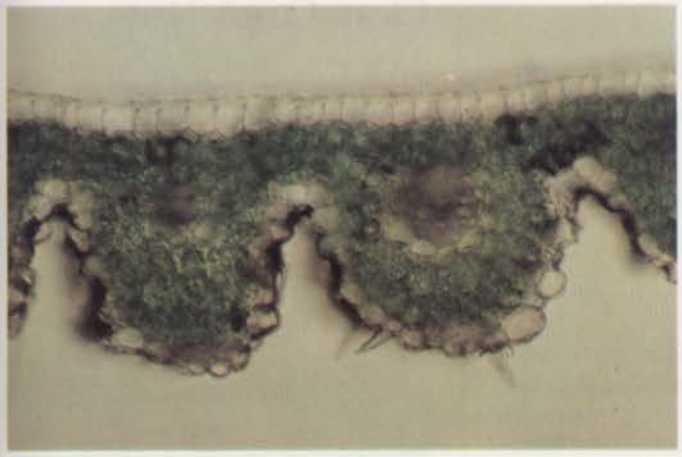

Figure 3a: Kentucky bluegrass, note clear bundle sheath surrounding the vascular bundles.

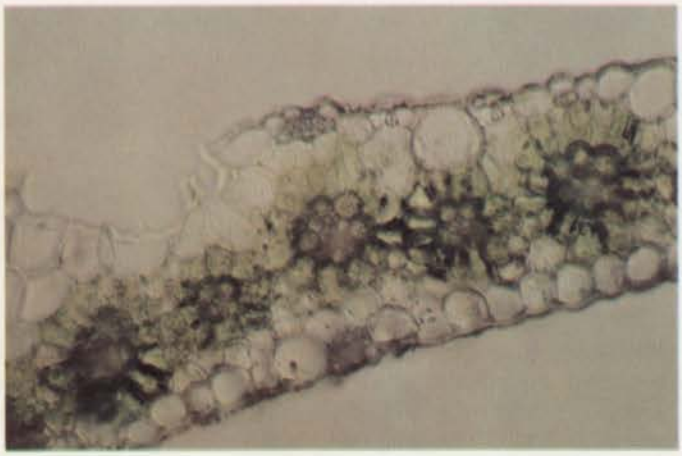

Figure 3b: Smooth crabgrass, note green chloroplasts in bundle sheath cells. Free-hand sections x250.

slightly greater affinity for CO_2 (in the form of bicarbonate) than does RuBP-CO_2ase, it is less inhibited by low CO_2 levels within the leaf tissues. More important, however, is the fact that PEP-CO_2ase does not react with O_2 even at high temperatures and high O_2 concentrations. Thus C_4 plants exhibit no photorespiration and their apparent photosynthetic rate is not influenced by atmospheric O_2.

The Cellular organization within the leaves of C_4 plants also increases their photosynthetic efficiency. A comparison of the leaf anatomy between C_3 and C_4 grasses is illustrated in Figure 3. In C_4 plants, the outer ring of green mesophyll cells is the site of CO_2 fixation by PEP-CO_2ase. Compounds resulting from the action of this enzyme are transported to the inner ring of bundle sheath cells where the CO_2 is released and refixed via RuBP-CO_2ase. The sugars resulting from the photosynthetic carbon reduction cycle operating in the bundle sheath are readily loaded into the nearby conducting cells in the vascular bundle and transported out of the leaf to sites of growth or storage. In this way, the PEP-CO_2ase in the mesophyll cells operates as a sort of preamplification system which efficiently traps atmospheric CO_2 without inhibition by O_2. Once transported to the bundle sheath cells, the CO_2 is released at greater than atmospheric concentrations where RuBP-CO_2ase can effectively refix it with little inhibition by the oxgenase action of the enzyme. There is some photorespiration within the bundle sheath cells but any CO_2 released is quickly refixed by the PEP-CO_2ase in the mesophyll cells and is never detected outside the leaf.

Summer weeds are efficient users of light at high temperatures

By comparison, C_3 plants rely totally upon RuBP-CO_2ase in their mesophyll cells for photosynthetic CO_2 fixation. There the inhibition by O_2 can occur and photosynthetic products must traverse several cells before they can be transported from the leaf (*Figure 3*). The whole process of photosynthesis and product removal is less streamlined and consequently less efficient. Under cool temperatures, C_3 plants carry on photosynthetic CO_2 fixation at rates often higher than C_4 plants but at elevated temperatures, the inherent inefficiency of the C_3 system becomes apparent and C_4 plants are clearly superior.

Because most summer lawn weeds are C_4 plants (Krenzer et al. 1975), it becomes obvious why they enjoy a competitive advantage over lawn grasses under summer conditions. This concept of weed competition was developed by Prof. Clanton Black at the University of Georgia (Black et al. 1969). Dr. Black has devoted much of his life to resolving the mysteries of C_4 metabolism and to understanding the advantages it gives to plants. He noted that because C_4 plants can make better use of high light levels, especially at elevated temperatures, they also are more efficient in their use of water. Because more CO_2 is fixed per unit of time there is less water lost through transpiration for each unit of photosynthetic product. This can be expressed in terms of the grams of water transpired per gram of dry matter produced or the water requirement. Such values for C_3 plants average about 800 g water/g dry wt., but for C_4 plants this value is only 300 g/g (Black et al. 1969). Thus C_4 plants are more efficient users of water as well as CO_2 and light.

Having discovered why summer weeds can thrive under conditions stressful to cool season lawn grasses, can anything be done to make turf more competitive? Probably the best approach is to minimize the midsummer advantage of C_4 weeds rather than trying to increase the growth of C_3 grasses under inhibitory conditions. The summer weeds are efficient users of light at high temperatures. Setting the lawn mower for a higher cut during the summer (two inches or more) will allow the lawn grasses to shade the soil more and reduce the light available for seedling weed growth. With the exception of yellow nutsedge, all the summer C_4 weeds are annuals and must reestablish

Lawn Weeds of Summer

themselves from seed each year. Consequently any practice which will favor a dense uniform turf during the spring, will discourage the establishment of C_4 weeds in the summer.

Because C_4 weeds are more efficient users of water than are heat stressed lawn grasses, irrigation should be practiced so as to maintain favorable moisture levels throughout the soil profile. This will favor the established deep rooted lawn grasses. Allowing the soil surface to dry between irrigations will retard weed seed germination but not injure the turf. Frequent light irrigations will favor the water efficient C_4 weeds and allow the soil profile to become dry thereby further weakening the lawn grasses. Maintaining a thick grass cover will retain lower soil temperatures which will reduce the heat stress to grass roots and provide a less favorable environment for C_4 weed establishment and growth.

Lawn grasses stressed by midsummer heat do not have the energy available in their roots for active nutrient absorption (Hull 1982). Therefore, fertilizer applied during the summer will likely do lawn grasses little good but will be used by summer weeds which have adequate energy for root function and growth. Unless the lawn is thick and growing with few weeds present, summer fertilization should be avoided since it will normally benefit weeds more than the lawn grasses.

Herbicides are available for the control of most summer weeds (Jagschitz 1981, Dernoeden 1981), however these materials, especially the postemergence herbicides, can injure lawn grasses when applied during times of heat stress. Therefore, a better approach is to manage the lawn so as to minimize the competitive advantage of C_4 weeds during the summer and resort to herbicides only in emergencies. Understanding why summer weeds are so competitive during hot dry conditions may help to design a successful lawn management strategy which will give a boost to the lawn grasses and discourage the weeds of summer.

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Clean Crop's New Soil Conditioner

Turfade is Clean Crop's new, "totally organic" soil conditioner. Turfade benefits turf grass lawns by stimulating grass root growth and helps water penetrate hard clay soils to support new plant growth. It will also assist in draining troublesome wet areas. Faster water penetration (27.4% at a test depth of 16 inches) and better root growth (average of 28% longer roots with 100% greater mass) mean better turf, a stronger, healthier lawn.

Turfade works without the addition of synthetic chemical surfacants. It is a natural plant extract, properly diluted with water to aid in application. It is not a fertilizer, but is intended for use as a supplement to good lawn fertilization. For more information contact Clean Crop, 419 18th Street, Greeley, CO 80632, or use reply card.

Circle No. 3 on Reader Reply Card

Sod Installation With Subsurface Watering

by W. H. Mitchell, University of Delaware

W. H. Mitchell is a Professor of Plant Science and Extension Agronomist at the University of Delaware. He received his B.S. and M.S. degrees from the University of New Hampshire and his Ph.D. degree from Penn State University. His special interests have been in the area of crop management.

The County Commissioners announced today that "watering of lawns will not be allowed until further notice." Announcements of this type can be expected more frequently as the population grows and demands for water escalate. Urban centers will suffer first, and most, even though they may be located in humid regions. There simply isn't enough water for casual use if everyone's needs are to be met.

The population centers are where the action is for the lawn maintenance industry. Recent water shortages have shown how quickly business dwindles when the rains stop and water-use restrictions are imposed. By contrast, when the rains return, concerns about water shortages are soon forgotten.

Water, which is fast becoming a limiting resource is of great concern to the cultivated sod industry. Sod is a perishable product. Without frequent watering it will not survive. When water supplies are cut off, sod lifting and installation stops. If limited watering is allowed, it's especially important that it be done efficiently and in this area subsurface irrigation can make a contribution. It is also an area where research and development work is badly needed.

SUBSURFACE WATERING MORE EFFICIENT

More efficient use of water can be achieved by adopting new concepts and methods or, in some cases, refining old ones. For example, subsurface watering essentially eliminates the water loss from evaporation that is associated with use of overhead sprinklers, resulting in as much as a 50% increase in water use efficiency. Another point in favor of subsurface watering concerns water use regulations established by municipalities. Knowing that a ban on watering can be very disruptive for business and homeowners alike and that exceptions are often difficult to justify, officials are inclined to allow limited use of water rather than cutting it off completely. A subsurface system is uniquely suited to this type of limited use. When water supplies are short, water use can be further cut by reducing pressures. While this may limit the performance of sprinklers, it will have little or no effect on the operation of subsurface trickle systems which normally function well at 5 to 10 psi.

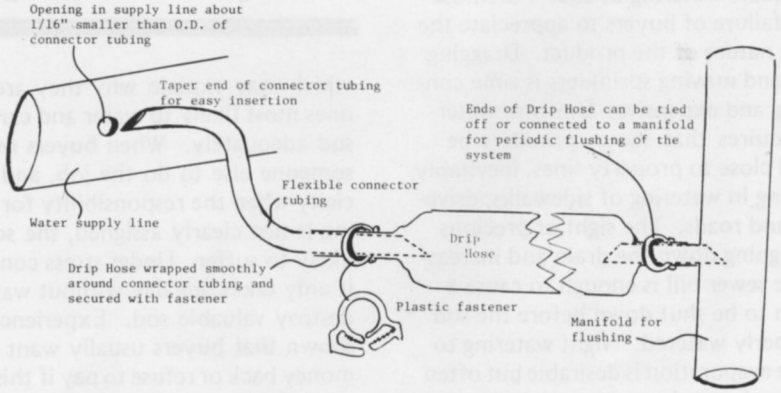

Figure 1. Suggested lay-out of tubing for subsurface watering

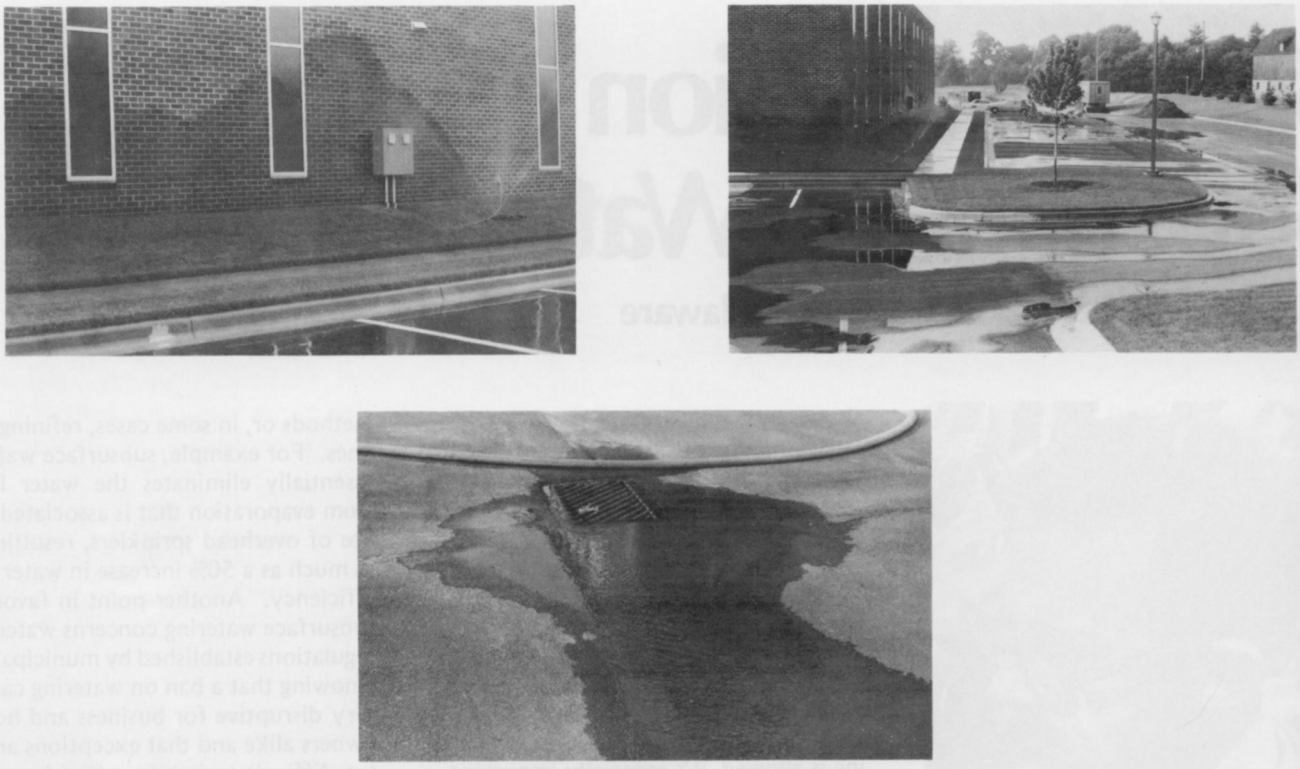

Figure 2. Avoid indiscriminate watering and excessive run-off by using subsurface irrigation to achieve a controlled wetting pattern.

SOD FAILURES COMMON DUE TO INADEQUATE WATERING

Officials of the American Sod Producers Association estimate that over 90% of all sod failures can be traced to inadequate watering. The problem is especially serious when sod is installed prior to or during high temperature–moisture stress periods.

There are many explanations for inadequate watering of sod. Foremost is the failure of buyers to appreciate the fragile nature of the product. Dragging hoses and moving sprinklers is time consuming and expensive. Uniform watering requires that some sprinklers be placed close to property lines, inevitably resulting in watering of sidewalks, driveways and roads. The sight of precious water going down the drain and increasing the sewer bill is enough to cause a system to be shut down before the sod is properly watered. Night watering to reduce evaporation is desirable but often inconvenient unless an automated underground sprinkler system is available. Hoses and sprinklers left unattended at night invite theft and vandalism.

LOSS OF SOD COSTLY TO BOTH PRODUCER AND BUYER

Homeowners are on-site and so constantly reminded of their investment, which may explain why they are the ones most likely to water and care for sod adequately. When buyers rely on someone else to do the job, and especially when the responsibility for watering is not clearly assigned, the sod is likely to suffer. Under stress conditions it only takes one day without water to destroy valuable sod. Experience has shown that buyers usually want their money back or refuse to pay if this happens. Since the sod market is not expanded by customers seeking satisfaction in the courts, one way or another the supplier pays the bill. However, the supplier, who wishes to stay in business, must pass on the cost to the next buyer. Besides the immediate financial losses to the supplier when sodding is unseccessful, damage is done to the image of sod.

Over 90% of all sod failures can be traced to inadequate watering

A sodding failure is usually dramatic. It shows up in hours or days, whereas a seeding failure develops over weeks or months and may even be rescued by the growth of weedy species which turn the area green. The usual response to a seeding failure is to seed again, but if sod fails, that's it– no more sod!

Many sod establishment problems associated with inadequate watering could be resolved by the installation of a subsurface irrigation system. Irrigation could become a part of the establishment package. The immediate advantages would be the elimination of costs usually associated with watering and the avoidance of sodding failures which are so damaging to the industry. This could be achieved with minimum cost to the sod buyer and it is conceivable that it would result in considerable expansion of the sod market.

Sod Installation

Figure 3. Subsurface watering is ideal for foundation plantings.

Drip irrigation technology is developing rapidly and the system is constantly being adapted for new uses. The equipment and supplies are readily available and installation techniques can be mastered by any lawn maintenance crew in a short time. Ideally, in new building construction, the system should become a part of the architect's design. In any case, a careful plan should be made which can be referred to later when trying to locate valves and feed lines since the entire system will be underground. This information will also be of value should the owner decide, at a later date, to extend the system to include a vegetable garden or flower beds.

INSTALLATION

For convenience, broadcast the required lime and fertilizer and make final soil preparations before installing the system. It can then be placed on the soil surface prior to installing sod, or the lines can be placed a few inches underground with a modified chisel.

Many types of irrigation tubing are available, ranging from 3 to 12 mils in thickness. Where tubing has been placed directly under the sod, we have had good success using the Chapin 6 mil Drip Hose. If machine placement to a greater depth is desired, the 12 mil hose would be preferable. Tubing can be purchased in 2000 to 4000 foot rolls at a cost of about 2 cents per foot. Use PVC tubing for water supply lines since cuts and cemented joints can be made easily with this type of tubing.

The main supply lines are usually connected to the drip hose by short pieces (12 inches) of flexible plastic tubing cut on a 45 degree angle to make it easier to insert into both the drip hose and main supply lines. To insure a tight connection, punch or drill undersized holes in the main line at the desired lateral spacing. Once tapered ends of tubing have been inserted, they will be held in place by friction.

Several devices are available for connecting the opposite ends of the drip hose. Spacing will depend on the soil, but in most cases 20 inch intervals give uniform and thorough soil wetting. Take care to keep sand and soil out of the system when making connnections. To minimize contamination, flush the main supply line as a first step in activating the system. It is essential to filter water. Selecting the proper type and size of filter is a basic step in designing the system. In most cases, a screen or cartridge type filter is adequate.

Before installing sod, activate the system to check for faulty connections. Let it run until the soil is thoroughly moistened. Then turn it off for an hour or so to allow water to move into the soil prior to laying sod.

Figure 4. The subsurface watering system can be attached to an outside faucet. A cartridge or screen filter is a basic component of the system.

Figure 5. Flush the supply lines before activating the system. Operate the system for a sufficient time to detect faulty connections and to observe wetting patterns.

Figure 6. Soil should be thoroughly moistened before sod is placed over drip hose.

Water impurities in some parts of the country may cause unacceptable amounts of orifice plugging. And if drip lines are placed on the soil surface prior to sodding and at some later date it becomes necessary to renovate the lawn, it will be necessary to use one of the popular chemical renovation procedures. Because of potential injury to the irrigation system, mechanical equipment such as a roto-tiller cannot be used, so this option is lost.

There are some irrigation needs that can't be met by subsurface watering, and, as with any new development, there will be unforeseen problems as the system is put into more general use. For example, unless placed on the contour, the system is not suitable for slopes greater than 2 or 3 percent. Since capillary movement of water is involved, the system is not well adapted for sands, unless the soil is amended with organic materials.

While accepting that subsurface watering of sod is a new approach and is obviously no panacea it is another way of solving a major problem in the sod industry— keeping the sod wet with as little water as possible.

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OHIO TURFGRASS CONFERENCE & TRADE SHOW

December 7, 8 & 9

The **1982 Ohio Turfgrass Conference and Show** will be held at the Ohio Center, 400 North High Street, Columbus, Ohio. Approximately 200 booth spaces have been reserved for the 1982 Tradeshow.

The educational sessions this year will include separate sessions for:

LAWN CARE
GOLF COURSE
GROUNDS MAINTENANCE

Two workshops will kick off the opening of the Conference and Show on Tuesday morning. A "Turfgrass Diagnostic" workshop will be conducted by Dr. Harry Niemczyk (OARDC) and Dr. Bob Joyner (ChemLawn).

A **General Session** on Tuesday afternoon will cover several pertinent topics and issues including a 2,4-D update, preemergence herbicides– successes and failures, turfgrass management and pesticides, liquid fertilization of landscape plants, and an EPA update.

The **Professional Lawn Care Session** will cover topics on cost cutting programs for customer retention, thatch management, fungicide and insecticide updates, nitrogen sources update, turfgrass renovation, bulk handling of pesticides, Oftanol effects on nontarget organisms, gypsum and liming materials, several disease topics and others.

The **Grounds Maintenance Sessions** will cover topics on management of intensively used athletic fields, hydromulching and materials for slope stabilization during establishment, animal pest problems and their control, new tall fescues, ornamental alternatives to grass for shade, turfgrass weed control, weed control in ornamental plantings, new fungicides for turf and ornamental disease control, and several others.

The **Golf Turf Sessions** will cover topics on selection and care of annual and perennial flowers, edaphology of the golf green, fungicide and insecticide updates, Curvalaria and other similar diseases, bentgrass breeding and new cultivars, water analysis soil drainage– new concepts, stream erosion control and aesthetics, wetting agents, bentgrass management strategies, people stress, and several others.

Speakers who have already accepted invitations to the conference include:

Dr. A. J. Turgeon, Texas A&M University
Dr. K. A. Hurto, ChemLawn Corporation
Dr. M. Petrovic, Cornell University
Dr. J. Vargas, Michigan State University
Dr. J. R. Hall, Virginia Polytechnical Institute & State University
Dr. Terry Logan, Ohio State University
Mr. Rick White, Village Green, Ltd.
Mr. John Moreland, Cambridge Soil Services
Dr. Joe Duich, Pennsylvania State University
Dr. Roger Funk, Davey Tree Expert Company

AND MANY OTHERS

The Ohio Department of Agriculture will credit specific subjects on the educational program for pesticide licensing.

FOR MORE INFORMATION CONTACT: Dr. John R. Street, Department of Agronomy, Ohio State University, 2021 Coffey Road, Columbus, Ohio 43210, or call (614) 422-2047.

Calendar of Events

September

ANNUAL TEXAS TURFGRASS FIELD DAY–

Wednesday, September 22, 1982 TAMU Field Laboratory on Agronomy Road at the Northwest corner of the Texas A&M University campus at College Station, Texas. Contact Dr. James B. Beard, Department of Soil and Crop Sciences, Texas A&M University, College Station, Texas 77843.

October

FLORIDA TURF-GRASS ASSOCIATION CONFERENCE AND SHOW–

October 3-6 at the Curtis Hixon Convention Center and Hilton Hotel, Tampa. Contact Elizabeth M. Eyman, Executive Office, 1520 Edgewater Drive, Suite E, Orlando, Florida 32804.

GOLF COURSE SUPERINTENDENTS ASSOCIATION OF NEW JERSEY TURFGRASS EQUIPMENT, IRRIGATION AND SUPPLIES FIELD DAY–

October 5 (rain date– Oct. 6), Rutgers University Stadium and Golf Course, River Road, Piscataway, New Jersey. Contact Dr. Henry W. Indyk, Soils and Crops Department, Cook College–Rutgers University, Box 231, New Brunswick, NJ 08903. Phone (201) 932-9453.

November

NEW YORK STATE TURFGRASS ASSOCIATION CONFERENCE AND TRADE SHOW–

November 9-11, 1982, Rochester War Memorial. The Genesee Plaza Holiday Inn will be the host hotel. For complete information on the trade show, contact Janet Dudones, The Ed Worthington Corporation, 50 Petrova Avenue, Saranac Lake, NY 12983. For all other information relating to the Conference, contact NYSTA Executive Director, Ann Reilly, 210 Cartwright Blvd., Massapequa Park, NY 11762, (516) 541-6902.

NORTH CENTRAL TURF GRASS EXPOSITION–

November 10-12, 1982, Arlington Park Hilton, 3400 Euclid Ave., Arlington Heights, Illinois. For more information contact Mae Maxwell, P.O. Box 501 Urbana, Illinois 61801, (217)333-2883.

PROFESSIONAL LAWN CARE ASSOCIATION OF AMERICA CONVENTION AND TRADE SHOW–

November 16-18, Indianapolis Convention Center, Indianapolis, Indiana. Contact Al Van Horn, 435 N. Michigan Ave., Suite 1717, Chicago, IL 60611.

December

NEW JERSY TURFGRASS EXPO '82–

December 6-9; Resorts International Hotel, Atlantic City, NJ; contact Dr. Henry W. Indyk, Soils and Crops Dept., Cook College-Rutgers University, Box 231, New Brunswick, NJ 08903. Phone (201) 932-9453.

OHIO TURFGRASS CONFERENCE TRADE SHOW–

December 7-9, Ohio Center, Columbus, Ohio. Contact Dr. John Street, Dept. of Agronomy, Ohio State University, Columbus, OH 43210.

WESTERN PENNSYLVANIA TURF & GROUNDS MAINTENANCE SCHOOL & TRADE SHOW–

December 7-9, 1982. Pittsburgh Marriott Hotel/Exposition Mart, 101 Mall Boulevard, Monroeville, PA. Sponsored by the Pennsylvania Turfgrass Council and the Pennsylvania State University. For further information, contact: Christine King, Executive Secretary-Treasurer, 412 Blanchard Street, Bellefonte, PA 16823 (814) 355-8010.

January

NORTH CAROLINA TURFGRASS CONFERENCE–

January 4, 5, 6 1983. Pinehurst Hotel, Southern Pines, NC. Contact L. T. Lucas, 3409 Gardner Hall, N. C. State University, Raleigh, NC 27650 (919) 737-2751.

February

PENNSYLVANIA TURFGRASS CONFERENCE & TRADE SHOW–

February 28 - March 3, 1983. Hershey Lodge & Convention Center, West Chocolate Avenue & University Drive, Hershey, PA. Sponsored by the Pennsylvania Turfgrass Council and the Pennsylvania State University. For further information contact: Christine King, Executive Secretary-Treasurer, 412 Blanchard St., Bellefonte, PA 16823 (814) 355-8010.

Visual Analysis of Turfgrass Problems

by Tom Mascaro, Consultant, Turfgrass Products Corp.

Sometimes it is difficult to explain why turf is in poor condition because we have a limited number of ways to determine problems. We have at our disposal only four methods for analysis, these being a soil analysis, tissue testing, measured response and visual analysis.

A soil analysis, if properly done, can reveal the nutrient and trace element situation of a soil at a given point in time. Tissue testing, although not an exact analysis, gives us a general idea of the nutrients, or lack of, in the plant tissue. Measured response indicates the total amount of leaf production from a turf grass area. For instance, golf course superintendents will count the number of baskets of grass clippings removed from a green at each cutting. This is a measured response, since the number of baskets of clippings is related to the number of square feet being cut.

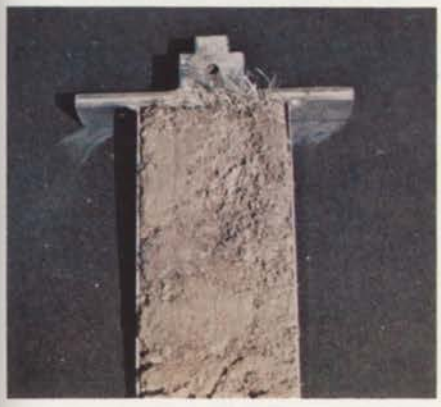
Gently wash away soil from a profile sampler to show extent of root system.

Visual analysis is quite frequently used to help determine the condition of the turf. This analysis would include color, density, some diseases, insects, drainage, soil compaction, thatch layers, etc. Many of these problems can be visually observed by taking an undisturbed soil profile sample. The better the soil profile sample is, the better the visual analysis that can be made. For this reason, a specially designed rectangular soil profile sampler was developed to take a clean 1/2" x 3" x 6" soil sample. The sampler is pressed into the turf. It is then drawn out and the two cutting blades are unscrewed from the handle. The cutting blades are designed to separate, revealing an undisturbed soil profile. Soil samples taken in this manner can be photographed, mounted and preserved or returned from where they are taken.

Following is a list of suggestions of what to look for when making a visual analysis:

Thatch:

Observe the depth of thatch. Study the state of decomposition by the color of the undecayed organic matter. Look for white, gray, red or black mycelium that might indicate the presence of active or inactive disease. Look



A good root system can easily be observed with a rectangular soil profile sample.

Turfgrass diseases in the soil, as revealed with a profile sample.

Visual Analysis of Turfgrass Problems

Poor soil preparation for turfgrass area is obvious in this soil profile.

for layers of buried thatch, because these can indicate real trouble.

Soil:

Soil compaction usually shows up in the first two inches from the soil surface. Visual observation will reveal a difference in the closeness of the soil particles. A magnifying glass will help detect textural or structural differences in the soil. Smell the sample as soon as you extract it. The reason the old gardener with a green thumb will hold a handful of soil to his nose is to detect anaerobic conditions. Aerobic soils have a pleasant musty woody odor, while anaerobic (soils without air) have a disagreeable or putrid odor.

Shallow roots indicate a problem of compaction, too much water or surface feeding.

Soil grubs and insects will sometimes show up in a soil sample profile.

Contamination, such as pockets of sand, plaster and other materials that affect the growth of turf, will be revealed with a good soil sample.

Taking soil profile samples will help you to better understand soils under turf, as well as diagnose your customers lawn problems.

Soil profile samples can be allowed to air dry and then sprayed with clear acrylic to preserve them. Permanently mounted samples can be used over and over to show typical problems, and as a selling tool when showing customers potential lawn problems, or existing ones.

Proper soil profile sampling can be a professional approach for lawn applicators.

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Classified Ads

7600 gallon upright STORAGE TANKS, excellent condition. $1,500 each. Contact: Atwood Lawnspray. Inc., 6489 Metro Parkway, Sterling Heights, MI 48077, Phone (313) 939-3636.

SPRAY TRUCK– 1979 Chevy one ton truck– 750 gallon tank– mechanical agitation– excellent spraying condition– low mileage– must sell– $9200. Call (502) 456-6777, ask for Pat McConnell.

1979 Louisville FORD TRUCK with custom designed storage compartments. 1979 FINN LAWN FEEDER with power take off. Both like new, will sell seperately or together. (313) 468-5285

1968 DODGE SPRAY TRUCK, 6 cyl., 5 ton, 1800 gl. 5 compartment tank. PTO, 300' hose and electric reel. $2500, call after 3:30. (313) 278-0440

SPYDER FORKLIFT/TRAILOR, 200 hours, exc. cond., Zionsville, IN $12,400. Call George (317) 873-5231 or 873-5937

WANTED TO BUY: Lawn care company in Mid West (Mich., Ill, Ind., Wisc.) area. Small to med. size. Chemical turf applications only– no mowing or tree care. Send information to Lawn Care, P.O. Box 361, Grosse Isle, Mich. 48138.

WANTED: Used four wheel self-propelled Hahn or Cushman 120 - 175 gallon sprayer for greens. P.O. Box 191, Brentwood, TN 37027. (615) 794-6646.

WANTED: Dealers/Distributors for Ag Spray Hose. Hose is of finest quality and fully guaranteed. Receive distributor discounts and supplement your winter income. Call Dick Charles, Green Thumb Spray, (516) 485-1919.

MYERS 2C95 centrifugal pump. 100 G.P.M./200 lbs. pressure. Like new, 2½ years old. $325 or best offer. (313) 939-3636

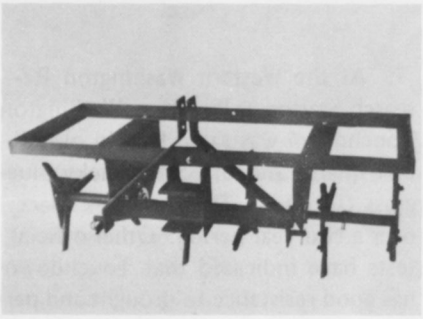
Fertilizer & Insecticide Combination

Lesco Products, a division of Lakeshore Equipment & Supply Co., Elyria, OH, now provides the turf manager with fertilizer and insect control combination products with Dursban and Diazinon. These combinations are specially designed to give varying amounts of slow-release nitrogen and proven insect control.

Lesco Fertilizer with Dursban is available in five fertilizer formulations including 40-0-0, 32-5-7, 30-5-7 and 39-0-0. Lesco Fertilizer with Diazinon is available in a 30-5-7 formulation. For more information, contact Barbara G. Betz, Lakeshore Equipment & Supply Co., 300 S. Abbe Rd., Elyria, OH 44036 or use reply card.

Circle No. 5 on Reader Reply Card

Agri-Fab Introduces New Coring Aerator Attachment



The all new Agri-Fab Coring (plug type) Aerator Attachment is a new development for home owners and commercial landscapers to aerate and stimulate lawn growth. The heavy duty, all-steel design and rugged construction follows in the tradition of Agri-Fab's other products. The hitch provides quick and easy hook-up for both the sleeve type and catagory "O" hitches.

The eighteen heat-treated, replaceable coring points rotate freely on ball bearings with an oversized 1" diameter shaft covering an approximate 40" witdth. The upper frame is designed to accept up to five concrete blocks or tractor wheel weights to improve coring point penetration in firm soils or hard ground. Complete details are available from Agri-Fab, Inc., 303 W. Raymond St., Sullivan, Illinois 61951, or use reply card.

Circle No. 6 on Reader Reply Card

Touchdown Rated at Washington State

At the Western Washington Research Station at Puyallup, Washington, Touchdown was rated first in overall turf quality out of 65 Kentucky bluegrass cultivars. The test took place over a two year period. Other official tests have indicated that Touchdown has good resistance to drought and performs well under low maintenance. For more information contact Pickseed West Inc., P.O. Box 888, Tangent, OR 97389, or use reply card.

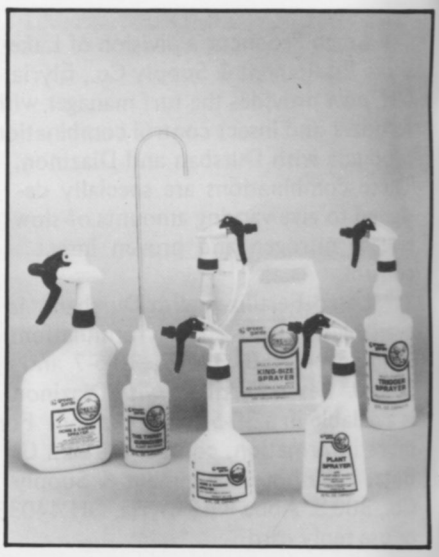
Circle No. 9 on Reader Reply Card

Encap Announces New Division

An announcement of the new Green Garde Trigger Sprayer Division has been made by Encap Products Company. According to Gary Marcus, General Manager of the new division, "Green Garde offers the widest selection of trigger spray bottles in the industry, six styles, from one pint to one gallon capacity.

Mr. Marcus further pointed out that the trigger spray bottles will be marketed under the green Garde label, and that the in-house silk screen facility will print special logos and designs for customers desiring to promote their own private label brand products. For further information, contact Gary A. Marcus, Green Garde Trigger Sprayer Div., Encap Products Company, P.O. Box 278, Mt. Prospect, IL 60056, or use reply card.

Circle No. 10 on Reader Reply Card



Indianapolis Countdown... PLCAA's Third Annual Convention & Trade Show

Members of the lawn care industry are making plans to attend the Professional Lawn Care Association of America's Third Annual Convention and Trade Show at the Indianapolis Convention Exposition Center November 16 - 18, 1982 in Indianapolis, Indiana.

This year's convention keynote speaker will be former U.S. Secretary of Agriculture, Earl L. Butz, whose address "Populism Politics, and Progress" will expand upon free enterprise and the essential need for profits in the American economic system. Dr. Butz was Assistant Secretary of Agriculture, 1954-57, during the Eisenhower Administration. He returned to Purdue in 1957 as Dean of Agriculture, and in 1968 was named Dean of Continuing Education and Vice President of the Purdue Research Foundation.

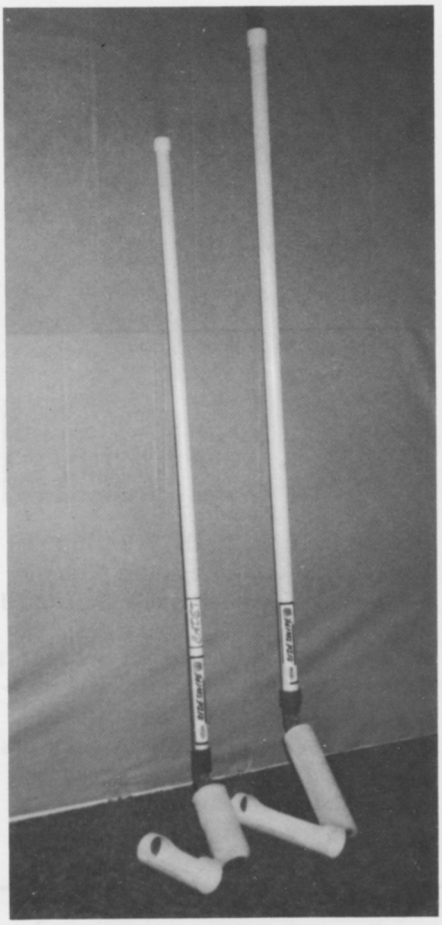
Dr. Butz served as U.S. Secretary of Agriculture from 1971-1976. In that post, he worked tirelessly to promote American agriculture, to keep the United States the world's best fed nation, to improve farm income, to strengthen rural America, to minimize Federal encroachment into farming, and to expand and keep open farm export markets. He has sought to convey to farmer and consumer alike the wisdom of the market system as the most effective means of obtaining an abundance of high quality food and fiber for consumers and acceptable income for farmers.

In his governmental posts, Dr. Butz served as chairman of the U.S. Delegations to the FAO in Rome, to the O.E.C.D. in Paris, and to the World Food Conference in Rome. He has travelled in over 50 nations, studing food and agriculture. He has traveled the U.S. widely, having spoken in 49 states of the Union. Among many recognitions made to Dr. Butz, he has received the American Farm Bureau Federation Award for Distinguished Service to Agriculture— the first Secretary of Agriculture to be so honored in a third of a century.

Educational workshop sessions, presented twice this year in response to 1982 attendees evaluations, will include such topics as: Advertising/Marketing; Management; Employee Training; Accounting; Budgeting; and Management/Organization. The number of exhibitors committed to date is running far ahead of expectations and lawn care professionals can look forward to viewing a vast array of goods and services on the exhibit floor. For further information contact Jane Stecker, PLCAA, 435 North Michigan Ave., Suite 1717, Chicago, IL 60611.

Sideswipe Applicator

Sideswipe is the Registered Trademark for our hand-held herbicide applicators, using the "wipe-on" method. Sideswipe has many unique features for the serious user of herbicides. Two models - identical except for size. All parts are replaceable and available as parts. The pad is constructed of a 1 ½" dia. PVC tube evenly perforated over the entire area of the pad, with ½" polyester nap chemically adhered to the outside. Herbicide is fed into the pad through a 1/32nd" hole in one end of the pad adapter and air pressure is equalized through this same hole. A clear plastic elbow allows a visual appraisal of herbicide level. The protective shield allows wiping beneath desirable and low hanging vegetation without damage. For more information contact Steve Struve, Sideswipe Inc., P.O. Box 926, Friona, TX 79035, or use reply card.



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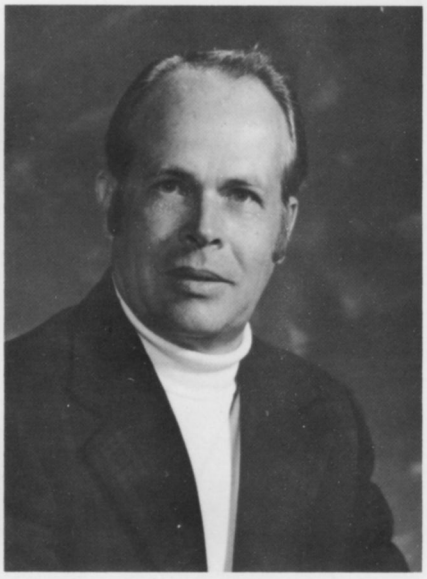
Quiz Answers

1. Yellow Patch
2. Dollar Spot
3. Melting Out
4. Dog injury
5. Pythium
6. Early stages of Fusarium
7. Leaf Spot
8. Stripe Smut
9. Fusarium Blight

Dr. Eliot Roberts New Lawn Institute Director

Dr. Eliot C. Roberts was confirmed as the second Director of the Lawn Institute at its annual meeting in Dallas, Texas, June 29. Dr. Roberts succeeds Dr. Robert W. Schery who is retiring after 25 years at the helm of the Institute. In welcoming Dr. Roberts aboard president Norman Rothwell indicated that the Institute was very fortunate to find so capable and dedicated a replacement for Dr. Schery as Dr. Roberts surely is.

Eliot C. Roberts is well known in not only turfgrass circles, but as an administrator and environmental ecologist with wide-ranging interests. He is resigning his position as Professor of Soil Science at the University of



Rhode Island, to assume Directorship of the Institute. Among his activities in Rhode Island were supervision of programs relating to the impact of urbanization, including benefits to be derived from understanding use of plants in disturbed environments.

Dr. Roberts did his undergraduate work at the University of Rhode Island and continued with his graduate work at Rutgers University where he received his PhD. degree in Soils and Plant Physiology in 1955. He specialized in turfgrass teaching and research at the University of Massachusetts for some years before accepting a professorship at Iowa State University, Ames, under aegis of both the horticultural and agronomy departments. Dr. Roberts left Iowa State to become chairman of the Ornamental Horticulture Department at the University of Florida, and eventually assumed similar responsibilities in a return to his alma mater, the University of Rhode Island.

Dr. Roberts is married to Beverly Cruickshank Roberts, who will be assisting him at the new Lawn Institute headquarters in Tennessee, as office manager and graphic artist. The Roberts have three children, Eliot, Jr., Mary Alice and William, the two elder married and established in Tennessee. New staff headquarters for Dr. Roberts and the Institute will be P.O. Box 108, Pleasant Hill, Tennessee 38578.

New Hand-Operated Sprayer

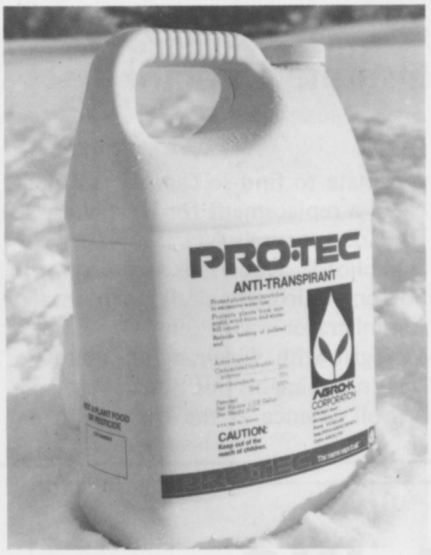
Warren's Turf Nursery, Inc. announced a light-weight, hand-operated, duster/granule spreader. Easy to operate, the strap-on, model 0-5, directs powdered or granulated fungicides, fertilizers and other chemicals to the base of the plant, or the underside of leaves, without extensive waste. The 0-5's adjustable length, hand-held wand keeps chemicals out of unwanted areas. Interchangeable, rotatable heads offer a variety of directional flow choices.

The 0-5 features an enclosed gear case and drive shaft. Interior exposed metal parts are made of stainless steel, and the 0-5 features a safety lid that locks in place to prevent odors, fumes and dusts from rising up into the operator's face. The easy-to-turn hand crank assures a constant, even, fan-driven flow, and the side handle prevents powders from bridging during operation. For more information, contact Emory Hunter, Warren's Turf Nursery, Inc., P.O. Box 459, Suisun City, CA 94585, or use reply card.

Circle No. 18 on Reader Reply Card

Pro-Tec Anti-Transpirant

Agro-K Corp. of Minneapolis offers a polymer-based chemical that has shown to significantly reduce winter-kill damage. The chemical will not harm trees and shrubs, and one applications gives effective protection for an entire season.



To the lawn care company, Pro-Tec can mean the extension of the business calendar by 2 or 3 months into the fall. By offering shrub protection service, Agro-K claims that many lawn care companies can increase sales and profits by 25% or more annually. For more information, contact Agro-K Corp. 5750 Main Street N.E., Minneapolis, MN 55432, or use reply card.

Circle No. 19 on Reader Reply Card

Lawn Institute's Board, Officers Elected

The Lawn Institute at its annual meeting held in Dallas, TX, June 29, elected Norman Rothwell of Canada as president, Bob Peterson of Oregon as vice president, and Robert Russell of New York as secretary/treasurer. Mr. Rothwell is president of Rothwell Seeds Ltd., Lidsay, Ontario, Canada; Mr. Peterson is in charge of proprietary developments at E. F. Burlingham & Co., Forest Grove, Oregon; and Robert Russell heads J & L Adikes, Jamaica, New York.

"Stubborn little buggers."

Lakeshore Now Marketing Two New Dicamba 2, 4-D Comb.

Lakeshore Equipment & Supply Co. is now marketing two new Dicamba Plus 2,4-D combinatiions.

Lesco Eight-One and Lesco Ten-One Selective Herbicides provide post-emergence control for selected broadleafs. University and field research indicates that these combinations give equally fine control in combination with other pesticides.

The two new Lesco herbicides join a line of herbicides with dicamba and 2,4-D including Lesco A,4-D, Lescopex (MCPP) and Lesco Dicamba + 2,4-D. For more information, contact Barbara Betz, Lakeshore Equipments & Supply Co., 300 South Abbe Rd., Elyria, OH 44036, or use reply card.

Circle No. 20 on Reader Reply Card

New Compact Sprayer

Bouldin & Lawson, Inc., introduces "The Spray Master". The Bouldin & Lawson Spray Master features a powerful 8 HP engine for plenty of power; and it's self-propelled, so all you have to do is guide it along. It also features a 20 gall tank for large capacity spraying. There's a multi-set flow valve to allow you to spray any combination of hood, left or right booms. And there's a gauge and regulator to help meter the flow of spray. There's also an optional "Hand Wand", with up to 200 lbs. pressure to allow you to spray trees and those higher, hard-to-reach places.

Bouldin & Lawson has put this into a compact design of only 28 inches overall width. So, there really are few places too small for The Spray Master. Used to spray fertilizer or pesticide on trees and foliage, or golf course greens. For more information contact Bouldin & Lawson, Inc., Route 10, Box 208, McMinnville, TN 37110, or use reply card.

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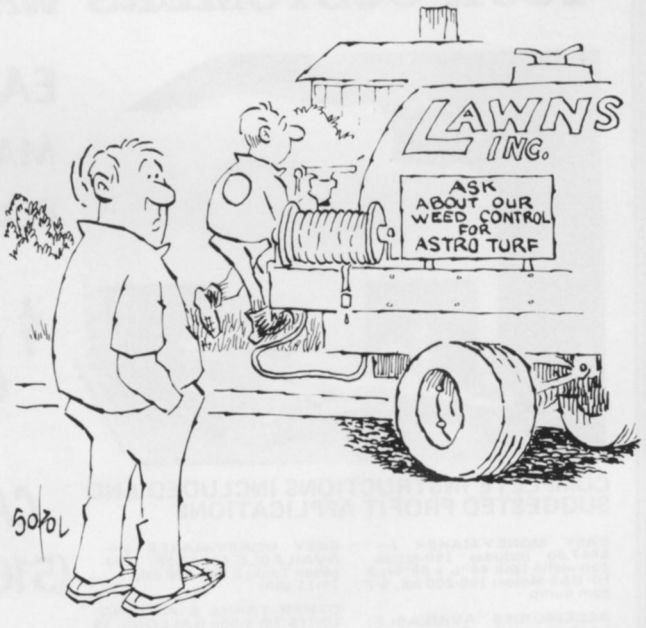

Supertrel Spray Hose

Flexitube International Corp. has pioneered the development of a new Spray hose called "Supertrel". Produced by a new process called "Co-extrusion", Supertrel combines different plastics with different properties into one type of high performance hose.

The inner core is manufacutred with a very thin layer of Hytrel* which has excellent resistance to hot, moist environments, and will provide a satisfactory performance under extreme climatic conditions.

Flexitube International Corp. has taken Hytrel*, a polyester that is not as yielding as rubber nor as rigid as plastic, for the inner core of the spray hose, welded it to a double layer of braid for a good PSI, and surrounded the thread with an abrasion-resistant cover of smooth PVC. Supertrel prevents chemical leaching, rotting, and explosion, and is combined with PVC for lightness and ease in handling. The braided inner layer gives Supertrel the high pressure needed by most applicators.

The combined tubing gives Supertrel the flexibility of rubber, the light weight of plastic and the excellent chemical resistance of Hytel*. For more information contact Flexitube International Corp., P.O. Box 292, Willow Grove, PA 19090, or use reply card.

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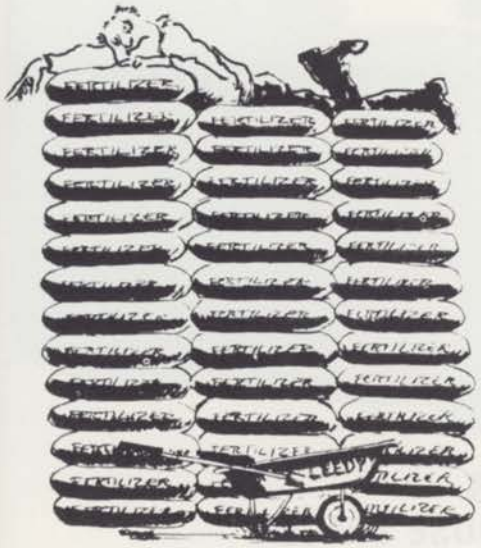

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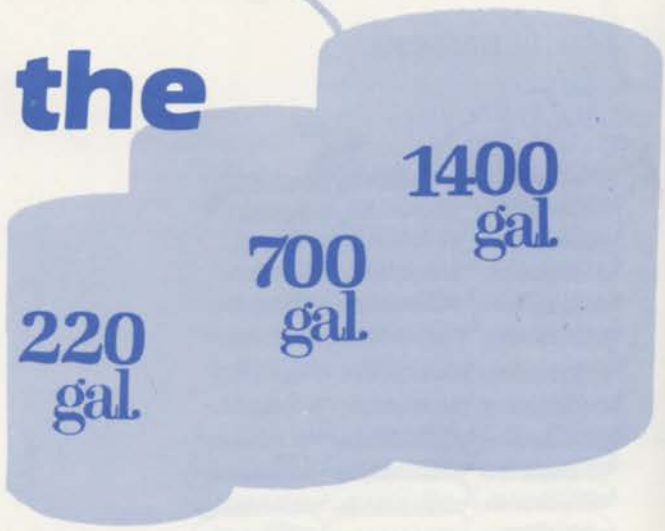

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