AMERICAN LAWN APPLICATOR

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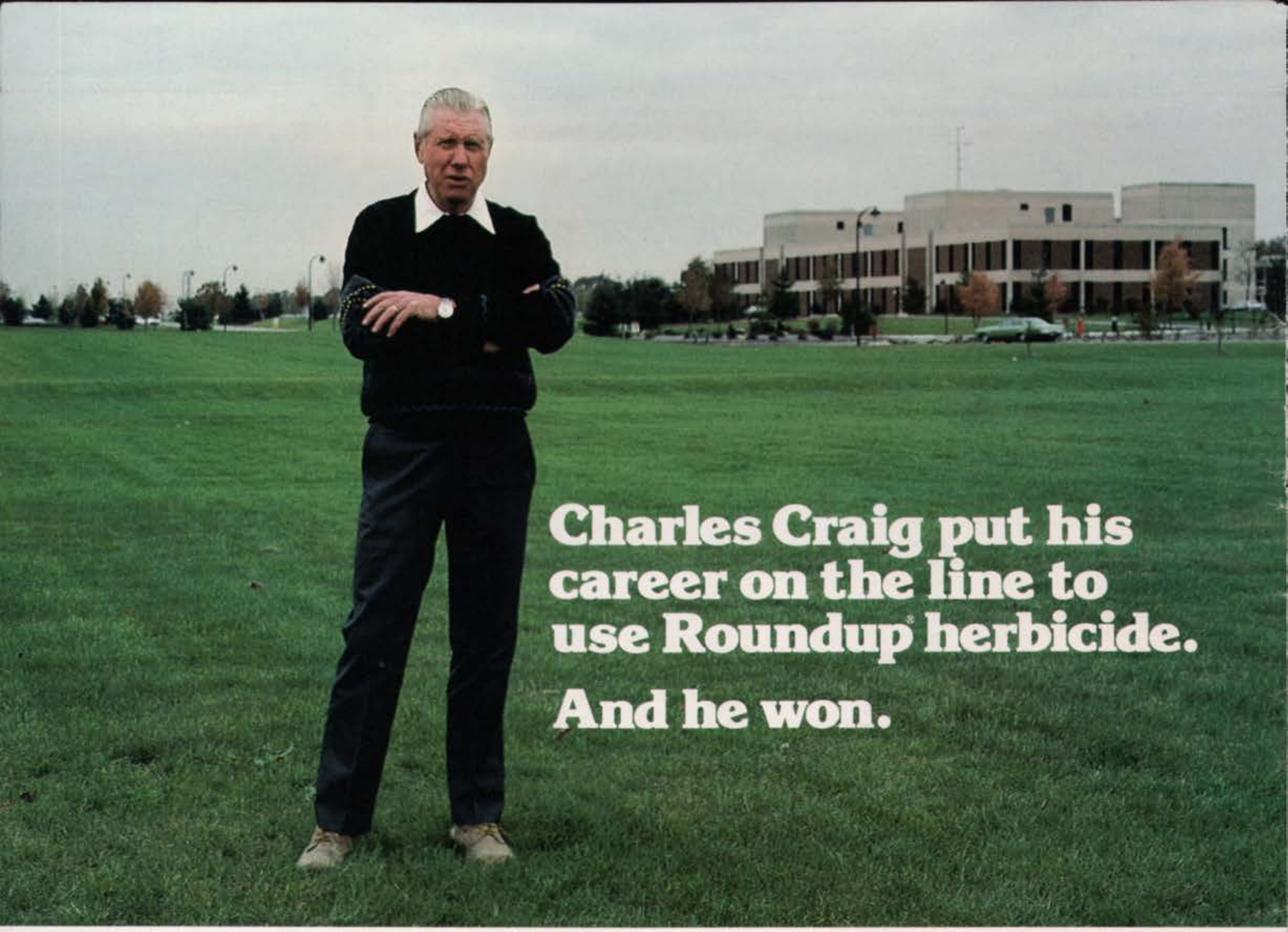

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Circle No. 1 on Reader Reply Card

Editorial

"Say first, of God above or man below, what can we reason but from what we know?"

Alexander Pope
An Essay on Man
1734

In the last issue of **ALA** we printed an article entitled, "Septoria? Or What?". The article described a condition which was quite common in home lawns in the upper midwest this past season. Soon after that article appeared, we received several calls and letters from lawn care businessmen across the country who have been struggling with this problem for some time. Interestingly enough, none of them had been able to determine the cause of the condition. Nor had they been able to get much assistance from turf pathologists.

Unfortunately, this frustrating state of affairs is common for many lawn care companies. Unless a company is large enough to afford agronomists, entomologists, and pathologists, it is often very difficult to find answers to the many perplexing problems everyone encounters. That is why we are pleased that **ALA** can serve as a means of sharing the knowledge and experience all of you possess.

It is obvious that most university-related turfgrass research programs are limited in size and in the financial support they receive. That situation is not likely to change soon. Furthermore, much of the research that is done benefits the golf courses much more than the lawn care industry. For this reason, it is so very important that lawn applicators communicate their experiences with each other.

One of the most interesting letters we received was from Mr. Frank Reynolds, Jr., President of Lawn Rescue, Inc. in North Haven, Connecticut. We would like to share it with you.

**

Dear Steve:

The most recent issue of AMERICAN LAWN APPLICATOR; volume 1, no. 3; proved to be one of the most worthwhile publications that I have read in a long while. I am specifically referring to an article authored by you entitled "Septoria? or What?".

For many years now I have experienced, on more lawns than I wish to remember, damage similar to the "condition" you describe. Appearing almost overnight, and sometimes disappearing just as quickly, small dinner plate sized areas to whole lawns being affected. Beginning soon after a physiological and/or environmental stress on primarily bluegrass and fine textured perennial ryegrass, there would begin to appear tan to bleached white lesions resembling Sclerotinia Dollar Spot but lacking the brown banded margins. If the impetus responsible for the progression of this "condition" continued to be a controlling factor, these lesions would rapidly constrict, taking on the appearance of an hour glass. At the point of constriction, the blade would fold under the weight of the leaf tissue above and appear as an accordian. Death of the blade above the folded area would follow. In severe cases death of the entire plant would occur; whether from the same condition and/or the shock of losing the foliar surface I cannot say. I should also note here that I have experienced initial development of these lesions, only to have them non-existent a few days later with no visable effect on turfgrass quality.

Imagine now, attempting to convince turfgrass pathologists and state extension agents that such a problem exists! Early attempts fell on deaf ears until one day I decided to bring a sample of soil supporting an area of grass being affected to a state employed nematologist. A high population of Lance nematodes (Hoplolaimus tylenchiformis) were found in that initial sample and 50 plus subsequent samples over a two year period. Unfortunately, we were never able to duplicate the "condition" under a greenhouse environment. The

continued on next page

nematologist, being the only one on staff, retired shortly thereafter so the project met with an untimely demise . . . as my lawns continued to do also. Next, came the repeated efforts of a state employed pathologist to isolate a primary pathogen from the lesion area of the effected turfgrass. Some thirty samples later, all that could be found was Curvularia spp. Due to strong feelings shared by many turfgrass pathologists that Curvularia spp. are not primary pathogens, an attempt at proving pathogenicity was never made. However, field applications of fungicide applied in early stages of lesion development completely arrested its advancement.

Until recently, I had not found anyone else who had experienced this problem. I began to wonder whether it was something being encouraged by my fertilizer and pesticide program. Then I received a slide from a DuPont representative who I had alerted to the problem six weeks earlier. The slide was of a lawn growing in the Baltimore-Washington area and depicted the same lesion I had seen here in New Haven. Shortly thereafter, a slide presentation made by a Chemlawn regional agronomist at the University of Massachusetts Turfgrass Conference also contained photos of similar lesions. And finally, the article in ALA *explaining your experiences. At last, I felt sane again— misery loves company!*

It was encouraging to read that research people at Michigan State are working with you to solve this puzzle. There seems to be a consensus of opinion that it will be difficult to do because of the complexities surrounding its development. Please keep me informed as to your progress.

Sincerely,
Frank J. Reynolds, Jr.

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Potential New Energy Source

Farewell, internal combustion engine. Adios, smoky industrial chimneys. The Environmental Protection Agency (EPA) says you're no longer at the top of the air pollution list. You've been replaced by burping cows. Burping Cows?

Yes, according to a report in *Clean Air and Water News*, the EPA recently reported that burping cows "must rate as the number one source of air pollution in the U.S." The agency says that the boorish bovines burp 90 million tons of hydrocarbons into the atmosphere every year.

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Circle No. 2 on Reader Reply Card

Part 2
What We DON'T Know About Fusarium Blight

by Patricia L. Sanders

Pat is a Research Associate in the Dept. of Plant Pathology at the Pennsylvania State University. She is responsible for the Research Program in Causes and Control of Turfgrass Diseases. In the last issue of ALA, *Pat discussed factors involved in the development of Fusarium blight.*

RETRACTION

The illustrations which accompanied Part 1 of "What We Don't Know About Fusarium Blight" were not chosen by Pat Sanders, who would have otherwise chosen illustrations with more typical symptoms.

FUSARIUM BLIGHT ON NEWLY-SODDED AREAS

The use of sod to establish and repair lawns and recreational areas has become increasingly prevalent. Newly-installed sod can be destroyed rapidly by Fusarium blight, with severe infections occurring in sod that has been established only 1-2 years. Purchasers of such sod believe that they have been sold "diseased grass." The question which is raised in such situations is whether the nature of the sod-growing site or the installation site was responsible for the disease outbreak. Bean has reported that approximately the same number of Fusarium propagules were recovered from a sod-growing site, the blighted areas in the installation site, and the blight-free areas in the installation site. *Thus it would appear that potentially pathogenic Fusaria occur with approximately equal frequency in both the sod-growing and the installation sites.* There may be stress factors in the transportation of sod,

There may be stress factors involved in the transportation of sod

as well as in the environment of the installation site, which can predispose newly-laid sod to Fusarium blight. Partyka suggested that sod which is allowed to dry or to heat in transit may be damaged so that Fusaria can subsequently cause disease. He also observed that sod laid down on dry soil or not watered adequately could be so stressed. He further stated that another source of stress was poor permeation of water or capillary action at the sod/soil (clay) interface, which might result in a poor root system and resultant stress. Bean reported that when turf was removed from Fusarium-blighted areas and these areas resodded with 1-year-old healthy sod, the newly-sodded areas were as heavily blighted as the original turf by the following summer. Cole has stated that when Fusarium-blighted sod was transferred to a blight-free site, the Fusarium blight symptoms abated and did not return.

CONTROL

Because of the regular association of Fusarium blight with hot, dry environments, heavy watering has been recommended for disease suppression. There is research evidence that adequate irrigation suppresses Fusarium blight,

Fusarium Blight

however, it encourages invasion of quality bluegrass turf by annual bluegrass (Poa annua) and other weed grasses.

The overseeding of turftype ryegrasses into blighted bluegrass stands has been suggested, with the added caution that improved resistance to Pythium and Rhizoctonia is needed for a good summer performance of ryegrass in the humid summer heat stress region. Turgeon suggested, in addition to the "plant-oriented" control approach of resistant Kentucky bluegrass cultivars, an "environmental-oriented" approach of avoiding excessive nitrogen fertilization during spring, providing adequate moisture for turfgrass survival during stress periods through irrigation, performing appropriate cultivation practices to control thatch and alleviate soil compaction, and applying effective fungicides.

In the period from 1966 through 1976, many chemical control experiments were conducted. During the early part of this period, most work involved the contact fungicides, such as mancozeb, thiram-organic mercury, anilazine, Difolatan, chlorothalonil, and others. Although a partial level of control was obtained in a few instances, the level of disease suppression was not satisfactory for practical use.

Soil fumigation as a method to control Fusarium blight was tested by Cutwright and Harrison. In fall 1966, sod was stripped from a test area that had been severely blighted, replicated plots were fumigated with three soil fumigants, and the area was seeded with Merion Kentucky bluegrass two weeks after fumigation. Only a few scattered Fusarium-blighted areas developed in the experimental area during the following summer. The disease ratings for 1968, however, indicated that none of the treatments effectively controlled the disease over even a short 2-year period.

The introduction of systemic fungicides provided the first highly effective chemical treatment, and in the ensuing years, various researchers have obtained successful control of Fusarium blight through preventive and curative applications of benzimidazoles, triarimol, and fenarimol. However, in 1975 and 1976, control failures were reported with benzimidazole-derivative fungicides due to apparent pathogen resistance to the fungicides.

During the 1977 and 1978 growing seasons, excellent control of Fusarium blight was obtained with the experimental fungicides, CGA 64251, DPX 4424, and RP 26019 (BC 6447). In-depth studies with triadimefon (BC 6447) and iprodione (RP 26019) demonstrated no in vitro fungitoxicity to Fusarium spp. Iprodione was found to increase sporulation of Fusarium spp. in vitro and to increase the number of Fusarium propagules in treated field soil.

DISCUSSION

The literature on Fusarium blight is extensive compared with reported work on other diseases of turfgrass. This attests both to the tenacity of turf researchers in attempting to understand the dynamics of symptom development and the elusive nature of the problem. In spite of extensive study, many aspects of Fusarium blight remain

Systemic fungicides provided first effective control

unexplained, and information is still lacking in several critical areas. A major shortcoming of inoculation studies to date is that much of this experimental work has been done in moist chambers with seedlings, while in the field the disease is most damaging on mature bluegrass under stress. Relating growth chamber experiments on seedlings to field situations involving mature stands is precarious. Although potentially pathogenic Fusarium spp. are regularly isolated from turfgrass showing symptoms of Fusarium blight, no one has been able to induce the field "frog-eye" or "dead ring" symptom by inoculating turfgrass with these Fusaria.

Fusarium Blight

In addition, the experimental fungicide, triadimefon which provided complete suppression of the field symptoms of Fusarium blight, exhibited lack of in vitro fungitoxicity to Fusarium spp. isolated from diseased turfgrass. Thus, one can reach the peculiar conclusion that the designated pathogen(s) have not incited the field symptom, and the chemical which suppresses the field symptom does not control the pathogen(s). However, these results more probably indicate that Fusarium spp. are pathogenic within an unexplained biotic or environmental complex which produces the field symptoms of Fusarium blight.

The literature indicates that the majority of the Fusarium blight outbreaks are associated with moisture stress. Research on related diseases may be drawn upon to explain several of the puzzling aspects of moisture stress and disease development. The works of Cook and Papendick regarding plant water stress and soil water potential and the effects of these factors on colonization of soil organic matter and host plants by Fusarium spp. may be particularly relevant to an understanding of Fusarium blight. Foot rot of dryland wheat, incited by F. roseum f. sp. cerealis 'Culmorum', was demonstrated to be most severe under high nitrogen regimes and in seasons of drought stress. Fusarium spp. were able to colonize organic matter under low soil moisture conditions which inhibited the activity of antagonistic microorganisms. In a like manner, the fungi were able to colonize wheat plants rapidly under internal moisture stress. High nitrogen fertilization increased moisture stress within wheat plants, accentuating colonization by Fusarium sp. This increased internal water stress probably was not due to a direct nutritional effect, but rather to indirect effects produced by larger root systems which increased water extraction from the soil, and greater leaf areas which increased transpiration.

One tiller may be dead and the next apparently healthy

The occurrence of the "frog-eye" or "dead ring" field symptoms and the sharp delineation of the infection center borders remains unexplained. Rather than a gradual transition from healthy grass to severely blighted grass, this transition often occurs over a very short distance. One tiller may be dead and the next one apparently healthy, thus producing a very distinct "dead spot" on the turf. If water stress is critical in disease development, then an attempt must be made to explain why, in a very short distance, one tiller should be under water stress and an adjacent one apparently free from such stress. This symptom has never been observed in a greenhouse or a growth chamber. Soil moisture availability, as affected by proliferation of soil Basidiomycetes, may influence the disease development pattern in the field, especially the "frog-eye" symptom. Shantz and Piemeisel, in their paper on fairy ring development, reported that, in the actual ring portion, soil moisture levels were lower and water percolation rates were reduced when compared with the ring interior or exterior. "Hard dry spot" associated with fungal proliferation has long been observed on bentgrass greens by golf course superintendents. Other factors may contribute to soil and plant moisture stress from place to place in turf area, however, the radial expansion pattern of Basidiomycete fungi in soil and the hydrophobic nature of Basidiomycete mycelium and by-products would seem to present one explanation for the "dead ring" and "frog-eye" symptom.

Fusarium Blight

Growth chamber studies indicate that bentgrass is most susceptible to Fusarium blight while field observations suggest that the disease is primarily a problem on bluegrass. Turfgrass management practices may explain this discrepancy. Traditionally, bentgrass is grown under adequate, or often excessive irrigation, especially during midsummer. On the other hand, bluegrass fairways are traditionally kept "dry" to minimize invasion by undesirable grasses. This difference in irrigation practices may explain the absence of Fusarium blight in most bentgrass areas.

Aside from benomyl and iprodione fungicide applications, a satisfactory control system for suppression of Fusarium blight is not available. Heavy and frequent use of benomyl has led to high levels of benomyl tolerance in Fusarium populations, and there are already research reports of tolerance to iprodione, although not yet in Fusaria. Practical research aimed at identifying control measures is seriously hampered by the lack of conclusive information about every aspect of disease development. The lack of an effective inoculation technique makes it impossible to determine whether the Fusaria which are regularly isolated from bluegrass showing symptoms of Fusarium blight, are indeed not the causal pathogens or simply that the inoculation procedure employed was not appropriate. We have, in the past, assumed that the latter was the case, when, in fact, the former conclusion is probably equally legitimate. At present, we have no certain information about causal fungi, where or how they colonize the host grass, what environmental conditions are required for disease development, and why some grasses are resistant to the disease. Without such essential basic knowledge, research and control decisions have little basis in biological fact, and often result in unproductive, random effort.

Conclusive information about disease development

Fusarium blight remains an enigma to all who work with turf and is not fully understood even 13 years after the first report of its occurrence. The foliar diseases of turfgrass are relatively well understood, and therefore, may be chemically and/or culturally controlled. This is largely due to the relative simplicity of foliar diseases, compared with the complex environment in which soil-borne diseases, such as Fusarium blight, develop. Soil and multiple pathogen complexes, as they relate to symptom development, have been largely unstudied because of the great difficulties which are encountered in working with the dynamic and interdependent systems of soil environment and microflora. Fusarium blight is only one recognized disease entity in a large number of turfgrass diseases, as yet unstudied, but strikingly similar in symptom presentation. There are, at present, many generally circular symptom patterns on turfgrass which are partially or completely unexplained. These patterns vary widely in size, shape, character, and environments under which expression occurs, and have been increasingly noted in recent seasons, perhaps coincident with the use of long-acting systemic fungicides. Because of the varying conclusions from research on Fusarium blight, the possibility exists that more than one disease entity has been studied— with the common thread of consistent isolation of pathogenic Fusaria from field infection centers.

Fusarium blight, and other soil-borne diseases, have been and are increasingly becoming a serious threat to turfgrass, particularly at a time when the soil microflora is being modified by the use of long lasting systemic fungicides. Elucidation of the etiology of Fusarium blight is essential to the development of soundly-based control practices, and may lead to the development of research protocols which can be utilized in the study of other soil-borne diseases of turfgrass.

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Insect Symposium

by Stephen Brown

The Chemlawn Corporation sponsored the "Symposium on Turfgrass Insects– 1980" in Columbus, Ohio on October 14th and 15th. The symposium, which was organized by Dr. Bobby Joiner of CL's Plant Diagnostic Labs, brought together outstanding turf entomologists from the United States and Canada. Such well-known entomologists as Dr. Harry Niemczyk, of the Ohio Agricultural Research and Development Center; Dr. Jim Reinert, of the University of Florida; and Dr. Harue Tashiro, of the New York Agricultural Experiment Station, spoke on topics of interest to lawn care professionals.

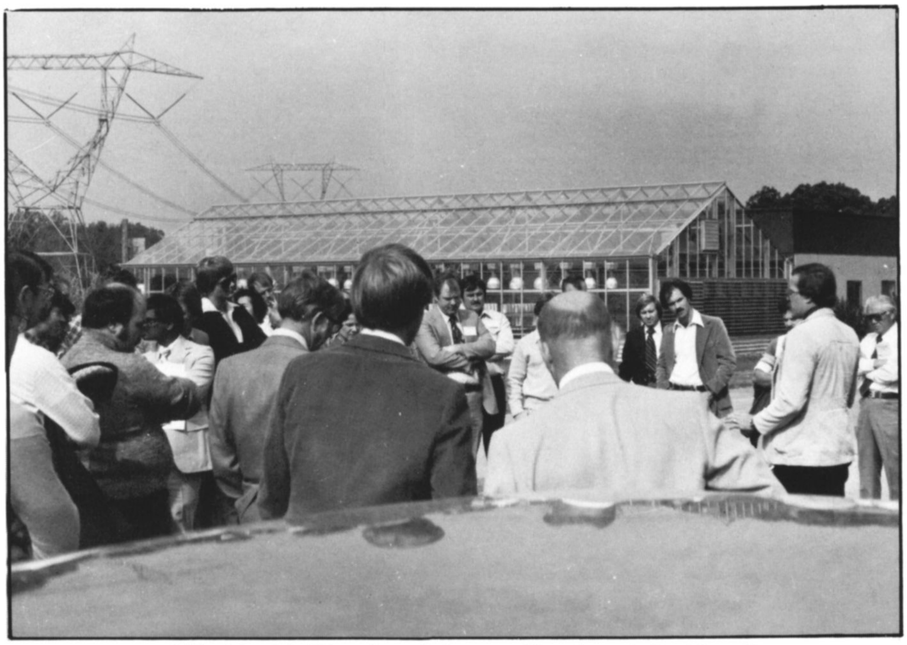
INSECTICIDE RESISTANCE SERIOUS CONCERN

Among the areas of concern to the turfgrass entomologists is the increasing incidence of insect resistance to the commonly used insecticides. Dr. Reinert detailed the development of resistance in the southern chinch bug as an example of what can be expected to happen if an insecticide is used repeatedly. In 1961, the common insecticides produced excellent control of the southern chinch bug in Florida turf. By 1965, poor control was reported for the widely used organophosphates, Dursban and Diazinon. The The 1976 season brought scattered chinch bug populations which were not controlled at all by the OP insecticides. Today, Baygon is still considered effective but resistance is likely to develop when lawns are sprayed 6 to 12 times per year and chinch bugs produce 7 to 10 generations in that same period of time.

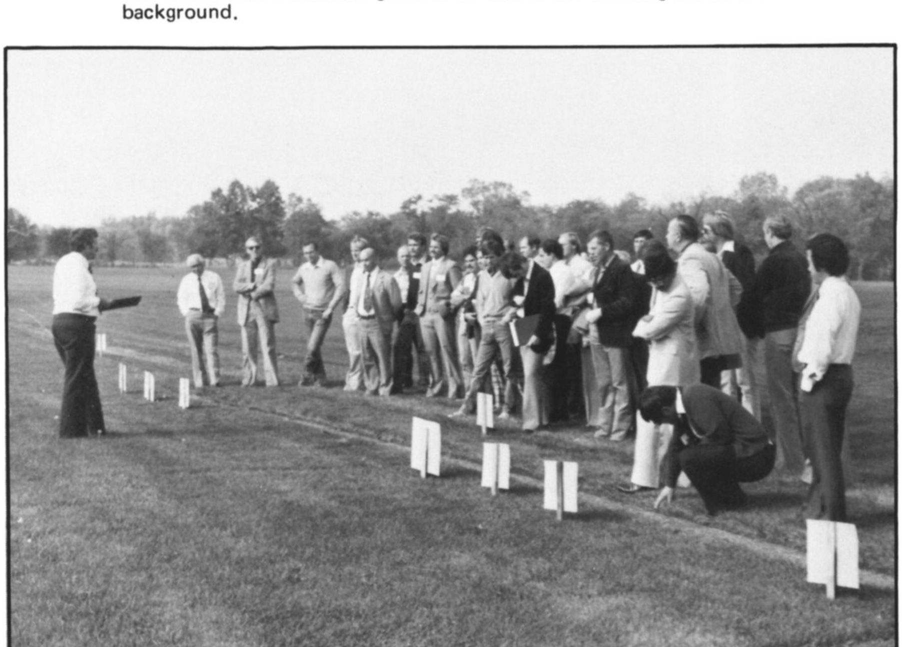
Dr. Harry Niemczyk (OARDC) discusses insect problems with Danny Gigax (Mobay Chemical) and James Fothergill (TechniTurf Lawn Spray Serv.) while on the ChemLawn Research Facility tour during the Insect Symposium (Oct. 14-15, 1980).

Edward Oberright (Aquatrols Corporation) trys out the Chem Lawn spray gun recently during a tour of ChemLawn's research facilities following the Insect Symposium (Oct. 14-15, 1980).

Insect Symposium



Mike Dietrich (ChemLawn) discusses ChemLawn's liquid applicator. ChemLawn's research greenhouse and office building are in the background.



Dr. Barry Troutman (ChemLawn) explains research plots involving weed control at ChemLawn's research facility.

Dr. Tashiro reported the problem of resistance is not restricted to turf insects. He indicated that some 430 species of insects are now known to be resistant to a variety of insecticides. Resistance to the chlorinated hydrocarbons, such as the now-restricted Chlordane, is widespread, and Dr. Tashiro expects to find OP tolerance in white grubs soon.

Chemlawn's John Moser discussed another resistance problem, the greenbug aphid. Moser reported that the aphid, a serious pest on turfgrass in Ohio, quickly developed resistance to Dursban and Diazinon in the mid-70's. Today, under the authorization of a "24-C special needs" label, Ohio lawn applicators control the greenbug by alternate spraying of Orthene (an organophosphate) and Pirimore (a carbamate).

The speakers agreed that the time has come for the turf industry to begin considering alternative strategies for the control of insects. Such concepts as IPM (integrated pest management), sex pheromones, and resistant turfgrass varieties will receive close scrutiny in the next decade. Dr. J. A. Kamm, of the U.S. Department of Agriculture, reported that sex pheromones have not been identified for the major turf insects. However, a concerted effort is underway in the use of pheromones for agricultural pests, and the techniques developed for agriculture will be adaptable to turf. Several speakers discussed the research that is currently being done to identify turf varieties which are naturally resistant to invasion by harmful insects.

Insect Symposium

Speakers: (Back row left to right): H. Streu (Rutgers Univ.), Art Bruneau (Univ. Nebraska), M. Klein (OARDC), J. A. Reinert (Univ. of Florida), J. L. Hellman (Univ. of Maryland), Dean Kindler (USDA), H. Tashiro (Cornell Univ.), R. Chapman (Univ. of Guelph), C. R. Harris (Canada Dept. Agriculture).
(Front row left to right): D. E. Short (Univ. of Florida), H. D. Niemczyk (OARDC), J. Fothergill (TechniTurf Lawn Spray Serv.), M. Sears (Canada Dept. of Agriculture), R. H. Ratcliffe (USDA).

"NEW" INSECT PESTS DESCRIBED

Dr. Streu, of Rutgers University, detailed the biology of one of the "new" turfgrass pests, the winter grain mite. This insect, which has only recently been found on turf, has two generations per year one in November/December and the other in February/March. The mites can live under a snow cover and, in fact, appear to avoid light. Mite damage appears shortly after the snow melts in the spring and the turf begins to dry out.

Mites survive the summer as eggs which are not affected by insecticide applications. It appears that more mites may be expected to occur in areas treated with insecticides during the summer because their natural predators are greatly reduced. Dr. Streu reports excellent control of the adult mites with Dursban, Proxol, and Diazinon.

The serious problem of mole crickets in southern turf was reported by Dr. D. E. Short, of the University of Florida. Mole crickets, which have no natural enemies in the United States, are extremely difficult to control in the adult stage. The period June 15th through July is the best time to apply insecticides, while the majority of the turf damage will not appear until August or September. If the lawn applicator waits until damage is apparent to apply insecticides, he will achieve virtually no control.

Dr. Short indicated that Mocap granules and Baygon wettable powder gives good control if applied at the proper time. Of the baits presently available, .5% Dursban has performed well, as has 2% Malathion and 2% Baygon. Ficam bait and 20% Sevin bait will prove to be excellent controls when they receive labels in 1981 or 1982, Dr. Short predicted.

IPM PROMOTED

James Fothergill, of Techniturf Lawn Spray Service, South Berlin, Massachusetts, received many questions from the audience after he described his company's IPM program. Fothergill reported that Techniturf lawn specialists inspect each lawn carefully several times each year and apply insecticides only when and where a problem is developing. Expressing satisfaction with his program, Fothergill argued against the blanket application of pesticides in the lawn care industry.

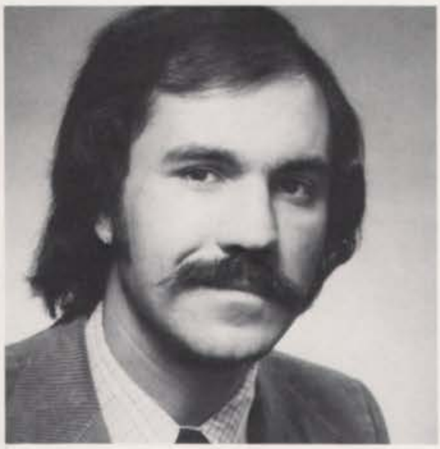
PROCEEDINGS AVAILABLE

While insect problems, new and old, continue to plague commercial lawn applicators, the Chemlawn symposium is evidence that some very good work is being done in the area of turfgrass entomology. Innovative approaches are being constantly evaluated and it appears that the lawn care industry will see many new concepts in insect control in the '80's.

The proceedings of "A Symposium on Turfgrass Insects— 1980" will be published early next year. Those interested in obtaining a copy should contact Plant Diagnostic Labs, 6969 Worthington-Galena Road, Suite L, Worthington, Ohio, 43805.

"New" Webworm Pests in Michigan Lawns

by Dr. M. Keith Kennedy



Dr. M. Keith Kennedy is an assistant professor and Extension specialist for ornamental crops at Michigan State University. He holds a B.A. degree in biology from Hendrix College, and an M.S. and Ph.D. in insect ecology from Cornell University. Dr. Kennedy's research interests include the biology and control of insects in urban areas.

Several unusual cases of insect damage to bluegrass lawns were observed this past September in Michigan. In one instance, a large area of lawn had become yellow and thin with patchy, irregular dead spots appearing throughout. Inspection of the damaged turf revealed the presence of numerous, small grub-like insect larvae feeding in the root zone. However, close examination of the insects in question revealed that they were moth caterpillars, not beetle grubs. The larvae were too small (3/8– 5/8") to be cutworms and lacked the characteristic brown spots of sod webworms. Moreover, webworms typically feed on the grass blades and not on root tissue.

Shortly after this turf problem was discovered, two additional reports of unusual insect damage were brought to our attention. Small caterpillars had been found feeding in the root zone of a Kentucky bluegrass lawn, causing circular dead areas, 4 - 6 inches in diameter. The damage created a pockmarked appearance in the lawn, very similar to early billbug injury. These larvae also resembled sod webworms but again the dark brown spots were missing.

Specimens were sent to Dr. Don Weisman, of the USDA Systematic Entomology Laboratory in Beltsville, MD, and to Dr. Harry Niemczyk, O.A.R.C.D., for identification. The pest causing the grub-like damage was identified as the corn root webworm (Crambus calignosellus) while the second pest was determined to be the cranberry girdler (Chrysoteuchia topiaria, formerly Crambus topiarius). The biology and habits of these somewhat atypical webworms are discussed separately below.

CORN ROOT WEBWORM

The corn root webworm (C. calignosellus) is a species that occurs naturally throughout the northcentral and northeastern U.S. and southern Ontario. Although it has been recorded as a pest of corn and tobacco seedlings in Virginia and North Carolina, it normally prefers narrow leaf plantain (Plantago lanceolata) or other weeds such as oxeye daisy, white heath aster, wild carrot, sheep sorrel, and orchard grass.

Adult moths have a wing span of 5/8" and vary in color from dark to light tan. Adults begin to emerge in late June, with peak activity occurring from late July to mid-August. Females lay an

cranberry girdler damage in home lawn, Lansing, Mich., Sept. 1980.

Webworms

average of 212 eggs with egg hatch occurring in 7 - 9 days. Fully mature larvae are about 5/8" long with a yellow to brown head capsule, and a yellow to off-white body. Larvae overwinter in the soil and complete their development the following spring. There is only one generation a year known for this insect.

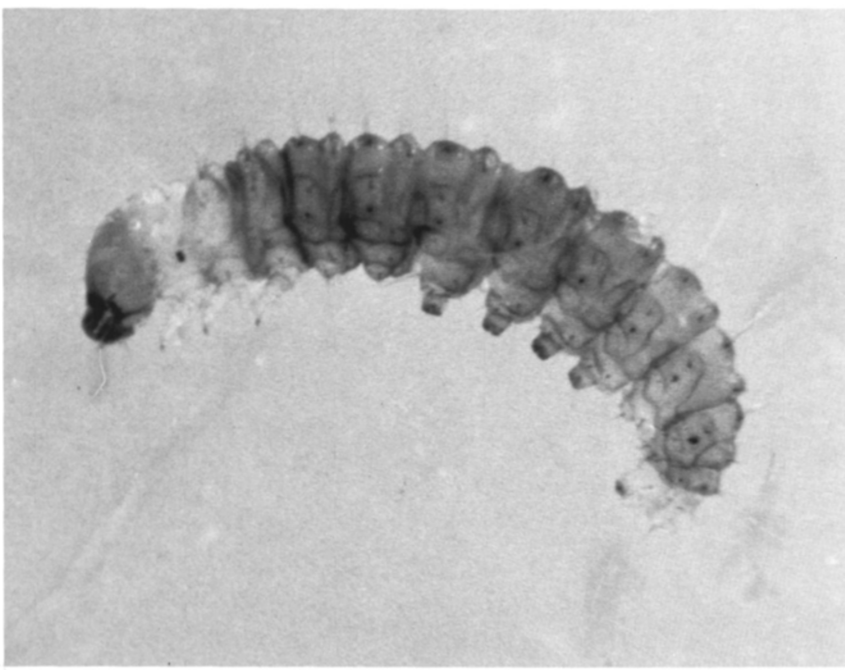
Damage is caused by the larvae tunneling through the crown and stem of the plant and feeding in the root zone. As many as 30 larvae have been found in the root zone of a single plantain plant, and the number found damaging turf was estimated at 20 - 30 per sq. ft.

Published reports of previous corn root webworm problems indicate they are more abundant in weedy areas or where old fields have recently been renovated and planted in annual crops. This would indicate that weedy lawns may be more susceptible to damage from this insect.

This is the first documented case of corn root webworm damage to turf in Michigan, and may be the first in the northcentral region. It cannot be considered a major turf pest at this time as it was found damaging bluegrass lawns in only one location (Marquette) but it is not an uncommon insect in Michigan; adults have previously been collected in the Detroit metropolitan area.

Control could be a problem because of the insect's root feeding habit and the difficulty of penetrating the thatch with insecticides. Fortunately, the infestation discovered was small and very localized. Application of Dursban, Diazinon, or Proxol in late August and early September would most likely provide adequate control. Weed control in infested lawns is also recommended to help reduce and prevent future problems with this insect.

corn root webworm larva



CRANBERRY GIRDLER

The cranberry girdler (C. topiaria) is a webworm species that has been a serious pest of commercial grass seed fields and cranberries in the Pacific northwest. It appears to be distributed across much of the northern United States. Often called the "subterranean webworm", the cranberry girdler has

Larva feed on plant's crown and root system

been found attacking several grasses, including Merion and Delta bluegrass, and Pennlawn and creeping red fescue. Damage is caused by the larvae feeding in the plant's crown and root system just beneath the soil surface. Small, circular areas of dead turf often result from this activity, giving an overall pock-marked appearance to the lawn. Large populations of the cranberry girdler larvae can produce a more widespread, grub-like damage to the lawn.

The adult flight period begins in late May and extends through mid-August, with peak activity occurring in mid-June to early July. Egg-laying begins one to two days after emergence, with an adult female capable of depositing an average of 471 eggs. Unlike other webworms, C. topiaria females deposit their eggs while resting in the grass. The non-sticky eggs drop to the soil and

Webworms

hatch in 9 - 11 days. Young larvae then feed on grass crowns and roots beneath the soil surface until early October. Some evidence of webbing and frass may be found in the root area during this time.

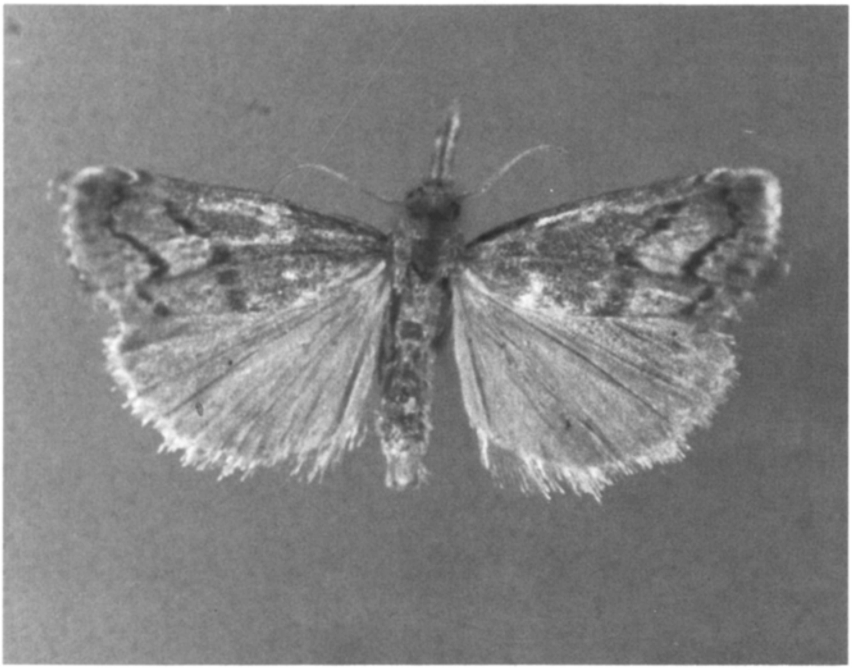
There may be as many as nine developmental stages or "instars" of this particular species, with the mature caterpillar reaching a length of 5/8 - 3/4 inch. Larvae are dirty-white in color with a tan head capsule. They lack the pronounced spots or markings of other webworm species. The corn root webworm, discussed above, is similar in appearance but has more tubercules or bumps on the body. After October 1st, larvae begin to construct tough silken cases in which they overwinter. Some larvae may resume feeding for a brief period the following spring before pupating in May and early June. There is only one generation per year.

Research done by Dr. James Kamm, a USDA entomologist in Oregon, indicates that factors such as predators and parasites frequently keep this species at low numbers. He found that birds, such as starlings and killdeer, may reduce a population by 80% in the fall. Other biological agents which help control this pest include a fungus, Beauveria bassiania, and a parasitic fly, Lydina polidoides.

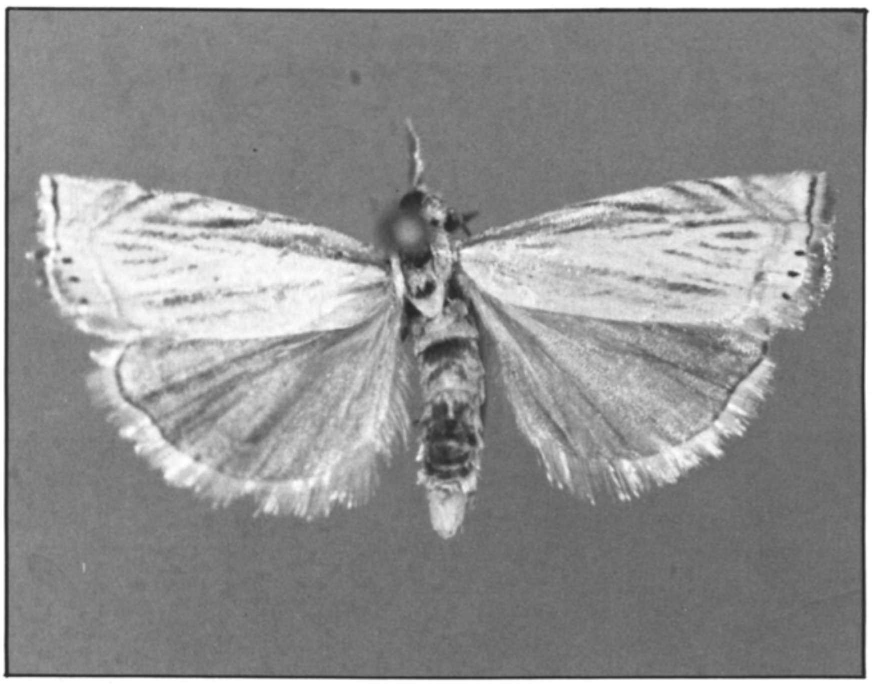
Kamm suggests that outbreaks of C. topiaria are related to the failure of birds to discover larvae, or the lack of favorable conditions for the fungus and parasitic flies. The natural control agents often exert their influence too late in the season to prevent late-summer damage of turf. However, by reducing the number of overwintering larvae, these beneficial organisms can prevent substantial increases in webworm populations the following year.

Control of the larvae stage may be difficult as infestations are often not identified until heavily damaged turf becomes apparent in late September. By that time, many of the larvae have stopped feeding. In addition, getting an insecticide through the thatch to a feeding larva may be a problem. Although little information is available at this time, organophosphate insecticides would likely provide adequate control when applied in late August or early September.

corn root webworm adult



Webworms



cranberry girdler adult

Recently, Dr. Kamm has been able to isolate the female sex pheromone of the cranberry girdler. The prospect of using this sex attractant to confuse males and disrupt males has shown some promise but is still in the experimental stage. At this time, pheromone traps for C. topiaria are not commercially available.

Although the cranberry girdler may be "new" to lawn care personnel, it is not new to Michigan. Date/locality labels of pinned specimens in the Michigan State University museum indicate its occurrence in the Lansing vicinity as early as 1933. However, it has not been previously recorded as causing economic damage to turf in Michigan. This past season, C. topiaria has also been observed in home lawns in other areas of the upper mid-west, including Ohio and western Pennsylvania.

As the experience with C. callignosellus and C. topiaria indicates, it is important that lawn care applicators collect and submit unusual insect pests to their state entomologists. In many states, the cooperative extension service operates an insect diagnostic laboratory in conjunction with the land-grant universities. Information on collecting and preserving specimens for identification can be obtained from county extension agents.

**

HOW TO HAVE A BEAUTIFUL LAWN

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By Dr. James B. Beard, Texas A & M University.

This outstanding 114 page book with 12 pages of full color gives a simplified, yet complete coverage of turfgrass establishment and maintenance practices. It is being widely used in introductory college courses for non-turf majors as well as in community colleges, night schools, and adult education courses. At the same time it is equally accepted as the finest book available to the home lawn enthusiast. Many companies within the turfgrass and lawn care industry are also recommending it to their field and sales personnel as both a training aid and reference guide.

TABLE OF CONTENTS

1. *Know Your Turfgrasses*
2. *How to Establish a Lawn*
3. *Caring for the Lawn*
4. *Controlling Weeds*
5. *Solving Lawn Disease and Pest Problems*
6. *Solving Soil Problems*
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Enquiries concerning purchase of this book can be made to H. J. Beard, Beard Books, 1812 Shadowood Dr., College Station, TX 77840. The single copy retail purchase price is $5.95. Discounts are available depending on the quantity purchased.

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Estech General Chemicals Corp. has developed a new concept in slow-released turf fertilizers called IBDU/SCU. The mix blends a three nitrogen formula with sulfur-coated urea and water soluble urea to provide a three-stage release that lasts up to 90 days. Contact Estech General Chemicals Corp., P.O. Box 1996, Winterhaven, FL 33880, or use reply card.

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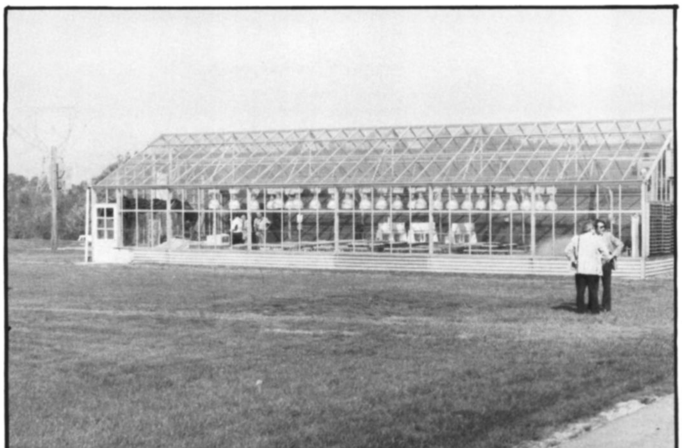
Chemlawn Tour

Dr. Barry Troutman, Chemlawn agronomist, explains a pesticide study to New Milford visitors.

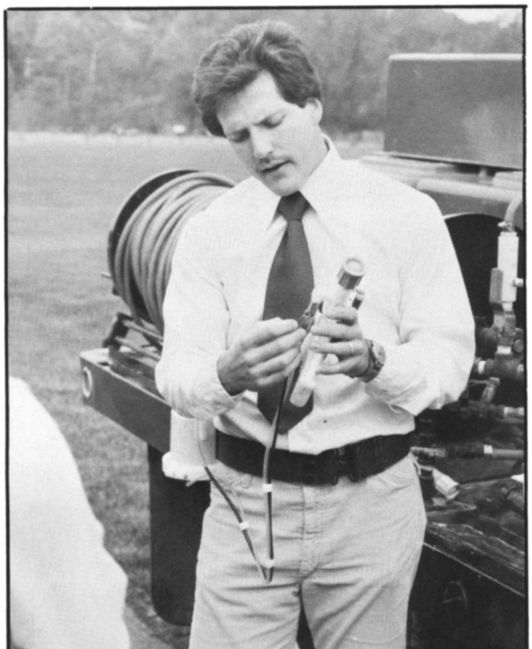
The Chemlawn Corporation conducted a tour of its research facilities in New Milford, Ohio on October 15th. The tour was offered in conjunction with the Symposium on Turfgrass Insects— 1980, which was organized by Dr. Bobby Joiner, of Chemlawn's Plant Diagnostic Labs.

Members of Chemlawn's staff were on hand to explain the research which is under way at the New Milford site. Such topics as alternative herbicides, nitrogen fertility, and equipment development were discussed. The Chemlawn "do it yourself" program for homeowners, which has been studied in Indiana markets, was presented to an interested crowd of about 100.

The visitors seemed to be particularly intrigued with the Chemscape concept and equipment. Chemscape, which is the ornamental trees and shrubs division of Chemlawn, also maintains research facilites at the 50 acre site.



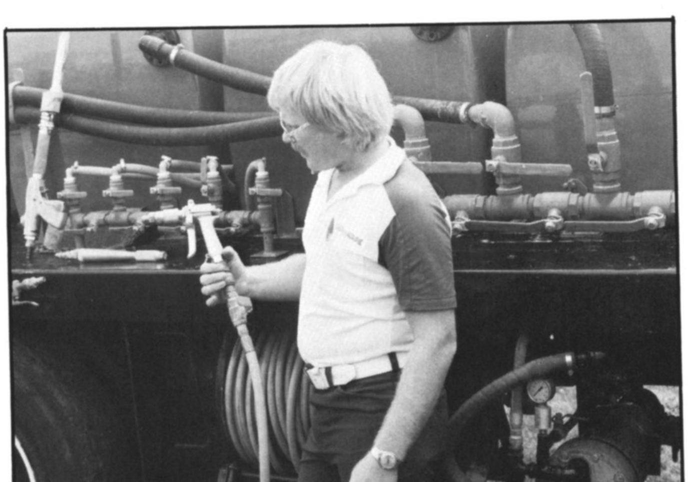
The Chemlawn greenhouse allows researchers to continue their work year 'round.



The new Chemlawn equipment for spot-application of herbicides is explained in detail.

Chemlawn's research agronomist, Dr. Charles Darrah, discusses his work on nitrogen fertility.

A staff member discusses the equipment and chemicals used in Chemlawn's "do it yourself" program for homeowners.



Rob Wendling, of the Chemscape Division, demonstrates the equipment used for ornamental care.

Total Vegetation Control

by M. D. McGlamery and E. L. Knake, Extension Agronomists, University of Illinois

M. D. McGlamery

E. L. Knake

Several lawn applicators have expressed their interest in total vegetation control, and their concern about a lack of information on the subject. For that reason, we are presenting the following article, which is an introduction to the chemicals commonly used in "total veg" programs.

Reprinted from the 1980 Urban Pesticide Dealers and Applicators Clinics, University of Illinois.

Total vegetation management is the application of nonselective chemicals or nonselective rates of selective chemicals as a means of controlling all vegetation in such noncrop areas as parking lots, drive-in theaters, driveways, patios, and certain industrial sites.

Herbicides can be classified by their length of control. Those with little or no residual activity are the fumigants and the contact herbicides. Fumigants are volatile materials that can affect the viability of weed seeds as well as existing growth. Contact herbicides, such as paraquat, control only the existing vegetation that the spray contacts.

Amitrole, dalapon, 2,4-D, and DSMA give temporary control for four months or less. Semipermanent control is provided by some inorganic salts, such as sodium borate and sodium chlorate. Organic compounds that provide semipermanent control are the uracils (bromacil), substituted ureas (monuron, diuron, and tebuthiuron), and the triazines (atrazine, simazine, and prometone).

Areas where total vegetation management is desirable include the following: (1) beneath asphalt pavement, (2) along railroads, (3) around buildings as a means of preventing the growth of weeds that are unsightly or present a fire hazard, and (4) along fences to control weeds. As an alternative to chemical control, it may be preferable to establish desirable, competitive vegetation along a fence to discourage weed growth and to provide protective soil and wildlife cover. Short-term herbicides, such as 2,4-D and dalapon, might be used for temporary control until desirable vegetation can be established.

PRECAUTIONS AND GENERAL PROCEDURES

Several precautions must be observed when you use nonselective chemicals. You must know what weeds are to be controlled and select the correct chemical for those particular problems. A survey of the area must be made, noting any desirable vegetation in the immediate or adjacent areas that could be affected by spray drift, chemical runoff, or leaching into the root zone.

Appropriate precautions should be taken to prevent damage to desirable plants. The risk of injury with some of these materials may be too great to allow their use in some areas, so be certain that you are familiar with the product and aware of the risks before using these materials.

Application timing is very important. The best time to apply nonselective, soil-residual herbicides is early in the spring before herbaceous weeds have emerged. If vegetation is heavy, it may be necessary to remove existing

Vegetation Control

vegetation or to add a contact or foliar herbicide or mix the herbicides with diesel fuel to speed top-kill. After existing vegetation is under control, the rate can be reduced for maintenance applications in the future.

Adjust the application rates according to the soil types or for the desired length of control. When you want to control growth for two or three years, maintenance applications are better than an initial application that is too high.

HERBICIDES FOR NONCROPLAND

Inorganic Compounds

1. Sodium chlorate has both foliar and root activity. This compound, however, presents an extreme *fire hazard*, so fire retardants such as calcium chloride or the borates are often added to reduce the hazard. Altacide is sodium chlorate with a fire retardant. Another drawback to sodium chlorate is the fact that it may be toxic to livestock that seek its salty taste. The rate is 500 to 1,000 pounds per acre.
2. Sodium borate (concentrated Borascu) has primarily root activity. Very high rates are required (1 to 2 tons per acre), so it is often used only as a granular carrier for organic compounds.

Vegetation Control

3. Sodium arsenite is a *highly toxic* compound. It is not usually recommended because safer products are now available. Sodium arsenite is formulated as a 9.5-pound-per-gallon liquid. The rate is 55 to 110 gallons per acre.
4. Ammonium sulfamate (Ammate-X) is formulated as 95-percent soluble crystals for weed control on woody plants and herbaceous weeds. It is sometimes used for brush control where volatilization of phenoxy herbicides would be a hazard. It is corrosive to metals. The rate is 60 to 100 pounds per acre.

Organic Compounds for Long-Term Control

1. Asulam (Asulox) is a 3.34-pound-per-gallon formulation that is used at the rate of 1 to 2 gallons per acre. It controls grasses better than broadleaf weeds.
2. Bromacil (Hyvar-X) has both foliar and soil activity. It is formulated as an 80-percent wettable powder (WP) and a 2-pound-per-gallon liquid. The rate of active ingredient is 5 to 15 pounds per acre. Urox B is a 4-pound-per-gallon liquid of bromacil.
3. Bromacil + diuron (Krovar I) is formulated as an 80-percent, 1:1 combination of bromacil:diuron. It is used to control shallow-germinating weeds and deep-rooted perennials. The rate is 6 to 30 pounds per acre. Krovar II is a 2:1, bromacil: diuron formulation.
4. Simazine (Princep) is formulated as an 80-percent WP, a 4-pound-per-gallon liquid, and a 4-percent granule. It has little foliar activity but has a longer residual control than atrazine. The rate is 5 to 40 pounds per acre of the 80-percent WP.

Vegetation Control

5. Atrazine is an 80-percent WP or a 4-pound-per-gallon liquid. Atratol 8P is 8-percent atrazine on a chlorate-borate pellet. The rate is 5 to 40 pounds per acre of the 80-percent WP or 0.25 to 1 pound per 100 square feet of the pelleted formulation.
6. Prometone (Pramitol) is available as a 2-pound-per-gallon liquid, an 80-percent WP, and a 5-percent pellet. It has more foliar activity than atrazine. The rate for the liquid is 5 to 30 gallons per acre. For the pellets, the rate is 12.5 to 75 pounds per acre or 0.5 to 2 pounds per 100 square feet.
7. Hexazinone (Velpar) is a 90-percent water-soluble powder. Apply 2 to 5 pounds per acre for contact kill and short-term control or 6 to 12 pounds per acre for season-long control.
8. Tebuthuiron (Spike) is available as an 80-percent WP. Apply before or during periods of active growth at a rate of 5 to 20 pounds per acre.
9. Diuron (Karmex) is an 80-percent WP. The rate is 10 to 60 pounds per acre. It is sometimes mixed with bromacil (see No. 3).
10. Dichlobenil (Casoron) is available as a 50-percent WP and a 4-percent pellet. It is more commonly used for nursery weed control than for soil sterilization. The rate is 10 to 40 pounds per acre of the 50-percent WP.
11. Amizine is a combination of amitrole and simazine, bringing together the foliar activity of amitrole with the residual activity of simazine. The suggested rate for general vegetation control is 20 pounds or 18 gallons of Amizine in 100 gallons of water per acre.

Vegetation Control

Many of the granular or pelleted materials are organic herbicides formulated on sodium borate or borate-chlorate granules. They can be applied dry, which is often convenient for spot treatment or application on small areas.

1. Chlorea is monuron on a chlorate-borate base.
2. Ureabor is 1.5-percent bromacil on sodium-borate pellets. Amoco Industrial Weed Killer B is also bromacil on a chlorate-borate pellet.
3. Atratol 8P is 8-percent atrazine on a borate-chlorate base.
4. Pramitol 5PS is prometone on a borate-chlorate pellet.
5. Benzabor is 2,3,6-TBA on a borate granule.

Organic Herbicides for Short-Term Control

1. Amitrole is available as Weedazol and Amino Triazole. It is a translocated herbicide that is especially effective on poison ivy and Canada thistle as well as perennial grasses such as quackgrass. Amino Triazole is a 90-percent soluble powder and is applied at a rate of 2 to 5 pounds per acre. Weedazol is a 50-percent soluble powder and is applied at a rate of 2 to 8 pounds per acre.
2. Amitrole-T is available as Cytrol and Amitrol-T with 2 pounds per gallon of amitrole plus ammonium thiocyanate. Since Amitrole-T is formulated as a liquid, it is sometimes considered more convenient to handle than amitrole. The rate is 1 to 3 gallons per acre.
3. Dalapon (Dowpon-M) is a foliar-applied, systemic grass killer. It is also available with TCA (Dowpon-C) for longer residual control. The rate is 10 to 15 pounds per acre of the 85-percent soluble powder. A wetting agent improves the control. Perennial grass may require more than one application.
4. Sodium-TCA is a root-absorbed grass killer that remains in the soil longer than dalapon. It is a 90-percent soluble powder used at 50 to 150 pounds per acre.
5. MSMA is available as Daconate, a 6-pound-per-gallon liquid with surfactant. It is used for perennial grass control at 0.5 to 1.5 gallons per acre. More than one application may be necessary.
6. DSMA is available as a liquid or soluble powder. It is frequently used for spot treatment of johnsongrass. The rate is 3 to 9 pounds per acre of the soluble powder or 1 to 2 gallons per acre of the liquid.
7. Paraquat is a 2-pound-per-gallon contact herbicide with little residual activity. The volume of water should be adjusted to the amount of vegetation. The rate is 1 to 3 quarts per acre. A surfactant is added at the time of application. Paraquat is restricted to use by certified applicators.
8. Glyphosate (Roundup) is available as a 4-pound-per-gallon systemic herbicide that is nonpersistent. Unlike paraquat, it will translocate to kill perennial weeds. The rate is 1 to 5 quarts per acre.
9. Dinoseb ("dinitro") is a contact herbicide often mixed with fuel oil. It is *quite toxic* and will stain clothes and skin. Mix 1 to 2 quarts per 30 to 50 gallons of fuel oil with enough water to make a total volume of 100 gallons.

Herbicides for Broadleaf Weed and Brush Control

1. Dicamba (Banvel) is available as a 4-pound-per-gallon formulation. Banvel presents a hazard to nearby soybeans, tomatoes, and desirable woody plants. The application rate is 1 to 4 quarts per acre.
2. Picloram (Tordon) is a persistent, broadleaf herbicide. It is formulated as a liquid with 2,4-D as Tordon 212 and on a borate pellet as Tordon 22K and Borolin. Special care must be taken because of its long soil life and mobility in the soil. Tordon is restricted to use by certified applicators.
3. Fenac is closely related to 2,3,6-TBA in terms of controlling deep-rooted, perennial broadleaf weeds. It is formulated as a 1.5-pound-per-gallon liquid. The application rate is 2 to 15 gallons per acre.
4. 2,4-D is a broadleaf herbicide with short persistence. Amine formulations present less hazard to nearby sensitive plants than ester forms. The common formulation is as a 4-pound-per-gallon liquid. Mixtures of 2,4-D and dalapon are often used for short-term control of both broadleaf and grass weeds.

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Vegetation Control

5. Dichloraprop (Weedme 2,4-DP) may be used for brush control. It gives better control of some woody plants and has a longer soil life than 2,4-D.
6. Bromacil (Hyvar-XL) is a 2-pound-per-gallon liquid for basal spraying of brush. A 10-percent pellet (HABCO-10B) is also available.
7. Krenite is available as a 4-pound-per gallon formulation. When it is applied within two months of leaf senescence, no symptoms are evident until the following spring. Because it does not translocate, it can be used for chemical trimming. The rate is 1.34 to 3 gallons per acre.

LONG-TERM RESIDUAL CONTROL

Spray Applications

Many of these chemicals are WP's and will require thorough agitation for spray application. The rates listed are for the different types of weeds to be controlled. Initial applications are often made at the higher rate, with subsequent treatments at the lower rate.

	Rate of formulation per acre		
Herbicide	Annuals	Shallow perennials	Deep perennials
AAtrex (80W)	6 to 12.5 lb.	12.5 to 25 lb.	25 to 50 lb.
Amizine (60 W)	6 lb.	12 lb.	20 lb.
Asulox (3.3 lb./gal.)	1 to 2 gal.	1 to 2 gal.	- - -
Casoron (50W)	8 to 12 lb.	12 to 25 lb.	25 to 40 lb.
Hyvar-X (80W)	3 to 6 lb.	7 to 12 lb.	15 to 30 lb.
Hyvar-X-L (2 lb./gal.)	1.5 to 3 gal.	3 to 6 gal.	6 to 12 gal.
Karmex (80 W)	5 to 20 lb.	20 to 40 lb.	20 to 60 lb.
Krovar I (80 W)	4 to 6 lb.	7 to 18 lb.	19 to 40 lb.
Pramitol 25E (2 lb./gal.)	5 to 7.5 gal.	7.5 to 15 gal.	15 to 30 gal.
Princep (80W)	6 to 12.5 lb.	12.5 to 25 lb.	25 to 50 lb.
Sodium chlorate	300 to 500 lb.	500 to 750 lb.	750 to 1,300 lb.
Spike (80W)	5 to 10 lb.	10 to 20 lb.	- - -
Velpar (90 W)	2 to 5 lb.	6 to 12 lb.	- - -

Vegetation Control

Granular or Pellet Application

Granulars are often more convenient for spot treatment and for small areas. Many granules are on a sodium chlorate-borate base.

Herbicide	Number of lbs. per 100 square feet
Atratol 8P	0.5 to 1
Benzabor	0.5 to 1
Casoron-10P	0.5 to 1
Chlorea-3 (3 pct. monuron + borate-chlorate)	1 to 2
Concentrated Borascu	4 to 6
Pramitol 5P	1 to 2
Princep 4G	0.5 to 2.5
Sodium chlorate	1.5 to 3
Sodium chlorate— borate	3 to 4
Sodium chlorate— modified	2 to 4
Spike 10G	0.1 to 0.5
Ureabor	2 to 4

BROADLEAF WEEDS

These weeds are often best controlled with foliar applications. Deep-rooted perennials can usually be controlled best when they are at the early bud to early bloom stage. The herbicides listed below can move through the air and damage nearby desirable broadleaf plants. They are quite soluble and mobile in the soil and can move into the soil and damage trees or other desirable shrubs and broadleaf plants.

	Rate of formulation per acre	
Herbicide	Annual and shallow perennials	Deep-rooted perennials
Banvel (dicamba)	0.5 to 1 qt.	1 to 4 qt.
Fenac	2 to 5 gal	10 to 15 gal.
Roundup	1 to 3 qt.	4 to 6 qt.
Tordon 212 (picloram + 2,4-D)	2 to 4 qt.	4 to 12 qt.
2,4-D	1 to 2 qt.	2 to 4 qt.

Vegetation Control

UNDESIRABLE WOODY PLANTS

Most of the materials used to control woody plants are applied to the foliage, but they can be applied (1) as basal bark treatments if the trees are less than 3 inches in diameter or (2) as a frilled treatment if the trees are larger. The basal treatment can be applied in fuel oil during the dormant season. Foliar treatments are usually applied as soon as the brush or trees have leaves fully expanded.

Herbicide	Method of application	Rate of formulation
Ammate-X (ammonium sulfamate)	Foliar	60 lb./A.
Banvel (4 lb./gal. dicamba)	Foliar	2 to 4 qt./A.
Habco 10B (10 percent bromacil)	Soil	1 to 2 tbsp./sq. ft.
Krenite (4 lb./gal.)	Foliar	1.5 to 3 gal./A.
Tordon 212 (picloram + 2,4-D)	Foliar or basal	1 gal./A.
2,4,-D	Foliar or basal	2 to 4 qt./A.

WEEDY GRASS CONTROL

Weedy grass control is often best accomplished with the herbicides listed below. The use of a spreader-sticker (surfactant) often helps.

	Rate of formulation per acre	
Herbicide	Annuals	Perennials
Ansar 529HC	1 to 2 qt.	2 to 4 qt.
Asulox	1 to 2 gal.	1 to 2 gal.
Cytrol, Amitrol-T	1 gal.	2 to 3 gal.
Daconate	2 to 3 qt.	3 to 5 qt.
Dowpon	5 to 10 lb.	10 to 30 lb.
Glytac (TCA ester)	2.5 gal.	5 gal.
Roundup	1 to 2 qt.	2 to 5 qt.
Sodium-TCA	20 to 50	100 to 150

Vegetation Control

CONTACT WEED CONTROL

Contact herbicides kill the plant tissue with which they come in contact; thus, adequate spray volume is needed for full coverage. The use of a surfactant often helps the spray to spread on the plants.

Herbicide	Rate per acre
Fuel oil + dinoseb	50 gal. + 2 qt.
Herbicidal naphtha	30 to 50 gal.
Paraquat	1 to 3 qt./A.

COMMENTS

Availability, formulations, trade names, and federal clearance for the use of herbicides change from time to time. Always refer to the most recent product labels for precautions, directions for use, and rates to use. Use herbicides with appropriate precautions to avoid injury to desirable vegetation, to protect the user, and to assure the safety of humans and animals. Store herbicides properly so that children and those who may not be responsible for their actions do not have access to them. Store herbicides only in the original, well-marked containers. Properly dispose of used herbicide containers and old herbicides.

Although both benefits and risks are associated with the use of herbicides, if you use them properly, the benefits can far exceed the risks, and the quality of our environment can be improved by controlling undesirable vegetation. Do not neglect the opportunities for using desirable vegetation to compete with and replace undesirable vegetation. Also, for some areas mechanical control may sometimes be quite practical and the most appropriate method.

* *

Turf Entomologists

The following list of turfgrass entomologists was selected from a study done by Dr. Harry Niemczyk, Ohio Agricultural Research and Developmental Center, Wooster, Ohio. The complete text of Dr. Niemczyk's study will appear in the proceedings of the Symposium on Turfgrass Insects— 1980, which will be published early next year.

Dr. Niemczyk urges lawn care businessmen to utilize this valuable resource, their state entomologist. It is through the cooperative efforts of the lawn care industry and university entomologists that we have identified and controlled such "new" pests as the greenbug aphid and the winter grain mite. By collecting unusual insect pests and submitting them to local entomologists, lawn care professionals can contribute to the growth of knowledge in this field. In just the past few months, the subterranean sod webworm and the corn root webworm have been found in home lawns in Michigan and Ohio. Dr. Niemczyk also suggests that cases of suspected insecticide resistance be reported. University entomologists may be able to suggest alternative controls or, as in the case of the greenbug aphid, help obtain a "24-C" special needs label.

ALABAMA
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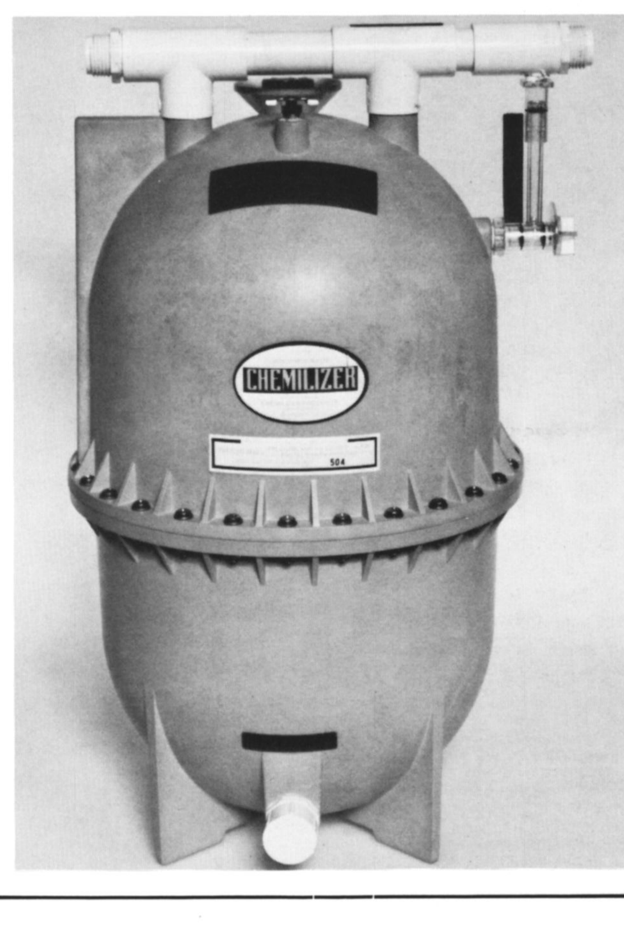

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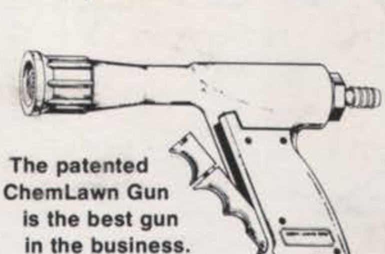

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