James B. Beard

AMERICAN LAWN APPLICATOR

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Gray Snow Mold

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Burn Characteristics of Ureaformaldehyde Reaction Products

by Richard G. Rathjens, The Davey Tree Expert Co.

Richard Rathjens is an Agronomist at the Research and Development Center of The Davey Tree Expert Company, Kent, Ohio. He is responsible for conducting research pertinent to liquid fertilization, weed and insect lawn care programs; classroom instruction of field personnel; providing technical information to both field personnel and clients in the form of technical manuals and fact sheets.

Richard received his M.S. in Turf Management in 1978 from Cook College, Rutgers University, New Brunswick, New Jersey, and his B.S. in Agronomy in 1975 from Delaware Valley College of Science and Agriculture, Doylestown, Pennsylvania.

Richard is also a member of numerous professional organizations.

In selecting a nitrogen (N) source for liquid lawn care, an important consideration is the potential for the fertilizer to cause burn.

Fertilizer burn is the dehydration of plant cells caused by an excess of salts following a fertilizer application. Fertilizer burn can occur as the result of fertilizer being placed on turfgrass leaves and stems or from an excess of salts in the soil solution. Varying degrees of fertilizer burn can occur from a simple discoloration of the leaf tip (known as tip burn) to a complete browning of foliage and death of the turfgrass plant.

The salt index proposed by Rader, Jr., White and Whittaker (3) is a measure of a fertilizer's tendency to raise the osmotic potential of the soil solution and is based on sodium nitrate being equal to 100. The salt index for several N sources is given in Table 1.

As a group, the soluble sources of N– sodium nitrate, ammonium sulfate, ammonium nitrate, and urea– have a relatively high salt index. For this reason, precautions should be taken to minimize possible fertilizer burn. Standard recommendations when applying soluble sources of N in dry form include applying the fertilizer to dry foliage and following the application with irrigation. These steps help to ensure that the fertilizer will not remain on the leaf surface where fertilizer burn can occur.

In addition to precautions before and after the fertilizer application, fertilizer burn can be minimized by using N sources such as natural organics (i.e., Milorganite) which are insoluble and have a relatively low salt index (3.5).

Sources of N such as sulfer-coated urea, isobutylidene diurea, and ureaformaldehyde, will also minimize fertilizer burn because of their limited water solubility.

Table 1: Salt indices of several N sources

N Source	N content	Salt index	Partial salt index (1)
Sodium nitrate	16.5	100.0	6.06
Ammonium sulfate	21.0	69.0	3.25
Ammonium nitrate	35.0	104.7	2.99
Urea	46.0	75.4	1.62
Natural organic	5.0	3.5	0.70

1. Based on equal amounts of N

Foliar tip burn of Kentucky bluegrass caused by an application of soluble fertilizer under high temperature and humidity conditions.

Since 1977, several liquid forms of ureaformaldehyde (UF) reaction products have been introduced to the lawn care industry as sources of N. One of the benefits promoted by the producers of the UF reaction products is that they possess a low potential for fertilizer burn.

UF reaction products are produced by reacting urea and formaldehyde (*Figure 1*). Variables such as the mole ratio of urea to formaldehyde, temperature, time, pH and catalysts used influence the type and concentration of UF compound (methylol urea or methylene urea) found in the final product. It is the combining of urea and formaldehyde which gives liquid UF reaction products lower potential to burn than urea. In comparison to methylol urea, formation of the more complex methylene urea polymer with varying chain lengths and solubilities further reduces the potential for fertilizer burn.

Hawkeye's Formolene and Georgia Pacific's 4341 are two liquid products which contain soluble methylol urea as the predominant UF compound (*Table 2*). C.P. Chemical's Nitro-26 Plus is also a liquid with methylene urea as the predominant UF compound. Cleary's Fluf is a flowable liquid (a liquid containing microfine particles) which, like Nitro-26 Plus, contains methylene urea as the predominant UF compound. In addition to soluble short-chain methylene urea, Fluf contains 20% water insoluble long-chain methylene urea. Although not a UF reaction product, the burn potential of Cleary's Fan is of interest since it is a newcomer to the lawn care industry. Cleary's Fan is produced by reacting urea and acetaldehyde to form ethylidene urea.

Knowledge of the relative amounts of urea, methylol urea and methylene urea contained in the liquid UF reaction products can be used as a guide in predicting their potential to cause fertilizer burn. Fluf would have the least potential to burn because it contains less than 16% urea, methylene urea as the predominant UF compound and 20% of the total N in a water insoluble form. Nitro-26 Plus, like Fluf, also contains less than 16% urea and methylene urea as the predominant UF compound but contains no water insoluble N and, therefore, could be considered intermediate in its burn potential. Formolene and GP4341 contain 50% urea with methylol urea as the predominant UF compound and would have the greatest potential to cause burn of the liquid UF reaction products.

Several field tests have demonstrated differences in the potential for liquid UF reaction products to cause fertilizer burn. Johnson and Christians (2) compared the extent of foliar burn caused by liquid fertilizers applied to Kentucky bluegrass turf. The average visual burn from applications of 0.50, 1.00, and 2.00 lbs. of N per 1000 sq. ft. made in

Figure 1: Formation of UF compounds.

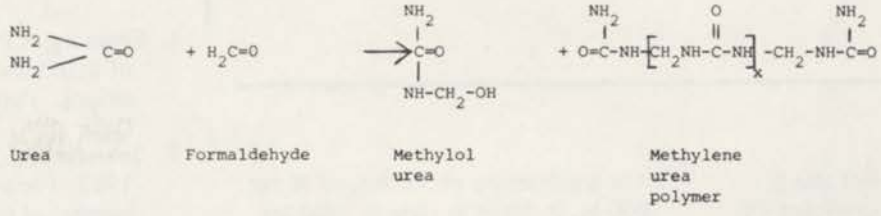

Table 2: Liquid ureaformaldehyde reaction products

Trade Name	Producer	Nitrogen %	Predominant UF Compound: Methylol Urea	Predominant UF Compound: Methylene Urea	Water Insoluble N %(1)	Urea %(1)
Formolene	Hawkeye Chemical Co.	30	x		0	50
GP4341	Georgia-Pacific Corp.	30	x		0	50
Nitro-26 Plus	C.P. Chemical Co.,	26		x	0	<15
Fluf	W.A. Cleary Chemical Corp.	18		x	20	<16
Fan	W.A. Cleary Chemical Corp.	20			0	20

(1) % of total N

Burn Characteristics of Ureaformaldehyde

Table 3: Effect of liquid fertilizers on foliar burn of Kentucky bluegrass turf.

Liquid fertilizer	Visual Burn Rating (1)
Control	9.0
Fluf	8.5
Formolene	8.0
Fan	7.0
Urea	6.5
F.S.D. (0.05) = 0.5	

(1) Scale of 1-9 with 1 = completely brown, 9 = no foliar burn

Table 4: Effect of liquid fertilizers on phytotoxicity of Kentucky bluegrass turf.

Liquid fertilizer	Phytotoxicity rating (1)
Control	10.0
Fluf	9.0
Formolene	8.0
Urea	6.7
Ammonium nitrate	4.7

(1) Scale of 1-10 with 1 = total leaf damage 10 = none

August of 1982 are given in Table 3.

While there was no significant difference between Fluf and Formolene, both gave significantly less burn than Fan and urea.

Freeborg (1) measured the amount of burn (expressed by phytotoxicity) caused by both liquid and dry fertilizer formulations applied to Kentucky bluegrass turf. Ratings of visual damage from applications of 3.0 lbs. of N per 1000 sq. ft. made in June of 1980 are given in Table 4.

Although not subjected to statistical analysis, Fluf gave the least burn followed by Formolene and urea. Ammonium nitrate gave more burn than urea which would be expected since ammonium nitrate has a salt index which is greater than urea.

Based on the liquid UF products included in the two field tests, the product with the least potential to cause fertilizer burn would be Fluf followed by Formolene. The data also indicated that both Fluf and Formolene have a lower potential for burn than Fan and that all three have a lower potential to burn than urea.

Illustrated below is a summary of both the prediction of burn potential based on the relative amounts of urea, methylol urea, and methylene urea and field burn test data for the liquid UF reaction products and urea.

Least potential to burn
↓ Fluf
Nitro-26 Plus
Formolene and GP4341
Urea
Greatest potential to burn

The potential to cause fertilizer burn is an important consideration in selecting a N source for liquid lawn care. However, other characteristics such as length of N release, handling and storage properties, and cost should also be considered by a lawn care company before making a final decision in selecting a N source.

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1. Freeborg, R.P. 1980. Comparison of liquid and dry fertilizer formulations. Purdue U. Unpublished Data.
2. Johnson, S.J. and N.E. Christians. 1982. Foliar burn comparisons of a number of liquid fertilizers applied to Kentucky bluegrass. Iowa State U. Unpublished Data.
3. Rader, Jr., L.F., L.M. White and C.W. Whittaker. 1943. The salt index–a measure of the effect of fertilizers on the concentration of the soil solution. *Soil Sci.* 55:201-218.

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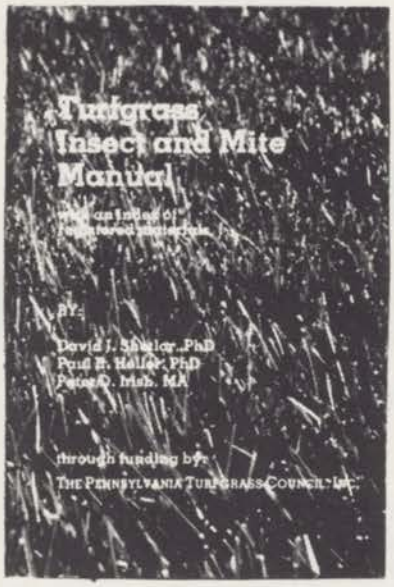
Turfgrass Insect and Mite Manual

Turfgrass Insect and Mite Manual available from the Pennsylvania Turfgrass Council, Inc. with an index of registered materials by Drs. David Shetlar and Paul Heller, Assistant Professors of Entomology, the Pennsylvania State University, University Park, PA and Mr. Peter D. Irish, MA, Manager, C&L Communications, Falls Church, VA. 63 pages, 44 color plates, 6"x 9". The manual contains introductory information about concepts of turfgrass pest management and use of chemical, biological and cultural controls. Pests and beneficial insects found in the northeastern United States are emphasized and the text is written in an easily understood style so as to be useful for turfgrass and landscape managers, pest control operators and even home owners. Problems associated with pesticide use and application are discussed in detail. Keys for the identification of pests are included and the handy index lists currently registered pesticides.



Copies of the Manual are available from the Pennsylvania Turfgrass Council, 412 Blanchard Street, Bellefonte, PA 16823. Cost of the Manual is: $8.00 for P.T.C. members, $12.00 for non-members, and $10.00 for educational institutions (plus postage and handling).

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Winter Diseases– Diagnosis and Control

by Stephen G. Fushtey, Agriculture Canada

Stephen Fushtey is a research scientist in turfgrass management at the Agriculture Canada Research Station, Agassiz, British Columbia. He received his B.S. and M.S. from the University of Alberta; Ph.D. in botany and plant pathology from the University of London, England. Steve was a professor in plant pathology and nematology at the University of Guelph in Ontario for 26 years prior to moving west in 1980. His main research interest is in developing integrated pest management systems for disease control in turf.

As far as the plant world is concerned, most of us would consider winter as a period of rest, when at least in the regions of appreciable frost and snow, most plants, including grass, go the sleep and nothing happens until spring. This is far from the truth. Grass, although not actively growing in the cold of winter, is very much alive and is affected by its environment. An interesting feature of this winter environment is that it supports an amazing array of micro-organisms among which are cold-temperature fungi which are active at temperatures near or below freezing and some of which cause disease in overwintering turf. Winter diseases or injury is also caused by agents other than low-temperature fungi. Among these other causes are dessication, direct low-temperature kill, ice sheet damage and traffic effects. It is important to be able to distinguish among these various causes if one is to take proper measures for control.

This article will attempt to explain the causes of some of the more common winter disease problems and outline measures for their control.

DISEASES CAUSED BY PHYSICAL AGENTS IN THE ENVIRONMENT

1. DESSICATION–

A problem not likely to occur in coastal regions but common in drier colder climates, especially on higher locations which tend to be blown free of snow and are exposed to the drying winds, and heavy frost. Under these conditions soil water is unavailable because it is frozen and the drying winds remove water from the exposed parts to the point where cells collapse and tissues die. If only the leaves are affected the grass will usually recover but, under severe conditions, the crowns are damaged and the plants are killed. The most diagnostic feature of this kind of injury is that the leaves turn distinctly white in damaged areas which range in size from small, irregular patches to extensive kill, often involving entire greens.

Figure 1: Dessication. A well-drained, elevated part of a green which was blown clear of snow and was exposed most of the winter.

Figure2: Ice Sheet Damage. This occurred on a poorly drained area in early spring after a quick snow melt followed by heavy frost. The puddles of water froze and stayed frozen for 2-3 weeks.

2. LOW-TEMPERATURE KILL, FREEZING INJURY—

This occurs most commonly during periods of alternating freezing and thawing, ususally in low-lying areas, when standing water increases crown hydration and large ice crystals form within the plant cells causing mechanical destruction. The higher the water content of the tissue, the larger the ice crystals and the more severe the damage, hence the importance of good drainage to remove excess water during snow melt. Some form of protective cover affords protection from both dessication and low-temperature kill. However, an important consideration in the use of covers is the increased incidence of snow mold. When using a protective cover it is important to apply a preventative snow mold fungicide prior to installation of the cover.

Control measures involve some form of protection to reduce the effects of the drying winds; application of some form of protective cover, wind breaks or brush cover to trap and hold snow for cover of vulnerable areas.

3. ICE-SHEET DAMAGE—

There is some controversy whether damage attributed to this cause is due to oxygen suffocation or toxic gas accumulation, or whether it is due to freezing and thawing injury of excessively hydrated tissue. There is evidence, however, that excessive CO_2 accumulation under ice is harmful. When turf under ice was flushed with nitrogen, no injury occurred in the absence of oxygen but when flushed with CO_2 it dies within 2 weeks. Whatever the mechanism, turfgrass is damaged under prolonged ice cover, especially during warmer weather in early spring. One method of dealing with this problem is to apply some black material such as milorganite to the surface of the ice. The dark particles cause the ice to melt more rapidly when the sun shines and gaseous exhange is restored.

Low-temperature fungi and physical agents cause most winter damage

4. TRAFFIC—

Damage from traffic occurs in 2 ways:

(a) Directly when pressure from traffic (shoes or wheels) on frozen grass causes the leaves to die in the shape of foot prints or wheel tracks, essentially mechanical injury due to crushing of brittle frozen leaves.

(b) Indirectly by compaction of snow cover. This results in increased snow mold under the compacted snow and often death of grass not attributable to snow mold. The latter is not completely understood but damage follows the pattern of compacted snow.

To control, do not permit traffic of any kind on sensitive areas when grass is frozen either with or without snow cover. On a golf green the effects of an overnight frost can be overcome by light irrigation in the morning before play begins.

DISEASES CAUSED BY LOW-TEMPERATURE FUNGI

Most of the damage caused by low-temperature fungi in turfgrass occurs under snow cover but one fungus, *Fusarium nivale* (recently renamed *Gerlachia nivalis*) causes Pink Snow Mold under snow cover and Fusarium Patch or Pink Patch in the absence of

Winter Diseases

snow. The latter is generally considered as the No. 1 disease problem of fine turfgrass in northwestern coastal regions such as the Pacific Northwestern States and Southern British Columbia. According to Drew Smith, who is an international authority on low temperature diseases of grasses and cereals, there are 4 low temperature diseases of turfgrass in Western Canada:

1. Fusarium Patch and Pink Snow Mold caused by *Fusarium nivale (Gerlachia nivalis)*
2. Gray Snow Mold caused by *Typhula* spp.
3. Snow Scald caused by *Sclerotinia borealis*.
4. Snow Mold caused by L.T.B. (low temperature Basidiomycete) recently (1980) identified as *Coprinus* sp.

Because the distribution of the latter two in North America is limited to colder regions of Canada and Alaska, and they have not been found in Mainland United States, the discussion which follows will confine itself to the more widely occurring first two diseases.

1. PINK SNOW MOLD and FUSARIUM PATCH

PINK SNOW MOLD occurs under snow cover, appearing as the snow melts in the form of roughly circular patches of diseased grass. Patches are considerably larger than in Fusarium Patch, occasionally up to 30 cm. dia., and often covered with a white to pinkish mycelium. Damage may be superficial with crowns intact and grass recovering readily with good growing conditions in spring, or fungal growth may be so abundant that it forms a crust with continued activity beneath and the plants in such patches may be killed. Patches often have a reddish-brown margin.

FUSARIUM PATCH appears in the fall during cool, wet weather when ground temperatures approach freezing at night. If this cool, wet weather persists the disease may continue to develop and be a problem throughout the winter until spring. Damage takes the form of small, round, reddish-brown spots, about 2-5 cm dia., occasionally exceeding this size in late fall and winter.

Figure 3: Pink Snow Mold. A uniformly heavy incidence on the fairway as well as the green is the background when no control measures were taken.

Figure 4: Pink Snow Mold. Close-up to show distinctly pink margins.

The individual spots are small but increase in number when weather is favorable and cause serious damage if not brought under control early.

Both these diseases are caused by the fungus, *Gerlachia nivalis*, which is inactive during the summer and is activated in the fall by prolonged cool (5-15C°), moist conditions resulting in development of Fusarium Patch. If the fall period is relatively dry, the fungus is unable to infect but may cause Pink Snow Mold under snow cover, especially if snow covers the ground that is not frozen.

No turfgrass is immune to these diseases but the bentgrasses and annual blue grass are particularly susceptible and suffer most severe damage. Proper cultural practices help reduce the risk of serious damage. In areas with a history of snow mold, fungicides are usually necessary to keep these diseases under control in highly susceptible grass species.

Figure 5: Fusarium Patch on **Poa annua** *pathway as compared to Penncross bentgrass green, upper right. No controls were applied to either area.* **P.annua** *is much more susceptible to this disease but the heavier traffic on the pathway would also contribute to heavier disease.*

Figure 6: Fusarium Patch. Individual spots are much smaller than those of snow mold but overlapping spots can result in large damaged areas.

2. GRAY SNOW MOLD (Typhula Blight)

Damage occurs under snow cover, appearing in the form of roughly circular to irregular shaped, bleached-brown to straw-colored patches, often matted and with fluffy, grayish-white mycelium at the margins. The patches are usually larger than those for Pink Snow Mold, (up to 60 cm. dia.) and usually produce small dark bodies (sclerotia), about the size of small mustard seeds, adhering to the dead leaves.

The fungus, *Typhula sp.* survives the summer in the form of dormant sclerotia at the soil surface and in the thatch. In the late fall, after exposure to cold, wet weather and ground frosts at night, the sclerotia germinate to produce fungal mycelium which feeds on organic debris but does not infect the grass. Infection occurs under snow cover and most severe damage occurs under heavy snow such as snow drifts which persist into early spring.

Control of this disease in the highly susceptible grass species used in high value turf such as golf and bowling greens usually requires the use of fungicides, but proper cultural management goes a long way towards reducing the risk of serious damage. These measures are outlined below.

RECOMMENDED CONTROL MEASURES

1. Follow a fertilizer program which maintains good grass vigor but does not stimulate succulent growth in the fall when the grass should be hardening-off. Turfgrass that goes into the winter in a succulent state is highly susceptible to snow mold and other kinds of winter injury.

Winter Diseases

Figure 7: Gray Snow Mold. More irregularly shaped, bleached-brown to straw-colored patches.

Figure 8: Gray Snow Mold. Sclerotia of the causal fungus on dead leaves, a positive diagnosis for gray snow mold.

Figure 9: Gray Snow Mold. A fungicidal control trial. Of 12 different fungicides tested only mercurials and quintozene (PCNB) gave satisfactory control in this heavily diseased experimental green.

Table 1: Guidelines for use of fungicides in the control of winter diseases.

	Active Ingredient	Examples of Products*	Comments on usage
1. Snow Molds (Gray snow mold, Pink snow mold or mixture of both)	chloroneb chlorothalonil iprodione mercury quintozene (PCNB) triadimefon	Tersan SP Daconil 2787 Chipco 26019, Rovral Calo Clor, PMAS Terrachor, Turfcide Bayleton	Preventative application in late fall prior to snowfall. Use maximum dosage recommended in areas which experience severe damage.
2. Pink Snow Mold Fusarium Patch	benzimidazole chlorothalonil iprodione mancozeb quintozene (PCNB) triadimefon	Tersan 1991, Fungo Daconil 2787 Chipco 26019, Rovral Tersan LSR, Fore Terrachor, Turfcide Bayleton	Treat when conditions favor disease development or at first sign of disease. Repeat at intervals depending on weather and fungicide used. Alternate benzimidazoles with other fungicides.

*These are examples of some commonly used products but the list is not complete. Other products with the same active ingredients and registered for this use may be equally effective.

2. Keep grass cut to the recommended height until growth ceases. Excessive top growth under snow cover provides more suitable conditions for growth of the snow mold fungi.

3. Keep thatch to a minimum. Excessive thatch reduces grass vigor and provides ideal conditions for growth of disease-producing fungi.

4. Take measures to prevent excessive accumulation of snow on sensitive areas such as golf greens. Disperse heavy accumulations of snow from such areas as soon as the snow begins to melt. As snow melts, water percolates down to ground level creating the wet, cold conditions ideal for growth of snow mold fungi. The longer it takes for all of the snow to melt the more severe the snow mold damage.

5. Apply a recommended fungicide in the fall to areas with a history of snow mold damage. Timing is important. For snow mold control, apply as late as possible before permanent snowfall. For Fusarium Patch, fungicide applications may be necessary as early as September, depending on the weather, and repeated periodically as long as cool, wet weather persists. The first application is made at the first sign of the disease or when disease is first expected. Spacings of repeat applications will depend on weather and the fungicide used. Contact fungicides afford protection for no more than 1 to 2 weeks whereas systemics are effective for up to 6 weeks. Care should be taken to not use benzimidazole systemics exclusively as the *Fusarium* fungus is known to develop resistance to these chemicals. The risk of this happening is reduced if these systemics are used alternately with other fungicides.

A snow mold problem can be caused by *Typhula* alone, *Fusarium* alone, or a mixture of the two in the same turf. Take care to use the proper fungicide and follow label directions carefully for dosage. Some guidelines are given in Table 1.

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Insecticides for the Control of Turfgrass Insects

by Nick Christians, Iowa State University

Nick Christians is an assistant professor of Horticulture at Iowa State University. His area of specialization is Turfgrass Science. Nick received his Ph.D. and M.S. degrees from Ohio State University in Agronomy and his B.S. degree from the Colorado State University School of Forestry. Nick is a member of the American Society of Agronomy, and the American Society for Horticultural Science. He is presently involved in several areas of research on Turfgrass Management.

It is often stated that the best control for the pests which attack turfgrasses is to maintain the grass in the healthiest possible condition. The use of chemicals for the control of pests is generally considered as a last resort to be used when cultural practices have failed.

Cultural controls for turfgrass insects are limited. Whereas weeds and diseases can often be partially controlled by modifications in the mowing, fertilization, and irrigation program, there are few things outside of the removal of thatch, which can be done to discourage attacks by insects. A well maintained turfgrass area will recover more quickly from minor insect damage; however, it often seems that the best areas are singled out by insects for destruction. In the absence of good cultural controls, the use of insecticides often becomes necessary.

Insects have not always presented such a difficult problem to the professional turfgrass manager as they do today. During the fifties and sixties and into the early seventies a class of chemicals referred to as the chlorinated hydrocarbon insecticides were available for use on turfgrasses. Included in this class of insecticides were such materials as chlordane, aldrin, dieldrin, heptachlor and DDT. The chlorinated hydrocarbons had two big advantages over most of the insecticides currently available. First, they were very broad spectrum. That is, they had the capacity to control a wide variety of insect pests. Chlordane, for instance, was toxic to practically every insect known to attack turfgrasses. The second advantage of these materials was that they left a long lasting residue. A single application of chlordane in April would control bluegrass billbug adults in May, white grubs in July, and would still be toxic to sod webworm larvae in early August. Many of the chlorinated hydrocarbons would even maintain toxic levels into the second and third years after application.

This long residual, even though it was a considerable advantage in the control of turfgrass insects, is one of the main reasons why these materials are no longer available. The chlorinated hydrocarbons are too persistent in the environment. They tend to build up in the fatty tissue of animals and to accumulate in higher order predators. A few of the insecticides in this class have also been linked to tumor formation in laboratory animals. As a result of these problems, the chlorinated hydrocarbons mentioned had their turfgrass use labels canceled or suspended. One by one these insecticides which had been labeled for use on turfgrasses were removed from the market and by the late 1970's, all of the long residual, chlorinated hydrocarbon insecticides had been restricted.

Understanding the life cycles of insects and timing of applications are essential for today's insecticides to be effective

The insecticides available today for the control of turfgrass insects are primarily from two chemical classes. These are the organophosphates and the carbamates. These materials are very effective insect controls, but lack the residual of the chlorinated hydrocarbons. An application in June to control the first generation of sod webworm would generally not control the second generation of this insect in August. One possible exception to this very short period of effective residue is isofenphos (Oftanol®), an organophosphate which has shown season-long control of white grubs with a single application. However, isofenphos is new to the turfgrass market in most areas and a few more seasons of use will be required before its

Table1: The common and trade names of a number of insecticides used for turfgrass insect control.

Common Name	Trade Name*
Organophosphates	
Acephate	Orthene
Aspon	Aspon
Chlorpyrifos	Dursban
Diazinon	Diazide, Diazatol, Diazinon Spectracide, Sarolex
Isofenphos	Oftanol
Malathion	Emmatos, ForMal, Malaspray, Malamar, Malathion, Zithiol
Ethoprop	Ethoprop, Ethoprophos
Trichlorfon	Danex, Dylox, Proxol, Trinex
Carbamates	
Bendiocarb	Turcam, Ficam
Carbaryl	Dicarbam, Denapon, Sevin, Tricarnam
Methomyl	Lannate, Nudrin
Pirimicarb	Pirimor
Propoxur	Baygon

*The inclusion of trade names in this list does not constitute an endorsement of these products by Iowa State University, nor does the absence of a trade name from the list indicate that the product is not recommended for use.

effectiveness can be fully evaluated. Under field conditions, the organophosphates and carbamates are also generally less broad spectrum than were the materials such as chlordane and are therefore somewhat selective in the insect pests that they will control.

Table 1 contains a listing of a number of organophosphates and carbamates. The common names listed on the left are the names that often appear on research reports and publications. They are not the property of any single company. The trade names on the right are the property of individual producers. These are the names that will appear on the label and are the names that most people in the field are familiar with. Notice that several names are used for exactly the same chemical material. The formulation of the material may change, but the active ingredient is the same.

The result of these trends in the insecticide industry is that a new burden has been placed on the turfgrass manager. In the past, an application of long residual, broad spectrum insecticide could be made with little regard to the type of insect pests which were a problem. Now that the turfgrass industry has been restricted to the use of short residual, less broad spectrum materials, the turfgrass manager must be able to identify the insect and understand the life cycle and habits of that particular pest in order to control it. Proper timing of insecticide applications has become critical and turfgrass managers must now monitor insect pest activity in order to properly time insecticide applications to coincide with the presence of the pest in a vulnerable stage.

A discussion of insecticides would not be complete without some caution on the use and handling of these products. Precautions must be followed when any pesticide is used, but this must be especially emphasized where insecticides are concerned. Many pesticides are designed to attack very specific life functions which are not present in man. An example would be certain types of herbicides which specifically disrupt the photosynthetic processes of plants. Although these materials should be handled with caution, they generally do not present a great hazard to the applicator. Insecticides, however, usually disrupt biochemical pathways that man holds in common with the target pests. This means that if a high enough dose is received, these materials can kill humans by the same methods with which insects are killed. Usually, the

Insects often seem to single out the well kept lawns for damage.

To control an insect pest the turfgrass manager must identify it and learn about its life cycle to determine its most vulnerable stage.

Insecticides

A lawn completely destroyed by insect damage.

dosage to which an applicator is exposed in the turfgrass industry would not be high enough to be fatal, but these substances can cause toxicity symptoms, such as nausea and headaches, even at low doses. Ironically, a few insecticides currently being used in the turfgrass industry, especially the organophosphates, are more toxic on the basis of oral and dermal exposure tests than are the chorinated hydrocarbons that they replaced. The safety advantage of the materials currently being used is their high water solubility and the fact that they do not accumulate in the body or in the food chain.

Within the body there is a chemical called acetylcholine, which is responsible for the transmission of impulses through the nervous system. The mode of action of the organophosphates and the carbamates center around an enzyme called acetylcholinesterase which acts upon the acetylcholine. To better understand the relationship, imagine a simple activity such as extending the hand. The brain forms the command, the impulse is carried along the nervous system with the help of acetylcholine, the muscles respond and the hand extends. Acetylcholinesterase functions by immediately breaking down the acetylcholine which was formed to carry the message. The impulse which tells the hand to extend is stopped and the hand can now close. The organophosphates and carbamates act to block the action of acetylcholinesterase. When this enzyme is blocked it can no longer breakdown the acetylcholine and the result is that the nerve transmission system fails to perform normally. Suppose the hand is extended and then an attempt is made to close it. The acetylcholine produced during both movements is present, the hand would try to open and close simultaneously. One of the first symptoms of low level organophosphate and carbamate poisoning is shaking or trembling. The muscles are receiving conflicting commands from the brain. At higher doses, the muscles which control breathing may stop functioning and, of course, suffocation follows.

The reason for dealing with the subject of mode of action in such detail is that some lawn service companies are becoming very interested in acetylcholinesterase testing programs for their employees. The quantity of this enzyme in the body varies from person to person and thereby the ability to withstand low doses of insecticides also vary. There are some individuals who should not be involved in the application of organophosphates and these people can be identified before employment. Those in the industry who do not have elaborate testing procedures readily available, should watch for symptoms such as trembling, headaches, and nausea in employees who are handling these materials. Some people can handle them, some cannot. Of course, the label should be carefully read and the instructions followed whenever these or any pesticides are used.

In the 25 years following World War II, a vast number of new chemical materials were released for use in the turfgrass industry. Many were excellent products which made the job of managing turfgrass areas much easier than it had been in the past. The trend in recent years has been to remove many of these products from the market. Chlordane, aldrin, and dieldrin which were once widely used for the control of insects are no longer available for use on turf. The removal of some of these materials was justified, the removal of others was questionable, but the result is the same. The art of managing turfgrass areas is becoming increasingly difficult. In many cases, individuals who grew up in the field using broad spectrum, long residual materials such as chlordane must re-educate themselves to adjust to the new technology which now exists.

The Author gratefully acknowledges Dr. Donald Lewis of the ISU Department of Entomology for his advice during the preparation of this article.

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PLCAA Announces 1983 Regional Seminars

Mark your calendar now!

ATLANTA, GA
June 14– Contact Max Graham, Graham Lawn Care Equipment (404) 942-7026

Date Change!
CINCINNATI, OH
June 30– Contact Larry Brandt, Spray-A-Lawn (513) 791-0360

WHITE PLAINS, NY
(SE New York-Northern NJ)
July 14– Contact Bill Carey, Lawn Masters, Inc. (914) 769-1256

FRAMINGHAM, MA
July 28– Contact Drew Kenney, Turf Doctor (617) 879-4510

BUFFALO, NY
July 21– Contact Des Rice, Weed Man, LTD (416) 823-8550

Date Change!
DETROIT, MI
August 4– Contact Donald Benham, Benham Chemical (313) 624-3200

CLEVELAND, OH
July 12– Contact Mark Laube, Lawnmark (216) 928-4431

ROCKVILLE, MD
(Washington DC)
June 16– Contact Bill Harrigan, Green Life Lawn & Tree (301) 694-6006

PHILADELPHIA, PA
June 23– Contact Jim Kelly, ChemLawn Corp. (215) 647-6587

CHICAGO, IL
July 20– Contact Charlie McGinty, McGinty Bros. (312) 438-5161

OMAHA, NE
August 10– Contact Allan Duey, Jay-Lan, Inc. (712) 252-5252

Members will receive more information as it becomes available. Non-members contact your local committee chairman or use the reply card.

PLCAA: 1225 Johnson Ferry Rd., Suite B-220, Marietta, GA 30067
(404) 977-5222 (dial 97P-LCAA!)

Circle No. 21 on Reader Reply Card

Embark Label Expansion Approved

The Environmental Protection Agency recently issued its approval for a significant expansion of the uses for 3M's Embark Plant Growth Regulator (PGR).

Embark PGR is now approved for use on a wider range of ornamentals, for control of *Poa annua* seedhead development, and for spraying grasses around agricultural premises.

For ornamentals, Embark PGR is now approved for application across the U.S. on the following species: Japanese ligustrum, pyracantha, English ivy and holly (Burford and Japanese). The EPA has approved Embark for use on 14 additional ornamentals in California. Embark can now be applied to over 24 California ground covers, shrubs and trees. It is also used to inhibit the flowering of ornamental olive trees.

Embark is now labeled for controlling *Poa annua* seedhead development on golf course fairways, using a ½ pint-per-acre rate. Golf courses throughout the cool season grass areas of the U.S. are spraying Embark PGR to suppress *Poa annua* seedheads. Research has shown that controlling *Poa annua* seedheads will strengthen the *Poa annua* root system and enhance summer color and vigor.

Recommended use areas for Embark have been expanded to include such "agricultural premises," as around farm buildings, storage sheds, implement storage areas and roadsides. In addition, the new label expands the list of herbicides approved for tank mixing with Embark to include Trimec® Broadleaf Herbicide.

Copies of the new label and literature on new uses for Embark are available from 3M Agricultural Products, Building 223-1N, 3M Center, St. Paul, MN 55144, or use the reply card.

Circle No. 10 on Reader Reply Card

New Herbicide for Ornamental Turf Use

Professional applicators serving the lawn care industry, institutional/government businesses, golf courses and other recreational areas now can receive the benefits from a recent Environmental Protection Agency label clearance for the use of new Weedone® DPC post-emergence turf herbicide.

Weedone® DPC combines two broadleaf killers, 2, 4-D and dichlorprop (2, 4-DP), for broad spectrum control of both annuals and perennials. It also is highly effective in controlling difficult weeds such as ground ivy, oxalis, chickweed and poison ivy, as well as the more common weeds like dandelion, plantain and wild garlic.

The post-emergence turf herbicide will be sold by Union Carbide Agricultural Products Company, Inc., through regional distributors in 2½ gal. poly containers, packed two per case, and 55 gallon drums for the larger user. In addition, Weedone® DPC herbicide will be marketed through Balcom Special Products as Clean Crop® Weedone® DPC herbicide, and Lakeshore Equipment and Supply Company as Lesco Weedone® DPC herbicide.

According to Tom Arnold, Union Carbide's market manager for specialty and professional chemicals, the newly-registered Weedone® DPC formulation should better meet the needs of the professional applicator and turf specialist with its wider range of weed species control.

For more information about Weedone® DPC, contact Tom Arnold, Union Carbide Agricultural Products Company, Inc., T.W. Alexander Drive, P.O. Box 12014, Research Triangle Park, NC 27709, or use the reply card.

Circle No. 11 on Reader Reply Card

Do it NOW!

Support "Your" Pro-Pesticide Coalition.

The concern, dedication & willingness of a few won't get the job done. The success or failure of this grueling battle will depend on YOU and YOUR support.

Find out how you can help! Contact Jerry Faulring, 656 Quince Orchard Rd., Suite 503, Gaithersburg MD 20878.

Please Note:

Degesch Phostoxin® which was referred to in Genn Dudderar's "Mole Control Update", in our May/June 1983 issue, is a restricted use pesticide and proper certification is required to purchase and use the tablets. Phostoxin® is the registered trademark held by Degesch GmbH of Frankfort, West Germany.

The "tablets in blister packs" referred to in the article are intended for fumigation of processed foods and are not registered for mole control.

"I accidently splashed some of our lawn fertilizer on my head last week."

Injection Gun System

An injection gun system introduced by Perma-Green Supreme, Merrillville, IN offers the potential for significant reductions in chemical use. A conservative estimate, according to the company, is 50%, and in many cases savings of 70% or more are possible. The majority of lawn area that has a dense turf cover or is shaded rarely will host crabgrass. Certainly the low risk of crabgrass in these areas does not justify the high cost of blanket covering the total lawn with pre-emergents. Tom Jesson of Perma-Green feels there is more to consider than just the immediate economic benefits associated with targeting pesticides. "The environmental considerations are possibly more important. We are high visibility users of pesticides, and therefore we are easy targets for the environmentalists. Unfortunately, some of their criticism of our industry's indiscriminate use of pesticides may be justified. Targeting pesticides would give our industry powerful ammunition against the forces attempting to restrict the use of pesticides, require pre-notification, or in some way legislate us out of business. If we apply pesticides on a need basis only, the chances of preventing restrictions will be greatly enhanced."

The Injector Gun System (IGS for short) is not only cost effective and good for the industry, but it is accurate, convenient, and safer to use. For more information contact Tom Jessen, Perma-Green Supreme, Inc., P.O. Box 8326, Merrillville, IN 46410, or use the reply card.

Circle No. 15 on Reader Reply Card

Upon Using A Chemical

by Bill Rhymes,
Mallinckrodt, Inc.

You probably started reading this article because the word "chemical" caught your eye. All we do is involved and made of the 103+ elements that by themselves, or in combination, make up every known substance in our universe.

In the turfgrass area, of which we are a part, chemicals play a resounding part. Our soils, grasses, and the entire ecosystem surrounding the whole is made of chemicals. We come along and apply additional chemicals to help our soils, grasses, water systems, etc., function properly.

The use of pesticides (a combination of chemicals) is one of the "performance improvers", and a very narrow segment of pesticide usage is the keystone of this article. In short, it is about how to get better results with various forms of pesticides, be they granular, liquid or wettable powders. Let us take them in order.

1. GRANULAR– many of our well known and top performing products are available in a granular form. The active ingredient (be it Ronstar, Pre-San, Balan, Koban, etc.) is sprayed, or pressure forced on, or into a clay granule. This granule can be easily applied by a tractor pulled, or manually operated spreader. It is very convenient and timely for emergency situations. However, it is more expensive to use than a liquid or wettable powder form of the same chemical because the cost of making it is greater.
2. WETTABLE POWDERS– Probably more of our pesticides are in this form than any other. In fact, over 60% of all pesticides used in turfgrass maintenance come as a wettable powder. Some examples are Duosan, Daconil, 26019, Koban-30 and Vorlan. What is a wettable powder? It is just that– a powder that you can wet (make a solution) and apply. The active ingredient is blended with a finely ground clay, a wetting agent is applied, the whole batch is blended together then drummed, or stacked up. And that is where the problem begins. Whan a wettable powder is placed in a drum or bag, then shipped, the product tends to settle, or compact in the container bottom. It makes no difference whose wettable powder we consider, they all do this. Therefore, in using any wettable powder, follow this procedure: a) Turn drum or bag over several times, re-mixing it well. b) Measure the recommended amount (ounces, pounds, etc.) and make a "starter" solution with warm or tepid water. In other words, don't add a wettable powder directly to a spray-tank of cold water. Make up a solution with warm water, then add to the cold water in the tank. By following this procedure, we overcome the problem of clogging spray-tip nozzles, get a better and more uniform dispersion and obtain the best results from our wettable powder.
3. LIQUIDS (or Flowables)– As the state of the art improves, we see more products in finished, liquid form. Examples are Pre-San, Dymet, Daconil-F and Koban-F. These are very easy to measure, mix and apply. We have no settling-out problems. In most cases, the cost in use is about equal to wettable powders, but less than granular.

SUMMARY

1. Granular chemicals are expensive, but offer ease of application, convenience and good insurance in emergency situations.
2. Wettable powders remain the most popular form of pesticides. Containers should be shaken to re-mix. Product should be mixed in small amount of warm water, stirred well, then added to cold water in spray-rig.
3. Liquids/Flowables– These are the easiest to use if we have a spray-rig. We measure them easily, they mix uniformly, stay in suspension, and cause no problems in spray-tip clogging.

Chemicals are what we are all about. We eat, drink, rub, spray, breathe and are them. When we use them as partners to help us do our jobs better, it is well to know a little about how the form we utilize performs.

Calendar of Events

AUGUST

ILLINOIS LANDSCAPE CONTRACTORS ASSOC. ANNUAL SUMMER FIELD DAY—
August 3, 8:30 a.m. to 4:00 p.m. Matt Tures Sons Nursery, Huntly, IL. Contact Lucile Little, (312) 879-5566.

INTERNATIONAL HORTICULTURAL SHOWDOWN—
August 26-27. Sponsored by the Landscape Ontario Horticultural Trades Assoc., this new trade show will be outdoors at Bronte Creek Provincial Park (midway between Toronto and Hamilton) Ontario, Canada. Contact Rick Gregory, Landscape Ontario, Suite No. 103, 3034 Palstan Road, Mississauga, Ontario L4Y 2Z6 (416) 276-6177.

SEPTEMBER

MICHIGAN TURFGRASS FOUNDATION FIELD DAY—
September 1. Hands on equipment display. Robert Hancock Research Center, Michigan State University, Lansing Michgan. Contact Paul Rieke, Dept. Crop & Soil Sciences, Michigan State University, East Lansing, MI 48824. (517) 355-0266.

POA ANNUAL GOLF TOURNAMENT—
Septemer 12. Sponsored by the New York State Turfgrass Association, the Central NY Golf Course Superintendents Association and the Finger Lakes Assoc. of Golf Course Superintendents, the second annual tournament is held to raise funds for Dr. A. Martin Petrovic's turfgrass research program at Cornell University. For information on participating in the tournament or on tee sponsorship, contact Bill Stark, P.O. Box 202, Homer NY 13077 (607) 753-3336.

NORTHERN MICHIGAN TURF CONFERNECE—
Septemer 20. Travers City Country Club. Contact Paul Rieke, Dept. Crop & Soil Sciences, Michigan State University, East Lansing, MI 48824 (517)355-0266.

1983 OKLAHOMA TURFGRASS RESEARCH FIELD DAY—
September 21. Horticulture Turf Research Center, 1 mile west of O.S.U. campus, Stillwater OK, follow signs from campus; 9 a.m. free admission. Contact Dr. Robert L. Green, 360 Ag Hall, Stillwater, OK 74078, (405) 624-5414.

1983 VIRGINIA TECH TURFGRASS RESEARCH FIELD DAYS—
September 27, 28, 29. Virginia Tech. Blacksburg, VA. Contact Dr. John R. Hall, III, Agronomy Dept., VPI&SU, Blacksburg, VA 24061-7294 (703) 961-5797.

OCTOBER

PROFESSIONAL GROUNDS MANAGEMENT SOCIETY 71st ANNUAL CONFERENCE AND TRADE SHOW—
October 15-19. Cincinnati-Marriott Hotel, Cincinnati, OH. Contact Allan Shulder, Exec Dir., Professional Grounds Management Society, 7 Church Lane, Suite 13, Pikesville, MD 21208, (301) 653-2742.

NOVEMBER

NEW YORK STATE TURFGRASS CONFERENCE AND TRADE SHOW—
November 1-3. Rochester, NY. For booth space information contact NYSTA Executive Dir. Ann Reilly, 210 Cartwright Blvd., Massapequa Park, NY 11762, (516) 541-6902. A detailed program will be offered to all interested by writing to the New York State Turfgrass Assoc. at the same address.

NATIONAL INSTITUTE ON PARKS AND GROUNDS MANAGEMENT MEETING—
November 7-10. Hyatt Hotel/Civic Center, Birmingham, AL. Contact National Insitute, Box 1936, Appleton, WI 54913, (414) 733-2301.

PROFESSIONAL LAWN CARE ASSOC. OF AMERICA CONVENTION AND TRADE SHOW—
November 8-10. Indianapolis Convention Center, Indianapolis, IN. Contact James Brooks, Executive Dir., PLCAA, 1225 Johnson Ferry Rd., Suite B-220, Marietta, GA 30067- (404) 977-5222.

ASSOCIATED LANDSCAPE CONTRACTORS OF AMERICA MAINTENANCE CONFERENCE—
November 13-15. Denver, CO. Contact ALCA, 1750 Old Meadow Road, McLean, VA, 22101. (703)821-8611.

1983 OKLAHOMA TURFGRASS CONFERENCE AND TRADE SHOW—
November 14-16. Camelot Tulsa, I-44 & Peoria. Concurrent sessions on golf course and commercial turf mgmt.. Hands on workshops Nov. 16. Contact Dr. Robert L. Green, 360 Ag Hall, Stillwater, OK 74078, (405) 624-5414.

DECEMBER

OHIO TURFGRASS CONFERENCE & TRADE SHOW—
December 6-8. Contact Dr. John Street, OTF, 2021 Coffey Rd., Columbus Ohio 43210 (614) 422-2047.

1983 PENNSYLVANIA TURFGRASS CONFERENCE AND TRADE SHOW—
December 12-15. Contact Christine King, 412 Blanchard St., Bellefonte, PA 16823 (814) 355-8010.

JANUARY

MICHIGAN TURFGRASS CONFERENCE—
January 17-18. Long's Convention Center, Lansing, MI. Contact Paul Rieke, Dept. Crop & Soil Science, Michigan State University, East Lansing, MI 48824. (517) 355-0266.

24th ANNUAL VIRGINIA TURFGRASS CONFERENCE AND TRADE SHOW—
January 18-20. Williamsburg Hilton and National Conference Center, Williamsburg, VA. Contact Dr. John R. Hall,III, Agronomy Dept., VPI&SU, Blacksburg, VA 24061-7294, (703) 961-5797.

United At Last!

by John Kenney, Turf Doctor, Framingham, MA

On Wednesday, April 6, 1983 a group of important and influential people met in a hotel meeting room at Logan Airport in Boston, Mass. to discuss the future of the commercial use of pesticides in the urban and suburban environment. Three of the major trade associations were represented: (NAA) National Arborists Assoc.; (PLCAA) Professional Lawn Care Assoc. of Amer.; and (NPCA) National Pest Control Assoc.

In addition to association representation, there were also a number of the larger companies and a few of the smaller ones represented. The major part of the day-long meeting revolved around the issues of continued attempts by some authorities to over-regulate the use of pesticides. The consensus of the group was that there exists sufficient evidence to prove that: A) attempted over-regulation will not slow down nor go away; B) protecting the rights of the applicator and the consumer would be better served if we were able to work together rather than duplicating each others efforts.

It was resolved that we would attempt to put together a document that would outline a new organization, purpose, structure and objectives. After each of the attendees added input to the concept, a new, multi-discipline and non-profit organization was incorporated on June 2, 1983, **(NELF) National Environmental Law Foundation.**

The original board of directors included members of NAA, NPCA, and PLCAA with both large and small company representation and also an attorney. The articles of organization states that "The purposes for which the corporation is formed is as follows: The purposes of the corporation shall be to foster and promote the use of law, including legal research, opinions, briefs, publication, forums and arranging for advice and representation, to encourage and expand, in the public interest, the wise use of environmental chemicals . . . including, but not limited to their use in order to protect the health and property of all citizens and to protect and improve our food supply, forests, parks and utilities, all of which serve the general populace, and also to assist in the same manner, charitable, scientific, literary trade and educational organizations interested in the responsible use of environmental chemicals."

The board of directors of the **National Law Foundation** has appointed an attorney, Ian S. Oppenheim, as its executive director. In the past, Mr. Oppenheim has been very active in both the public relations areas of pesticide issues and in the legal battleground as well. Ian is also the executive director of the New England Pest Control Assoc. (NEPCA), an NPCA affiliate and he is the executive director of Rational Approach to Pesticides (RAP) which is a Massachusetts coalition of pesticide users. Ian has been the featured speaker at many local, state, national and international user group gatherings and has developed thousands of contacts on both sides of the pesticide issue.

On Wednesday, June 15, 1983, the first annual meeting of **NELF** took place in Washington D.C. The list of invitees (19) was expanded to include some of the trade press, Mr. Oppenheim, some suppliers and manufacturers as well as some key players within each discipline; arborists, PCO's and turf.

Most of the meeting was spent gathering the specifics from the attendees as to how the **NELF** should go about achieving its objectives. The major concepts which were agreed upon were: (not in order of priority) 1) Develop good lines of communication with the media to get the other side of the story told– the benefits of the use of pesticides. 2) Get well-written and accurate articles into the trade press. 3) Collect the names, addresses and phone numbers of all the users in the country so that when an issue arises within a certain area all the affected companies and individuals can be notified. 4) Notify the affected companies, organize a coalition of multi-discipline local users and then teach them what to do to protect themselves from over-regulation. 5) Keep all users informed about the truth of situations which have been distorted by the press. 6) Act as a central clearing house for accurate and detailed information about the specifics of every pesticide related activity that could impact the users: a) on all levels; federal, state, county, city and town. b) on all legislation; repealed, amended, proposed, current, etc. c) on all regulations; boards of health, agriculture, etc. d) on all litigation; civil, criminal, etc. e) on all methods; ground, aerial, liquid, granular, etc. f) on all disciplines; arborists, rights-of-way, structural pest control, aerial, farm, turf, etc. 7) Educate the "decision makers": town fathers, regulators, legislators, and the reporters and editors of the general press. 8) Seek out and iden-

(Continued next page)

List of Advertisers

(Continued from previous page)

tify external "friendlies", i.e. those out-side this arena who have a vested interest in seeing that the urban and suburban use of pesticides continues. [e.g. realtors, insurance companies, etc.] 9) Establish a "Hot Line" where any user can call for free and accurate information and/or guidance on how to handle a local and/ or personal situation regarding pesticides. 10) Direct all inquiries to join their trade associations and/or their local coalition in order to have the strength of our numbers.

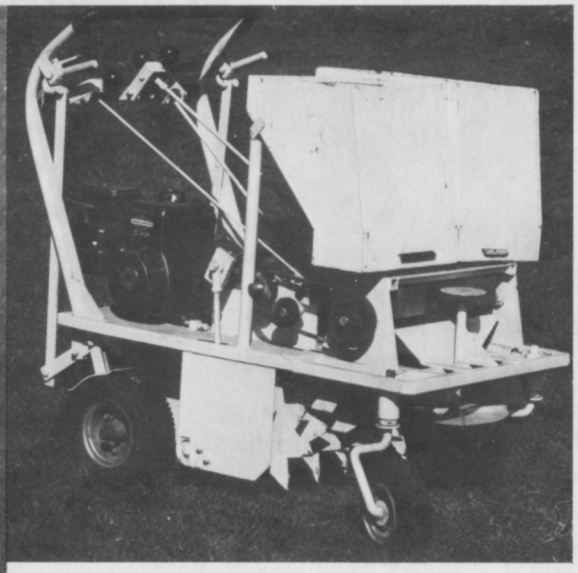
The immediate task in front of the **NELF** advisory committee is to draft a document which could be endorsed by the NAA and by the NPCA. The government affairs committee of the PLCAA has endorsed the **NELF** and only the board of directors vote is necessary for **NELF** to begin to solicit funding with the official 'stamp of approval'. The three people who are working on the document are: James Brooks, Executive Director of the PLCAA; Robert Felix, Executive Vice President, National Arborists Assn.; and A. Jack Grimes, Director, Government Affairs, National Pest Control Assn. (at press time, it was not quite finished)

NELF will be contacting you very shortly for your individual support. The formula being discussed is one-tenth of one percent of gross revenues. More than 70% of PLCAA members have already stated that they will contribute at this level or more!

Full and strong support for **NELF** has already been announced by the following trade publications: American Lawn Applicator; Pest Control; Lawn Care Industry; Pest Control Technology; Lawn Care Professional; and Weeds Trees and Turf.

+++

Before you buy any other machine that fertilizes, seeds, coreaerates and spikes, READ THIS AD !!



Now there are two tough machines that handle the grueling punishment dished out by today's lawn professional!

ABOVE: The *Walk/Ride Behind*, a new generation of compact seeder and fertilizer.
LEFT: The *Lawn Maker*, an all-in-one seeder/fertilizer/coreaerator for riding operation.

If you're considering the purchase of a single machine that can perform all the functions of seeding, fertilizing, coreaerating and spiking, you should be looking at the Lawn Maker and the Walk/Ride Behind! Unfortunately, there's just not enough room in this ad to tell you the whole story, but here are a few facts...

LAWN MAKER

Welded construction · Weight, 625 lbs. ·Seeds, fertilizes and aerates 4,000 sq. ft. in only 9 minutes · 11 hp Briggs & Stratton electric start motor · Easy to transport ·Variety of attachments · 1 year warranty

WALK/RIDE BEHIND

Welded construction · Weight, 300 lbs. ·Seeds and fertilizes 10,000 · sq. ft. per hour ·Easy reach controls · 3 hp Briggs & Stratton motor · Short turning radius · Rider Cart available · 6 month warranty

Made-to-spec loading ramps available for both models

To find out more about how you can turn a greater profit in seeding and aeration, call us today!

SALSCO
Welding & Fabrication, Inc.
196 Clark Street, Milldale, CT 06467 (203) 621-6764

BIG GREEN PLUS
MICRONUTRIENTS

Iron-Sulphur plus Nitrogen *

RESULTS EQUAL PROFIT.

1. QUICK GREEN-UP

Apply 1.5-2 ounces/1000 BIG GREEN PLUS for a beautiful green turf within hours of application. Micronutrients can be a help in solving your service problems.

2. HARDIER TURF

University experiments have shown turf applied with micronutrients such as BIG GREEN PLUS to be more resistant to disease and insects.

3. LESS NITROGEN USE

Tests have shown that turf color and quality can be maintained with **higher** rates of micronutrient and **lesser** rates of nitrogen. BIG GREEN PLUS contains 15% nitrogen, 4% sulphur and 6% iron.

4. NON-STAINING (indilute state)

BIG GREEN PLUS has been shown to have non-staining properties when diluted at 3-4 ounces in 3-5 gallons of solution.

* 5. AVAILABLE IN BULK

Easy transport, less waste, no handling problems, safer to use when handled in bulk.

ASK ABOUT OUR SPECIAL CONTAINER PROGRAM.

CALL our toll free number 1-800-447-4131

or write for further information.

manufactured by:

BULKKEM
BULK SUPPLIERS OF LAWN CHEMICALS

THE BULKKEM CORPORATION • 400 NORTHTOWN ROAD • NORMAL, IL. 61761

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